

NICHOLAS A. ASHFORD



RALPH P. HALL

TECHNOLOGY, GLOBALIZATION, AND SUSTAINABLE DEVELOPMENT

TRANSFORMING THE INDUSTRIAL STATE

REVISED EDITION



environment • economy • employment

"I am excited to see a new edition of this classic in environmental studies. *Technology, Globalization, and Sustainable Development* is an indispensable tool for teaching sustainability, and a must-read for everyone concerned with environment, development and the future."

– Giorgos Kallis, *ICREA Research Professor,
Autonomous University of Barcelona, Spain*

"Whilst the debates around the sustainability agenda continue to progress and evolve, Ashford and Hall provide a lucid and prescient analysis of sustainability at a crossroads, influenced by several inter-related crises: financial, investment, production, consumption, employment, and environmental. This comprehensively revised and updated new edition of *Technology, Globalization, and Sustainable Development* recognizes the multi-dimensional character of sustainability and follows a transdisciplinary approach which stands out both for its clarity of argument and practical insights into where the solutions can be found, pulling no punches in identifying where responsibility for action lies. A clearer manifesto for change would be hard to find."

– Richard Fenner, *Professor of Engineering
Sustainability, University of Cambridge, UK*

"This text provides a superb distillation of a wide range of ideas on social science topics that are of critical importance today. If you read this you may find that you can put aside several shelves worth of books you had been planning to read! With excellently chosen quotes and references the authors show the interlinkages between the workings of the economy and the natural world, and the need to rethink employment, both in relation to the meaning of work for the workers, and the possibility of replacing dirty industries and deadening, inequality-increasing hierarchies with cooperative, profit-sharing, green forms of production. They present ideas on the concept of essential needs, and the need for a cultural/values transformation away from the current conception of the good life. If they are correct – and I believe they are – that 'building a truly sustainable future will necessarily involve new theories, new paradigms, and new policies' – this book provides a firm foundation for doing so."

– Neva Goodwin, *Co-director, Global Development
and Environment Institute, Tufts University, USA*

"Environmental degradation, climate change, deteriorating health, and inequity: the challenges are well-known but urgent and effective action is needed now. This new book by Ashford and Hall provides a deep analysis of the root causes; which is necessary to develop speedy but effective solutions. In addition to innovative technologies and effective governance the focus in this book has shifted towards fulfilling basic needs, wellbeing, developing sustainable livelihoods, and the necessary transitions of the economic and governance systems. A must-read for policy makers and all concerned citizens."

– Philip J. Vergragt, *Boston, Associate Fellow, Tellus
Institute, and Professor Emeritus of Technology Assessment, TU Delft, The Netherlands*

"Just in time! A thoughtful, balanced antidote in a destabilized world. Makes a strong case for a clear agenda of transformative socio-technological development for improved sustainability, heightened social justice, and enhanced human happiness. Even better in this newly refined and updated edition."

– David A. Sonnenfeld, *Contributing Editor,
Routledge International Handbook of Social and Environmental Change*

“Where in the world can you find, in one book, competent professional state-of-the-art reference works on topics as diverse, yet vital, as the sources of income inequality, fundamental critiques of neo-classical economics, free trade vs. protectionism, the history of technology, theories of innovation and policies to promote it, organizational learning, employment policy, trans-boundary migration of pollution, financing sustainability, binary economics, and much, much more. The answer to that over-long question is short: This book, by Ashford and Hall is the answer. It is, to policy studies, what the OED is to ordinary dictionaries. It should be on the desktop of every policy professional and every student of (and in) the field. Responding to the tremendous amount of new scholarship since the first edition, in this significantly revised edition, the authors address the increasing importance of addressing global climate change and energy challenges; the revelations of the fault lines in the global financial system; the splintering of political alliances, such as in the European Union and in the UK with Brexit; the increasing challenges presented by economic, political, and environmental migrants; and the effects that both technological advances and trade are having on employment and earning capacity.”

– Robert U. Ayres, *Novartis Professor Emeritus of Economics, Political Science, and Technology Management, INSEAD, France*

“Ashford and Hall have produced a book of extremely ambitious scope and magisterial scale. This volume is simultaneously expansive and accessible and will be a hallmark of scholarly achievement for years to come. A generation of students, academics, policymakers, and practitioners – and perhaps the planet as a whole – will be beneficiaries of their impressive achievement.”

– Maurie J. Cohen, *Professor of Sustainability Studies, New Jersey Institute of Technology, USA and Editor of Sustainability: Science, Practice, and Policy*

Technology, Globalization, and Sustainable Development

Technology, Globalization, and Sustainable Development offers a unified, transdisciplinary approach for transforming the industrial state in order to promote sustainable development. The authors present a deep analysis of the ways that industrial states – both developed and developing – are currently unsustainable and how economic and social welfare are related to the environment, to public health and safety, and to earning capacity and meaningful and rewarding employment. The authors offer multipurpose solutions to the sustainability challenge that integrate industrial development, employment, technology, environment, national and international law, trade, finance, and public and worker health and safety. The authors present a compelling wake-up call that warns of the collision course set between the current paths of continued growth and inevitable unsustainability in the world today.

Offering clear examples and real solutions, this textbook illustrates how the driving forces that are currently promoting unsustainability can be refocused and redesigned to reverse course and improve the state of the world. This book is essential reading for those teaching and studying sustainable development and the critical roles of the economy, employment, and the environment.

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Nicholas A. Ashford and Ralph P. Hall

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For those willing to undertake the difficult political and technological transformations needed to achieve sustainability.



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Preface

Technology, Globalization, and Sustainable Development explores the rich and multidimensional elements of sustainable development. The first edition of this book, published in 2011, grew out of courses taught for a decade at the Massachusetts Institute of Technology offering a certificate in sustainable development, Cambridge University, and the Harvard–Cyprus International Institute for the Environment and Public Health, now associated with the Cyprus University of Technology. Since 2009, the course has been taught at Virginia Tech and more recently at the Harvard Extension School offering a sustainability concentration.

Although some scholars continue to insist that the concept of sustainable development is vague and unwieldy – and no longer of any use in directing industrial transformations – this writing seeks to explore the rich and multidimensional elements of sustainability history and thinking which we regard as essential and, further, which offer an integrative, transdisciplinary approach to policy design for its attainment. Sustainability and the related concepts of development, globalization, and economic and environmental justice are interwoven with technological, organizational, institutional, and social innovation and with trade as drivers in need of reform in order to achieve the necessary transformation of industrial and industrializing societies.

Too many have dismissed government intervention as unrealistic manifestations of a top-down approach and argue that sustainability requires a bottom-up, cultural and institutional transformation of society. We argue that both are needed, but bottom-up approaches seem to work best in experiments and on smaller scales. Increased attention to resilience and adaptation, while necessary, is wrong-headed when these become an excuse for abandoning sustainable transformations.

Since writing the first edition of this work, much has changed with regards to the global economy, the emerging fields of new economics, and the global political climate. In this revised edition, we respond to the increasing importance of addressing global climate change and energy challenges; the revelations of the fault lines in the global financial system; the splintering of political alliances, such as in the European Union and in the UK with Brexit; and the increasing challenges presented by economic, political, and environmental migrants.

The Schumpeterian notion of technological innovation as “the engine of growth” is being challenged as the globalization of trade is increasingly recognized as an additional and different driving force for growth – and further source of unsustainability and instability – of industrial economies. With the establishment of the World Trade Organization (WTO) implementing the General Agreement on Tariffs and Trade (GATT), the North American Free Trade Agreement (NAFTA), and other evolving trading regimes and relationships, serious questions have been raised concerning the effects of global trade on sustainability. These effects must be viewed broadly to include not only a healthy economic base but also a sound environment, stable employment with adequate purchasing power,

distributional equity, national self-reliance, maintenance of cultural integrity, and social inclusion. At the same time, technological development is increasingly recognized as a cause of technological displacement and a driver of increasing wealth/income inequality.

Different trading regimes treat environment and labor standards differently, sometimes regarding more stringent regulatory requirements as illegal non-tariff trade barriers. This book explores the many dimensions of sustainability and the use of national, multinational, and international political and legal mechanisms to further sustainable development. The interrelationship of technological change, economic growth, industrial development, employment, and the environment is examined in the context of theories of trade, employment, regulation, networks, organizational innovation, and learning. Policies for resolving the apparent conflicts among development, economic welfare, the environment, employment, earning capacity, and the disparity of the ownership of productive capital are explored in generating a different vision for the future.

This book draws extensively on both American and European writings on social and political theory; management science; industrial, labor, and environmental economics; ecological economics; the new economics; and environmental and international law. Students with very different origins in a variety of courses of study in three countries have taken the courses on which this work has been developed, and it is hoped that this book will be taught in programs of schools of management and economics, law, international relations and political science, industrial relations, engineering, science, and public health beyond the American venue.

This work can serve as both a comprehensive reference book on the many aspects of sustainable development and a textbook that would ideally be taught on a multidisciplinary team basis. There is a dedicated website for the work (www.ashfordhall2018.com). It contains both new materials and, perhaps more importantly, the authors' slides that will aid in the teaching and comprehension of the work. These slides will be updated periodically. We are conscious of the deep and encyclopedic nature of the book, and we have found in our own teaching at many institutions that the slides are necessary to aid in both teaching and understanding.

Parts of the book could also be incorporated into existing conventional curricula. For example, Chapters 1 and 2 (Part I) are relevant for courses in history, sociology, and political science and can serve as a primer on sustainable development for all programs. Chapters 3, 4, and 5 (Part II) would be valuable in courses on economic growth and development in economics departments, schools of management, public policy, and international relations programs. Chapters 6, 7, and 8 (Part III) ideally fit into courses on innovation and industrial policy in engineering, management, and public policy programs. Chapters 9 and 10 (Part IV) and Chapter 11 are dedicated to national, regional, and international environmental and trade law and could be taught in law schools and public policy programs, international relations programs, political science, and schools of public health. Chapter 12, dealing with global climate and energy challenges, is essential for all venues.

Thus, a number of selected chapters from this work could easily fill several traditional courses in different departments, but the entire book offers an opportunity for a trans-disciplinary course that cuts across departments and schools, which is the trend in many forward-looking programs.

Acknowledgments

For this revised edition, we wish not only to acknowledge the support of our families during the development of this revised work, but also to thank the students, scholars, writers, and public servants from whom we have learned so much. We also thank our colleagues at the Massachusetts Institute of Technology, Cambridge University, the Harvard Extension School, the Cyprus University of Technology, and Virginia Tech who understood the importance of crossing disciplinary lines and engaging in transdisciplinary thinking.

The original work on *Technology, Globalization, and Sustainable Development: Transforming the Industrial State* began two decades ago and benefited from the keen insight and inquisitive minds of our early research staff, acknowledged in the first edition, hundreds of students, and numerous colleagues. We are indebted to all those who have played a part in enriching the writing of this revised work over an eight-year period. In particular, we would like to thank the following individuals for research and writing assistance: Jessica Agnew, Johan Arango-Quiroga, Marine Gerard, Zeyneb Magavi, Marta Pradanos, Curtis Rowlette, Jeena Sajimon, and Jean-Baptiste Seby. We are also grateful to Robert H. Ashford, Distinguished Professor of Law at Syracuse University, who contributed original writing and thinking on binary economics found in several places in the text, and to Charles C. Caldart, Director of Litigation of the National Environmental Law Center, for his original work on U.S., EU, and international environmental law in Chapters 9 and 10. Finally, we are grateful to Androniki Askounes Ashford for her artwork in the design of the book cover.



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0.1 Introduction

Like other books with the word “sustainability” in the title, the motivation of this work stems from a dissatisfaction with the current state of the world and from a desire to identify those policies and strategies that will transform firms, institutions, governments, and societies in a more positive direction. We will argue that the main driving forces that have sent us in the wrong direction are the same forces, but differently fashioned and designed, that could be used to reverse course and improve the state of the world. These forces fall under the broad heading of technology and trade or, more strictly speaking, technology and globalization, especially globalized finance. We hope that the prescriptions discussed in this work will not be regarded as utopian. Indeed, it may be difficult to decide precisely on the right course of action, but a major accomplishment would be to deepen our understanding of, and refrain from continuing, those policies and strategies that are clearly wrongheaded. It is also important to acknowledge that there are many more ways to do it wrong than to get it right. But understanding the history, mistakes, and successes of industrialization, economic change, and policy formulation and implementation is an essential step in getting it right.

There are those who argue that the economic system and the political system are the things that primarily need fixing, and, to a certain extent, they are right. But, as will be shown, there is much more that needs fixing. Systemic difficulties are central to understanding the unsustainable industrial state, and both economic and political dynamics affect the extent and direction of technological advance and social change. But it is also true that social and cultural attitudes influence the direction of policy, both through markets and through the political choices we make. Because there are important interacting elements that need to be put in place to achieve more sustainable transformations, we will argue that holistic and integrated policy design, as distinct from mere coordination of policies, is essential. As Costanza and Daly (1991) argue, achieving a more sustainable world requires transdisciplinary approaches involving democratic, participatory governance. A transdisciplinary perspective is what characterizes the analysis and recommendations emanating from this work.

0.2 The multidimensional character of sustainability

The concept of sustainability and, indeed, most of the writings on sustainable development tend to conjure up *environmental* sustainability. We will argue that the three essential pillars of sustainable development must necessarily focus on a broader set of policies for improving *competitiveness*;^{*} *the environment and public, worker, and consumer health and safety*; and *meaningful and well-paid employment and earning capacity*.

For a long time, the earlier sustainability literature focused almost exclusively on *environmental* sustainability, which included resource exhaustion, toxic pollution, ecosystem destruction, and global climate disruption. The sources of environmental problems were acknowledged to stem from industrialization and the ever-increasing consumption of materials and energy. Some attention surfaced on environmental justice, reflecting the disparate effects of environmental deterioration on poor people and poor nations, as well as the failure of governments to address their plight. Recently, concerns with environmental sustainability have become dominated by global climate change, almost to the exclusion of other environmental concerns.

While concerns about poverty and earning capacity have often been raised, it was only after the 2008 financial crisis that employment and the earning capacity of people were catapulted into the center stage of political discourse. Part of this discourse has focused on the relationship between employment and consumption, where the tension between providing jobs and decreasing the environmental footprint of industrialized and industrializing states was acknowledged. This relationship has historically focused on increasing production and consumption with insufficient or little regard to their effects on the environment and energy and resource limits.

The relationship between industrialization and its effects on the environment has captured the serious attention of national governments and international organizations, especially in light of increasing international trade and globalization. Sustainability in products, processes, and services has been increasingly emphasized by placing the environment (or at least climate change) at the center of some industrial transformations or on a par with competitiveness. The key to environmental sustainability was recognized early as involving the design and implementation of environmentally sound products, processes, and

* Competitiveness can have two different meanings: (1) improvements in “competition” that yield higher national or corporate revenues and market share, or (2) the ability of the nation–state to provide the essential goods and services to the largest possible segment of its populations. As the remainder of this book will reveal, policies directed at these two contrasting formulations of competitiveness can be very different and have different consequences.

services rather than addressing environmental concerns as an afterthought in industrial systems. At the same time at which the environment has become more important in economic policy, European as well as American industrial economies have also begun to pay attention to the restructuring of labor markets. This attention reflects changes brought about by or anticipated from new and emerging technologies, new environmental priorities, particularly global climate change, and globalization. However, unlike recent initiatives addressing environmental issues, these policies have been largely reactive rather than proactive toward new job creation and better organization of work.

In addition to the environment, work and the workplace are essential elements of industrial and industrializing economies. In the workplace, human effort (work) is combined with physical and natural capital to produce goods and services. The workplace is also the marketplace where workers and owners or managers exchange their contributions, with the transfer of financial capital as wages providing purchasing power for those workers. Beyond markets, work provides both a means of engagement of people in society and an important social environment and mechanism for enhancing self-esteem (Klitgaard 2017). Finally, in the absence of broadening the ownership of productive physical capital and energy to a larger segment of the population, work is the main means of distributing wealth and generating purchasing power in dynamic national economic systems. There is a complex relationship between employment and the increasingly environmentally unsustainable and globalizing economy. The changing nature of industrial economies presents new challenges and opportunities for the organization of work, as well as for the environment, in both industrialized and industrializing countries. Just as thinking about the environment before industrial development is planned and implemented is necessary to optimize environmental quality, consideration of labor concerns also requires deliberate and intelligent actions before embarking on (re)industrialization efforts in guiding industrial transformations. The downturn of the extraordinarily long economic boom and the financial crisis that began in 2008 reveals fundamental structural employment problems in the industrialized world that were not previously appreciated. It is likely that employment considerations will be the central issue in the coming decade for countries in the European Union, as well as for the United States and the developing world, and employment concerns will influence the nature and direction of (re)industrialization and the growth of the manufacturing and service economies. It is therefore timely to explore options and opportunities for co-optimizing economic development, environmental quality, and labor and employment concerns.*

0.3 The unsustainable industrial state

Those who argue that the industrialized state, whether developed or developing, is currently unsustainable emphasize a number of sustainability challenges. These are depicted schematically in Figure 0.1. A key problem is the failure of government to provide – either directly or indirectly through the private sector – an adequate supply of, and access to, essential goods and services for all its citizens. Here the term “adequate” can be considered to mean the ability of citizens to enjoy a decent standard of living. This standard of living can be thought of as an acceptable level of minimum welfare and is likely to differ among countries and over time, but which can be determined for a specific context.

* Co-optimization will be a central theme throughout this book and describes the fashioning and implementation of policies and initiatives that achieve multiple goals without sacrificing one for another, that is, reaching an optimum described as achieving “a proper balance” that necessitates reaching a compromise or trade-offs among goals.

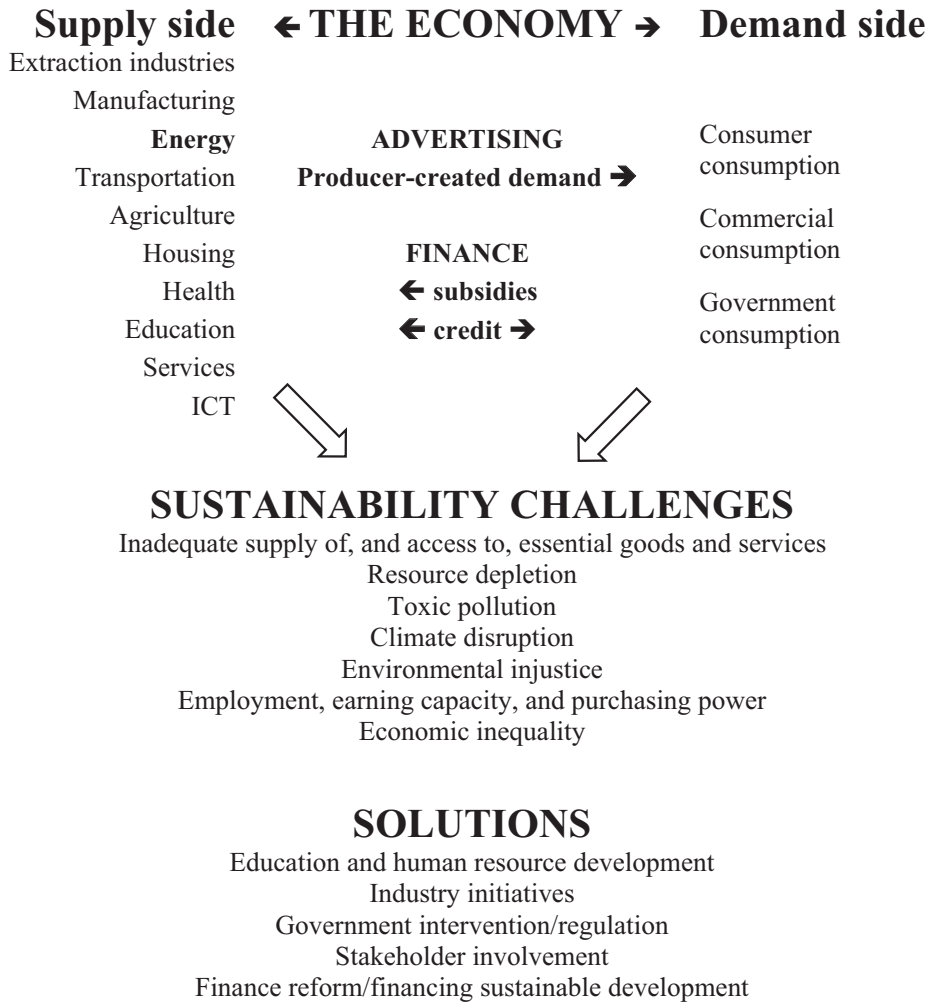


Figure 0.1 The sources and drivers of unsustainability, resulting challenges, and solutions

Goods and services include manufactured goods, food, housing, transportation, and information and communication technology (ICT), among others. The environmental problems include toxic pollution (which directly affects public and worker health and safety), climate change, resource depletion, and problems related to the loss of biodiversity and ecosystem integrity. The environmental burdens – and efforts to ameliorate them – are felt unequally within nations, among nations, and among generations, giving rise to international, intranational, and intergenerational equity concerns that are often expressed as “environmental injustice.” All three kinds of maldistributions are important.

The environmental problems stem from activities concerned with agriculture, manufacturing, extraction, transportation, housing, energy, and services – all driven by the demands of consumers, commercial entities, and government. In addition, there are effects of these activities on the amount, security, and skill of employment, the nature and

conditions of work, and purchasing power associated with wages. An increasing concern is economic inequality stemming from inadequate and unequal purchasing power and earning capacity within and among nations and for the workers and citizens of the future, as well as disparities in the ownership of productive capital.

A key distortion in visualizing supply and demand as independent forces in traditional economics is the failure to acknowledge the influence of producer-created demand (facilitated through advertising) (Galbraith 1967). Other important market distortions include subsidies and financial credit that create financial bubbles that eventually burst (Ayres 2014; Stiglitz 2010). These distortions combine to create a pseudo-equilibrium between supply and demand. On the supply side, energy is bolded because rather than dollars or euros, the currency of the industrial state is argued to be energy.

Whether solutions involving education and human resource development, industry initiatives, government intervention, stakeholder involvement, and financing can resolve these unsustainability problems depends on their potential for correcting a number of fundamental flaws (the systemic problems mentioned earlier) in the characteristics of the industrial state:

- 1 *The fragmentation and inadequacy of the knowledge base*, resulting in a lack of understanding of the complex origin and interrelatedness of problems and the need for integrated solutions rather than unidisciplinarily designed and/or single-purpose solutions;
- 2 *The inequality of access to economic and political power* among people and nations and between individuals and corporations or business organizations;
- 3 *The tendency toward gerontocracy*, whereby there is technological and political lock-in, usually, but not always, accompanied by concentration of economic and political power;
- 4 *The failure of markets* and of the policies that shape market transactions to price correctly the adverse human and environmental consequences of industrial activity (i.e., negative externalities) and to provide rewards for those voluntary or charitable activities that benefit society as a whole (i.e., positive externalities);
- 5 *The limitations of perfectly working markets due to (1) disparate time horizons*, whereby costs must be incurred now to solve problems whose solutions yield benefits later, sometimes in generations to come, which are discounted in value in present terms and therefore receive inadequate attention, and (2) *the delay in recognizing problems with current industrialization and consumption*, such that responses come very late (for example, the failure to perceive limits to growth), both of which cause inappropriate production and consumption patterns to persist;
- 6 *The failure to engage individuals (workers and citizens) in society* to realize their human potential, resulting in social exclusion;
- 7 *A high-throughput industrial system*, driven by ever-increasing material and energy consumption;
- 8 *An addiction to growth and productivity*; and
- 9 *Corruption*.*

* Corruption is more than the misappropriation of funds or unjustifiably favoring a firm or person in government dealings. We argue that it includes the perversion of governmental responsibility implicit in the social contract, such as failing to enact, monitor, or enforce environmental, public health, anti-trust, banking, economic, labor, social, and other regulations or legislation that protects or promotes the public welfare. In the United States, the 2008 financial and mortgage industry breakdown stands out as a good example.

0.4 Sustainability at a crossroads

The crises we encounter today could be described as the “perfect storm” (see Box 0.1) (Ashford et al. 2012). Now, in the aftermath of the global financial crisis that began in 2008, it is imperative to understand its related structural causes and effects. This will help us discover what solutions might be worth pursuing to deal with this perfect storm of several interrelated crises: financial, investment, production, consumption, employment, and environmental.

The financial crisis left consumers with too little money and/or willingness to spend. In the United States, a loss of some 40 percent of family wealth forced a cut in spending. The experience in Europe has been worse in some countries. The United States is suffering from the greatest income inequality since 1928 with an unprecedented concentration of wealth (Kochan 2011, 2012; Piketty 2014). Similar disparities are seen in the United Kingdom (Atkinson 2015). This crisis in employment-related purchasing power results in too few goods and services being produced (an investment and production crisis) and too little being purchased (a consumption crisis).

This in turn causes increasing unemployment and underemployment (exacerbating an employment crisis). As a result, a vicious circle is created in which there is less money spent in consumption and in investment in subsequent and repeated cycles, further exacerbating the crisis in consumption.

Box 0.1 The perfect storm

- **FINANCE:** *Origin:* reckless provision of (leveraged) credit + issuance of dubious financial instruments. *Aftermath:* collapse of the housing and financial markets; reluctance of lenders to lend, and producers and consumers to borrow in uncertain and volatile futures. This affects the concentration of wealth and employment prospects ↓
- **WEALTH CONCENTRATION:** As financial practice increases the concentration of wealth, political and economic power is also concentrated, leading to erosion in fair and inclusive market rules, government capture and intervention on behalf of the few, exploitation and exclusion of poor and middle-class people, manipulation of democratic preferences, and erosion of widespread opportunities for ownership and employment ↓
- **EMPLOYMENT:** The financial/credit crisis exacerbates the prior long-term crisis in increasing high un- and underemployment, with declining skills, wages, and purchasing power (demand) for some. This affects ↓
- **CONSUMPTION:** The decline in purchasing power and easy credit further lowers consumer demand and production leading to further unemployment. This affects ↓
- **INVESTMENT AND PRODUCTION:** Firms have historically focused on increasing productivity → over capacity (unrealized profits), with increasing reliance on trade to generate revenue and the shedding of labor. Decreasing demand globally and the end of cheap energy increasing costs, decreasing profits and increasing economic volatility → reluctance to expand production and hire workers → greater preference for using capital rather than labor. This affects employment and investment.
- **ENVIRONMENT:** Excessive and polluting production, throughput, and consumption by part of the society using too much energy and resources; pressure to relax or avoid regulation, making things worse.

In reality, there are several different but related crises in consumption: (1) not enough products and services are demanded, consumed, and produced, leading to lower or negative growth of the producing sector and thus smaller GDP for the economy; (2) some people do not consume enough of the *essential* things to lead a healthy and productive life, exacerbating poverty; and (3) some people and economic actors consume too much from an energy and resource perspective, exacerbating environmental problems. To the extent that the economy becomes “greener” through technological innovation and turnover in energy systems and manufacturing processes, modernization can actually lead to more under- and unemployment if labor is replaced by physical capital or energy.

Increasingly, in many countries, there is insufficient political will to address environmental problems – from global climate change and environmental pollution, to worker injury and disease – and public health impacts related to unsafe food, drugs, and other consumer products. Critics of government involvement decry “job-destroying regulation” and call for a “regulatory freeze” to keep agencies from acting to protect the environment, and public and worker health.

Many advocates of so-called reform implicitly assume that the economy can actually “recover.” In contrast, Robert Ayres argues with conviction that the prior era of cheap energy – mostly responsible for the historic high rates of GDP growth – is over (Ayres and Warr 2009). Ayres concludes that we have reached the end of exponential growth (Ayres 2006, 2016). Reliance on more-difficult-to-extract petroleum and natural gas from fracking, nuclear energy, and bio-fuels is unlikely to return us to an era of cheaper, safer, and environmentally sound energy, so recovery of the economy to what it once was may be unrealistic.

We have been living, producing, and consuming in a bubble (Ayres 2014; Stiglitz 2010). Financial and fiscal mismanagement and de-regulation created an economic system in which supply-side production costs were kept artificially low by both subsidies to production and excessive credit to producers and service providers – and by too much credit given to unworthy individual and economic consumers. Both the supply and the demand side of the economy were artificially pumped up. Throw in a good dose of toxic assets, unrealistic credit ratings of financial investments by the government, financial industry-inspired de-regulation, greed and corruption of the political process, and you have the perfect storm. We not only created enormous financial risk, we privatized the profits made by selling that risk through the creation and circulation of dubious financial instruments, and we socialized the losses through government bailouts. We encouraged spending by both those who already have enough or too much, and those at the bottom of the economic ladder who borrowed on credit unlikely to be repaid.

Past economic recessions have taken longer and longer to recover full employment (Kochan 2011, 2012). What is needed is a fundamental transformation of the economy. Although Keynesian spending, as recommended by Paul Krugman and Joseph Stiglitz, will relieve immediate pressure on unemployment – arguably the most immediate political problem in need of attention – neither Keynesian spending nor recapitalization of the banks (which are sitting on excess cash and have been unwilling to lend) can guarantee long-term revision of the economy. More fundamental reform of the dynamics of the economy is needed. The historically high profit-taking, and the resulting increasing concentration of wealth, which is suppressing growth and crippling democracy, cannot be reversed by lowering taxes on the rich and eliminating tax loopholes. There is overwhelming empirical evidence for this (Atkinson 2015; Stiglitz 2010, 2011). Why politicians – including those in the new U.S. administration elected in 2016 – and many in the media continue to frame this alternative as a legitimate policy option for improving the economy reflects the concentrated and skewed ownership and influence of those who have gained disproportionately from the system and seek to continue to gain. Unequally meritorious ideas do not deserve equal space and time in the public debate. Inconvenient truths should not be dismissed as merely *opinion*, to be balanced in the media by opinion not grounded in facts.

The financial sector needs serious restructuring. It is important to understand whose interests are being served by the banks and special financial interests. The continuing financial crisis in Europe pits those financial interests against ordinary people who are now rebelling against squeezing the last drop of debt from ill-gained profit through so-called austerity measures. What are needed are new highly regulated – and likely publicly owned or controlled – financial institutions.

0.5 Globalization

Globalization affects four major areas important for sustainable development: (1) the production of goods and services (which we will call industrial globalization), (2) the mobility of knowledge and information, (3) financial capital mobility, and (4) the international movement of labor and human resources, and migration. All these present opportunities and challenges for sustainable development.

The mobility of knowledge and information is facilitated both through changes in the locus of production and services (otherwise known as the international division of labor) and through advances in ICT, such as the Internet and wireless technologies. Financial capital mobility has in turn been greatly enhanced by ICT. Both financial and knowledge mobility allow almost instantaneous transfer of money and information, a radical departure from the industrial system of twenty years ago.

In the context of industrial and commercial production, the term “globalization” has at least three distinct meanings (Gordon 1995), with different implications for the environment and for workers and working life. First, “internationalization” is the expansion of product and service markets abroad, facilitated by ICT and e-commerce, with the locus of production remaining within the parent country. Second, “multinationalization” occurs when a (multinational) company establishes production or service facilities abroad to be nearer to foreign markets and/or to take advantage of more industry-friendly labor, environmental, and tax policies while maintaining research and development (R&D) and innovation-centered activities in the parent country. The third meaning of industrial globalization is the creation of strategic alliances, what might be called “transnationalization,” in which two different foreign enterprises merge or share their R&D and other capabilities to create a new entity or product line or service. A special kind of transnationalization, in which the members of the supply chain span different national locales, is increasing in the current globalization dynamic. Those concerned with enhancing trade are especially worried about barriers to internationalization, while those concerned with possible erosion of labor and environmental standards bemoan the consequences of multinationalization. Multinationalization and transnationalization may lead to industrial restructuring, with unpredictable consequences for national economies. Indeed, some corporations doing business in the global marketplace have larger annual cash flows than many small countries.

All three kinds of globalization raise questions of excessive market, and hence political, power where concerns for profits overwhelm democratic and ethical values, even if international nongovernmental organizations, such as Greenpeace, or international institutions, such as the International Labour Organization (ILO), challenge their activities.

Globalization raises new challenges for governance, especially vis-à-vis the roles of government, workers, and citizens in the new economic order. Within nation-states, the extent to which the externalities of production – adverse health, safety, and environmental effects – are internalized differs according to the differential success of regulation and compensation regimes and the extent to which economies incorporate the ethics of fair play into their practices. There has been a constant struggle to establish good environmental and labor standards and practices within nations. With the advent of globalized, competition-driven markets, attention has now shifted to the harmonization of standards

through multilateral environmental agreements and ILO conventions, with only a modicum of success. Countries are slow to give up national autonomy, and only where there is a trend toward significant economic integration (as in the European Union [EU]) are there successes at harmonization. In contrast, trade regimes such as the World Trade Organization (the WTO) have emphasized the rights of different nations to adopt their own and different standards of environmental and public health protections (see the related discussion in Chapters 4 and 11).

Globalization has brought an even more complex set of challenges through the creation of trade regimes – such as the WTO, the Association of Southeast Asian Nations (ASEAN), and the North American Free Trade Agreement (NAFTA) – where the term “free trade” means the elimination (or equalization) of tariffs and so-called non-tariff trade barriers, which, in practice, place environmental and labor standards at odds with trade objectives. Free trade may not be fair trade. Problems of reconciling the economic benefits with environmental and labor objectives plagued the adoption of the Transatlantic Trade and Investment Partnership (TTIP) and the Trans-Pacific Partnership (TPP). (See the discussion in Section 4.3.3 in Chapter 4, and Sections 5.1.2 and 5.2 in Chapter 5.)

The trade regimes promote international laissez-faire commerce, and rights-based laws and protections and market economics have become competing paradigms for public policy and governance. Government plays very different roles when it acts as a facilitator or arbitrator to resolve competing interests than when it acts as a trustee of citizen and worker interests to ensure a fair outcome of industrial transformations (N. A. Ashford 2002). The differences are pronounced when stakeholders have significantly disparate power, or when some are not represented in the political process, as in the case of emerging or new technology-based firms.

John Rawls (1971) argues that no transformation in a society should occur unless those who are worse off are made relatively better off. Operationalizing a Rawlsian world has its difficulties, but law operates to create certain essential rights that enable just and sustainable transformations.* These include the right to a healthy and safe environment, products, and workplace; citizen and worker right to know; the right to participate in decisions affecting one’s working and nonworking life; and the right to benefit from the transformation of the state or global economy. Struggles won at the national level are now being eroded by a shift in the locus of commerce and increased globalization. Without consensus about fair play and the trustee institutions to ensure fair distributions from, and practices in, the new global economy, equity and justice cannot be achieved. See the discussion in Chapter 1, Section 1.2.2 on the increasing concern with inequality of wealth and income. Inequality is manifested both within and among countries. It is now agreed that future development must be “sustainable,” but that means different things to different commentators.

0.6 Drivers of economic growth and development

0.6.1 *Strategies to enhance competitiveness*

We have already argued that sustainable development must be seen as a broad concept, incorporating concerns for the economy, the environment, and employment. All three are driven or affected by both technological innovation (Schumpeter 1939) and globalized trade (Diwan and Walton 1997; Ekins et al. 1994). They are also in a fragile balance, are interrelated, and need to be addressed together in a coherent and mutually reinforcing way (N. A. Ashford 2001).

* For an argument that law is essential for achieving just transformations, see Dernbach (2008).

Technological innovation and trade drive national economies in different ways (Charles and Lehner 1998). The former exploits a nation's innovative potential, the latter its excess production capacity. Innovation-based performance is enhanced by technological innovation and changing product markets, characterized by fluid, competitive production, often with the upskilling of labor. Innovation-based strategies have positive impacts in both domestic and international markets. In contrast, cost-reduction strategies are enhanced by increased scales of production and/or automation, usually characterized by rigid, mature monopolistic production, the shedding and deskilling of labor, the saturation of domestic markets, increased reliance on trade, and the location of production where wages and health, safety, and environmental costs are minimized. Economies seeking to exploit new international markets may enjoy short-term benefits from revenues gained as a result of production using existing excess capacity, but they may ultimately find themselves behind the technological curve. In contrast, performance-driven markets, which capitalize on first-mover advantages, may be slower to gain profits but may outlast markets driven by cost-reduction strategies that are unable to compete with emergent and disrupting innovations.*

0.6.2 The consequences of different industrial strategy options for workers

Increasing labor productivity, defined as output per unit of labor input, is a concern in nations pursuing either an innovation or trade strategy to encourage economic growth. But labor productivity can be improved in different ways: (1) by utilizing better tools, hardware, software, and manufacturing systems; (2) by increasing workers' skills; and (3) by a better matching of labor with physical and natural capital and with ICT. Theoretically, increasing worker productivity lowers the costs of goods and services, thereby lowering prices and ultimately increasing the demand for and sale of goods and services. It can be argued that at least in some markets, more workers may be subsequently hired than displaced as a consequence of needing fewer workers to produce a given quantity of goods and services.† This optimistic scenario assumes a continual throughput society with increasing consumption. However, the drive toward increased consumption may have dire consequences for the environment (Daly 1991). In addition, questions arise whether, in practice, (1) labor is valued and paid more or less after productivity improvements, (2) there are positive or negative effects on job tenure and security, and (3) more workers are hired than displaced. The answers depend on the sources of the increases in worker productivity and the basis of a nation's competitiveness. Giving workers better technologies to work with may increase their productivity, but not their productiveness; that is, the labor content of, and contribution to, the product or service may have actually decreased. Here it is *capital* productiveness that has increased. Increasing workers' skills, even if the technologies of production remain unchanged, can increase both worker productivity and worker productiveness, the latter reflecting an increase in the contribution that labor

* See the discussion later in this overview of the important distinction between sustaining and disrupting innovation.

† Robert Ayres (2006, p. 1194) observes, "Information technology has exemplified the feedback cycle and the rebound effect. Costs have fallen, prices have followed and demand has risen in consequence. But IT [information technology] is not the panacea for the economy as a whole, unless it results in dramatically lower costs and increased demand for all other tangible goods and services the society needs. Up to now the applications of IT outside its own sector seem to be eliminating more jobs than it creates, but without significant corresponding impacts on consumer demand for products and services that would create more jobs." See also the more recent work of Brynjolfsson and McAfee (2013) warning about the potential "hollowing out of the middle class" by technological displacement.

makes to the production of goods or services. Better matching of skills to technology artifacts may yield synergistic effects, increasing labor productivity and both labor and capital productiveness.

A sector or national economy that increases its competitiveness through innovation-based performance presents opportunities for skill enhancement and higher-paying jobs, whereas pursuing competitiveness through cost-reduction strategies focuses on lean production (with worker displacement), flexible labor markets, and knowledge increasingly embodied in hardware and software rather than in human capital. The consequences of these two strategies for workers are different. The former strategy rewards and encourages skill acquisition for many, with appropriate financial benefits for those workers. The latter creates a division between workers: some are necessarily upskilled, but the skill content of many is reduced. Different national strategies might be pursued, reflecting different domestic preferences and culture, but there are further implications, depending on the extent to which trade drives the economy.

The 2016 election of Donald Trump is widely acknowledged to have been partially bolstered by disaffected people who blamed their worsening situation in terms of wages and the availability of jobs on trade. See Faux (2016) and Piketty (2016), hardly right-wing sympathizers, who have commented persuasively on this likelihood.

Trade aside, Brynjolfsson and McAfee (2014), in their book *The Second Machine Age*, foresee the creation of a small number of highly paid and skilled workers impacted by advances and opportunities in artificial intelligence, with technology possibly hollowing out the middle class with a subsequent lowering of skills demanded and compensation provided. In contrast, see Bivens (2017) for an argument that trade and globalization, especially of finance, are the major contributions to the suppression of wages and employment.

The economic crisis of 2008 has exacerbated disparities in income throughout the world. Even before the crisis of 2008, the changing global economy presented challenges for all nations as concerns increase about the number of available jobs, the nature of skills demanded, the extent of job security, levels of compensation, compromises to occupational health and safety, and most recently both economic migrants and political refugees. In the private sector, labor needs a role in choosing and implementing information-based and labor-affecting technologies. In the public sector, there is a need to integrate industrial development policies with those of employment, occupational health and safety, and the environment.

The following strategic changes are expected to influence firms to use labor more effectively:

- Distinguishing productiveness from productivity;
- Striving for an innovation-enhancing rather than a cost-reduction strategy;
- Investing in increasing the capacity of human resources rather than replacing labor with capital;
- Paying attention to the human/technology interface;
- Advancing beneficial industrial relations in the nation, sector, or firm;
- Investing in education and training;
- Using economic incentives to maximize human resource use and improvement; and
- Taxing pollution and carbon content of energy sources rather than labor.

From the perspective of labor, the success of these strategies requires implementation of the right to know, the right to participate, and the right to benefit from industrial transformations. Also see Section 0.9 for a discussion of additional system-focused changes that national governments might implement to promote the employment dimension of sustainable development.

The right to know has been described elsewhere (N. A. Ashford and Caldart 2008, Chapter 10) and includes citizens' and workers' right to know and have access to scientific, technological, and legal information and manufacturers' and employers' corresponding duty to inform and warn workers about this information. Scientific information includes chemical or physical hazards or risk information related to product or material ingredients, exposure, health effects, and individual or group susceptibility (N. A. Ashford et al. 1990). As important as information about hazards is, information about technology is key to enabling citizens and workers to play a role in reducing risks. This kind of information includes not only knowledge about pollution and accident control and prevention technology, but also technology options for industrial, agricultural, and other kinds of commercial activity. Knowing how production and services might be changed to make them inherently cleaner, safer, and healthier and the source of more rewarding, meaningful work is a *sine qua non* of being able to participate meaningfully in firm-based decisions. Finally, information about legal rights and obligations is crucial for using legal and political avenues for environmental and workplace improvement and redress from harm.

Workers' right to know is made operational through the right of workers to participate in (1) the technology choices of the firm (through technology bargaining and system design) (N. A. Ashford and Ayers 1987); (2) firm-based training, education, and skill enhancement; (3) the formation of national and international labor-market policies; and (4) the setting of national and international labor standards. Although national unions enable workers to work with employers through industrial relations systems, and the ILO uses a tripartite system that includes labor, management, and government, the trade regimes mentioned earlier give few or no participatory rights to labor (or environmentalists) in global economic activities that have potentially significant effects on wages and working conditions. As trade becomes an important part of national economies, this omission needs to be corrected (EC 2003, 2006). See Section 4.3.4 in Chapter 4 on the Comprehensive Economic Trade Agreement negotiations between EU and Canada, which attempted to address the neglect of participatory rights in previous trade agreements. Ironically, under the WTO trade rules, importing countries can restrict imports or place countervailing duties on items that harm their environment, but it is unclear whether there is any equalizing action that can be taken if the exporting countries produce those goods unsafely or with adverse environmental effects within their own borders (see the discussion in Chapter 11). This situation reinforces non-enactment or non-enforcement of national health, safety, or environmental laws in the exporting countries, to the detriment of their own citizens and workers. Further, countries may be reluctant to ratify or adopt international accords, including multilateral environmental agreements or ILO conventions, in hopes of maintaining or gaining short-term competitive advantage (see the discussion in Chapter 10).

Finally, and at the core of justice in the global work life, is the right of working people to benefit from industrial transformations. The right to know and the right to participate are essential, but the ultimate rights are those of a fair division of the fruits of the industrial or industrializing state, as well as a safe and healthful workplace. This translates into sufficient job opportunities, job security, and purchasing power, as well as rewarding, meaningful, and safe employment. This cannot be left to chance or serendipitous job creation. In formulating policies for environmental sustainability, economic growth and environmental quality should be simultaneously optimized rather than having environmental interventions occur after harmful technologies are in place. Instead, we need to design and implement cleaner and inherently safer production. Employment concerns deserve no less a place in center stage; competitiveness, environment, and employment must be co-optimized. Systemic changes must be pursued and selected that intentionally benefit both the environment and employment. Even with better prospects for employment, in an industrial system that continues to replace labor with physical capital, increasing worker

capital ownership and access to credit (R. Ashford 1998; R. Ashford et al. 2012) that turns workers into owners may be an additional and necessary long-term option if disparities of wealth and income prevail. In Section 3.6 in Chapter 3, we address the issue of enhancing earning capacity by changes in capital ownership through binary economics and other options that expand community-based ownership of essential services which can supplement or even supplant wages.

0.7 Conceptualizations of sustainable development

0.7.1 The interrelatedness of the economy, the environment, worker health and safety, and employment, and the need to address them together

It makes quite a difference whether one looks at sustainable development as just an environmental issue or as a multidimensional challenge in three dimensions: economic, environmental, and social.* We argue that competitiveness, the environment, and employment are the operationally important dimensions of sustainability, and these three dimensions together drive sustainable development along different pathways and go to different places than environmentally driven concerns alone, which may otherwise require trade-offs, for example, between environmental improvements and jobs. The interrelatedness of competitiveness, the environment, and employment is depicted in Figure 0.2.

A sustainable development agenda is, almost by definition, one of systems change. This is not to be confused with a (health, safety, and) environmental policy agenda (depicted in Table 0.1), which is explicitly effect-based and promotes a program of policies and legislation directed toward environmental improvements, relying on specific goals and conditions. The environmentally sustainable development policy agenda focuses at least on processes (for example, related to extraction, manufacturing, transport, agriculture, energy, and construction) and may extend to more cross-cutting technological and social systems changes, but an all-encompassing sustainable development agenda deals with more than health, safety, and the environment.

In Table 0.2, current strategy agendas, even those that go beyond environmental goals, are defined as those that are focused on those policies that (1) improve profit and market share by improving performance and efficiency in current technologies or by cutting costs; (2) control pollution, make simple substitutions and changes to products and processes, conserve energy and resources, and find new energy sources; and (3) ensure an adequate supply of appropriately skilled labor, confer with workers, and provide safer

* The sustainability triangle is often depicted as the economy, the environment, and social concerns, or the economy, the environment, and equity. Because all policies that affect the economy and environment have social effects and because the distributional consequences of differential access to necessary goods and services and different environmental burdens have significant equity consequences, we do not relegate the third corner of the triangle to either. Instead, we argue that employment should occupy the third corner of the triangle because employment is the enabling activity that allows workers and citizens to achieve economic, environmental, and social well-being and because employment is the focus of traditional government concerns and policies, along with economic and environmental policies. Because an important aspect of this book focuses on changes in current government policies, the depiction of a triangle that is consistent with policy areas better serves our purposes. We argue for attention to equity within each corner and further acknowledge the importance of culture in interpreting the triangle. What is an acceptable distributional disparity in one culture is different in another, and the importance work and environment have in one system may be very different in another. Broad, participatory mechanisms of affected stakeholders are needed to account for the acceptability of different policy mixes and outcomes.

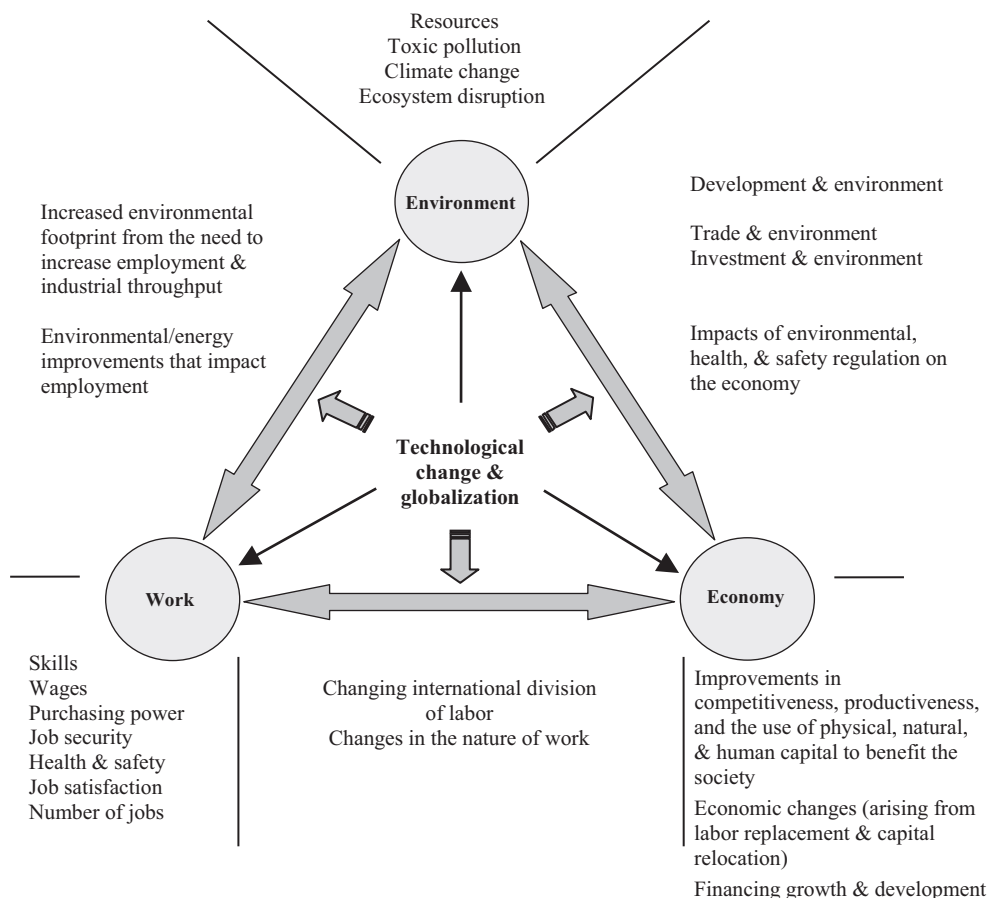


Figure 0.2 Technological change and globalization as drivers of change within and between three operationally important dimensions of sustainability

and healthier workplaces. We describe these strategies as reactive vis-à-vis technological change, rather than proactive. They are usually pursued separately and by different sets of government ministries and private-sector stakeholders. At best, policies affecting competitiveness, the environment, and employment are coordinated but not integrated. In contrast, sustainable agendas are those policies that focus on (1) technological changes that alter the ways goods and services are provided, (2) the prevention of pollution and the decreased use of energy and resources through more far-reaching system changes, and (3) the development of novel sociotechnical systems – involving both technological and organizational elements – that enhance the many dimensions of meaningful and rewarding employment through the integration rather than the coordination of policy design and implementation.

0.7.2 Sustaining and disrupting innovation distinguished (for an expanded discussion, see Section 8.2 in Chapter 8)

The kind of innovation likely to be managed successfully by industrial corporations is relevant to the differences between current and sustainable technology agendas. We argue

Table 0.1 Evolution of approaches to health, safety, and environmental problems

<i>Approach</i>	<i>Observations</i>
Dispersion of pollution and waste	The solution to pollution is dilution (ultimately leading to trans-boundary pollution)
End-of-pipe pollution control	Collecting wastes; workplace ventilation and protective equipment No fundamental changes in inputs, final products, or production technology Media shifting: air and water pollution → waste and workplace exposures Problem shifting: toxicity → accident potential
Industrial ecology: waste and material exchange and consolidation	No fundamental changes in inputs, final products, or production technology
Pollution prevention and cleaner technology	Improvements in eco-efficiency and energy efficiency; fundamental changes in inputs, final products, or production technology
Shifts to product services, system changes, and sustainable development	Restructuring of industrial, agricultural, and service industry actors and relationships involving new collaborations and actors; changes in the nature of consumer and business demand

Table 0.2 Comparison of current and sustainable policy agendas

<i>Agenda</i>	<i>Competitiveness (economic development)</i>	<i>Environment</i>	<i>Employment</i>
Current	Improve performance and efficiency Cut costs	Control pollution Make simple substitutions or changes to products and processes Conserve energy and resources; find new energy sources	Reduce worker hazards Maintain dialogue with workers on working conditions and terms of employment Ensure supply of adequately trained people
Sustainable	Change the nature of meeting market needs through radical or disrupting innovation (a systems change) Transition towards product services Change the nature of demand by cultural transformation	Prevent pollution through system changes Design environmentally sound products and processes Decrease resource and energy dependence	Radical improvement in human–technology interfaces (a systems change) Design inherently safe products and processes Create meaningful and rewarding jobs

that the needed major product, process, and system transformations may be beyond those that the dominant industries and firms are capable of developing easily, at least by themselves. Further, industry and other sectors may not have the intellectual capacity and trained human resources to do what is necessary.

This argument is centered on the idea of “the winds of creative destruction” developed by Joseph Schumpeter (1939; 1942) in explaining technological advance. The distinction

between incremental and radical innovations – be they technological, organizational, institutional, or social – is not simply line-drawing along points on a continuum. Incremental innovation generally involves continuous improvements, while radical innovations are discontinuous (Freeman 1992), possibly involving displacement of dominant firms, institutions, and ideas rather than evolutionary transformations. In semantic contrast, Christensen (1997, p. 47) distinguishes continuous improvements as “sustaining innovation” and uses the term “disrupting innovation” rather than radical innovation, arguing that both sustaining and disrupting innovations can be incremental, moderate, or radical, where the term “radical” is reserved for rapid or significant performance changes within a particular technological trajectory.

Thus, in Christensen’s terminology, radical sustaining innovation is a major change in technology along the lines which technology has been changing historically – for example, a much more efficient air pollution scrubber – and is often pioneered by incumbent firms. A major innovation that represents an entirely new approach, even if it synthesizes previously invented artifacts, is termed “disrupting,” and in product markets, it usually is developed by firms not in the prior markets or business. This is consistent with the important role of outsiders – both to existing firms and as new competitors – in bringing forth new concepts and ideas (van de Poel 2000).

Counting only or mainly on existing industries or traditionally trained technical expertise for a sustainable transformation ignores increasing evidence that not just willingness, opportunity, and motivation are required for needed change, but another crucial condition – the ability or capacity of firms and people to change – is essential (N. A. Ashford 2000). Incumbent firms may develop disrupting innovations in response to a strong signal from society or the market, but such occurrences appear to be uncommon.

We argue here that the same holds true for government and societal institutions faced by the triple challenge emanating from new demands in the areas of competitiveness, the environment, and employment. Intelligent government policy is an essential part of encouraging appropriate responses of the system under challenge, and of assisting in educational transformations as well.

An essential concept in fostering innovative technical responses is that of “design space.” As originally introduced by Allen et al. (1978) of MIT, design space is a cognitive concept that refers to the dimensions along which the designers of technical systems concern themselves. Especially in industrial organizations that limit themselves to current or traditional strategies or agendas, there is a one-sided use of the available design space. Solutions to design problems are sought only along traditional engineering lines. In many cases, unconventional solutions – which may or may not be high-tech – are ignored. For that reason, radical, disrupting innovations are often produced by industry mavericks or as a result of some disruptive outside influence (such as a radically different or more stringent environmental regulation, foreign competition, or the influence of an outsider on the organization).

0.7.3 A capsule definition of sustainable development

To summarize the discussion so far, sustainable development decries a simplistic definition and rather is a multidimensional concept characterizing development that seeks to:

- meet needs and avoid adverse effects of industrialization within and among nations and on subsequent generations;
- provide an adequate supply and fair distribution of essential goods and services;
- provide for good health, safety, and an environment without environmental injustices;
- provide for fair working conditions and occupational health and safety;
- provide for fair and meaningful employment;
- provide for adequate and fair purchasing power through a combination of employment and physical capital and energy ownership;

- meet and expand the potential for a nation's self-reliance, capacity for innovation, and participation in the global economy; and
- engage individuals in society to realize their human potential (that is, social inclusion).

0.8 Governance options for achieving a transformation to a more sustainable state

Various commentators offer a range of strategies to improve the sustainability of the world's economies. These include (1) collaborative approaches among stakeholders, locally, nationally, and internationally; (2) mobilization of public opinion, especially at the grassroots level, to provide pressure on government and the private sector and to shift the nature of the demand for goods and services; and (3) government intervention in areas from environmental protection to energy supply, anti-monopoly action, and job creation. Government action has not been particularly popular among free-market advocates, although recent events have increased the demand for more government involvement.

Although we are strong advocates of civic engagement and participatory democracy, we contend that their power is seriously compromised by vested financial and political interests, the power of the corporate sector, the influence of advertising and ideological broadcast and electronic/social media, and the influence on elected officials through campaign contributions. One needs only to examine the results of negotiated regulation in U.S. environmental and safety areas to be convinced of the inadequacy of the collaborative approach at the national level (N. A. Ashford and Caldart 2005).*

Although stakeholder involvement and enhancing public awareness are essential elements of a needed transformation, these vehicles move too slowly and ineffectively to address the challenges brought on by the tipping points immediately ahead. National health care, environmental protection, the creation of needed jobs, the saving of people's homes, and the creation of real incentives to stem financial manipulation cannot wait for enlightenment and public involvement processes. In the end, even strong leadership from the executive branch of government, in combination with public participation and increased awareness, may not come quickly enough to avoid serious consequences, but strong and deliberate executive leadership and aggressive initiatives by the administrative agencies of government already legally empowered to act are certainly necessary components worthy of resurrection in the political process.

Further, industrial policy, environmental law and policy, and trade initiatives must be "opened up" by expanding the practice of multipurpose policy design, and these policies must be integrated as well. Sustainable development requires stimulating revolutionary technological innovation through environmental, health, safety, economic, and labor market regulation. Greater support for these changes must be reinforced by "opening up the participatory and political space" to enable new voices to contribute to integrated thinking and solutions. This may require political, institutional, and social innovation as well.

0.9 The role of national governments

In this book, we will argue that national government support and intervention at the highest level are essential for achieving the kinds of industrial transformations that are desirable from an economic perspective, and that are fair and just in their production

* Collaboration and negotiation may well be successful at the local level, where public concern about local pollution or economic issues makes political accountability more visible and important. At the international level, because supranational governmental authority rarely exists, collaboration and negotiation among stakeholders may be valuable, but whether voluntary or mandatory agreements are negotiated, national governmental action must follow lest those agreements remain a paper tiger.

and delivery of essential goods and services. Among the suggested general functions of government are the following:

- To provide the necessary physical/legal infrastructure;
- To support basic education and skills acquisition (human resource development);
- To invest in path-breaking science and technology development to enhance competitiveness, environmental improvement, and job design;
- To sustain a healthy economy that creates sufficient earning capacity through some combination of personal ownership of productive capital and rewarding and meaningful employment with sufficient purchasing power, reduces poverty, and provides the opportunity for a high quality of life for all;
- To protect the environment and ensure that every person benefits from clean air, clean water, and a healthy home, work, and leisure environment;
- To regulate deceptive and inaccurate advertising, as well as to provide counteracting government messaging to discourage unsustainable consumption;
- To act as a facilitator or arbitrator of competing stakeholder interests to ensure a fair process;
- To act as a trustee of (underrepresented) present and future worker and citizen interests to ensure a fair outcome in transformations of the economy;
- To act as a trustee of new technologies;
- To act as a force to integrate, not just coordinate, policies; and
- To ensure a democratic political process, free from corruption and undue influence of vested interests which act to the detriment of the rest of society.

More specifically, depending on the specific transformation desired, there is a role for government from the direct support of R&D and incentives for innovation through appropriate tax treatment of investment to the creation and dissemination of knowledge through experimentation and demonstration projects; the creation of markets through government purchasing; the removal of perverse incentives of regulations in some instances and the deliberate design and use of regulation to stimulate change in others; training of owners, workers, and entrepreneurs; and education of consumers. The role of government should be considered beyond simply creating a favorable climate for investment. Although it is true that the government may not be competent to choose specific firms as winners, it can provide funding in a portfolio approach focused on stimulating innovation and diffusion (see Mazzucato 2014 for important evidence for the U.S.), as well as create winning forces and provide an enabling and facilitating role by creating visions and scenarios for sustainable transformations.

There is continuing debate about the appropriate role of government in encouraging industrial transformations (N. A. Ashford 2000). Major differences revolve about two competing philosophical traditions: the dominance of unfettered market approaches and a more interventionist, directive role for government through laws and regulation. Market approaches concentrate on “getting the prices right,” ensuring competition in capital and labor markets, and increasing demand for a clean environment, product safety, and good working conditions through providing information and education. In contrast, government intervention approaches focus on establishing minimum environmental, product-safety, and labor standards and practices; requiring full disclosure by employers and producers of information needed by consumers, citizens, and workers to make informed choices and demands; encouraging technology development, transfer, and infrastructure expansion through a deliberate industrial policy; and requiring decision bargaining in industrial relations. Alternative roles for government in promoting sustainable development accomplish different things:

- 1 *Correcting market failures* by regulating pollution and by addressing inadequate prices, monopoly power, uncompetitive labor markets, and lack of information achieves *static efficiency* through better working markets.
- 2 Acting as a *mediator or facilitator of environmental and labor disputes and conflicts* among the stakeholders achieves *static efficiency* through reducing transaction costs.
- 3 Facilitating an industrial transformation by *encouraging organizational learning, pollution prevention, and dialogue with stakeholders* leading to win-win outcomes – based on the concepts of ecological modernization (Jänicke and Jacob 2005; Mol 2001) or reflexive law (Teubner 1983) – relies on rational choice and evolutionary change that moves toward a more *dynamic efficiency*, usually over many decades.
- 4 Moving beyond markets and *acting as a trustee for minority interests, subsequent generations, and new technologies* by forcing and encouraging innovation through coordinated regulatory, industrial, employment, and trade policy transcend markets, moving toward *dynamic efficiency* within a shorter time horizon.

These options are listed in increasing order of intervention, and different stakeholders will, of course, have different preferences according to their ideology and self-interests. As a practical matter, we will argue in this book that extensive intervention is needed to address the nine systemic problems discussed in Section 0.3. Some of the specific interventions that are needed are, respectively:

- adopting a *transdisciplinary approach* to sustainable development*;
- establishing mechanisms for democratic, participatory governance; reducing channels of influence by concentrated sources of power and wealth;
- stimulating technological, institutional, organizational, and social innovation;
- getting prices right – or least not wrong – through effective corrective taxation and other policies;
- transcending markets and implementing farsighted and integrated policies;
- instituting deliberate policies and strategies for the development and utilization of human resources, that is, education (for both skills and citizenship), training, and job creation;

* Appreciating the distinctions among inter-, multi-, and transdisciplinary approaches is essential to understanding why well-meaning efforts to solve complex problems by assembling professionals from different disciplines or to expand traditional education in a particular direction often lead to disappointing results. Interdisciplinary research (and teaching) – literally “between disciplines” – often precedes the creation of a new, well-defined field. Thus, biochemistry begins with a focus on traditional chemistry principles and knowledge applied to understanding biological systems; it adapts and grows; and the intellectual boundaries are refocused and redrawn. Finally, biochemistry becomes a field of its own, different from but not necessarily broader or narrower than the parent disciplines that spawned it. Multidisciplinary research (and teaching) – literally “several or many disciplines” – brings together several disciplinary foci and thus deals with more than one traditional concern. For example, costing out different energy options necessarily involves knowledge of both energy technology and economics. Multidisciplinary research and teaching can be carried out by multidisciplinary teams or by one individual who has been trained in more than one discipline.

Transdisciplinary research (and teaching) – literally “across disciplines” – transcends the narrow focus of one or more disciplines and is not constrained to adopt preexisting models for problem definition or solution. Boundaries might necessarily have to be drawn as a practical matter, but they are not dictated by limitations of the analyst or designer. Where broad system changes are desirable, transdisciplinary approaches are essential. Transdisciplinary approaches open up the problem space of the engineer. By their nature, transdisciplinary approaches synthesize and integrate concepts whose origins are found in different disciplines.

- enforcing anti-corruption, anti-monopoly, fair-trade, and advertising law; undertaking serious campaign finance reform and disclosure legislation; considering term limits for elected officials; establishing accountability and whistleblower protection measures; reforming the chartering of corporations;
- encouraging innovation in material and energy use; taxing unsustainable extraction, production, products, and services; educating citizens and consumers; and
- replacing GDP, labor productivity, and other inappropriate measures of progress with more sustainability-relevant metrics; reforming the reward structure that encourages unsustainable growth.

In addition to national responsibilities in a world of increasingly globalized commerce, information, finance, and interconnectedness, national governments also have a responsibility to:

- reform institutions at the global level to ensure that developing nations have equitable access to international markets, technology, and information;
- establish trade and foreign policies that further the achievement of sustainable development;
- ratify, implement, and enforce international treaties and accords designed to protect the environment, workers, and human rights; and
- ensure peace and tranquility.

These and other interventions will be explored throughout this book, but especially in the last chapter where our policy recommendations are organized and discussed in greater depth.

If the authors of this book are correct in their prediction that earning capacity, purchasing power, and sustainable livelihoods of people are destined to become the major social concerns facing not only developing countries, but developed nations as well, then what are the options for addressing this concern?

- 1 Transfer wealth or income from capital owners and highly paid workers to those under- or unemployed. *A redistribution of wealth or income.**
- 2 Engage in Keynesian spending for labor-intensive projects improving infrastructure, with government and taxpayers footing the bill. *This represents job creation in the face of insufficient current demand for public services, probably by deficit spending: effective over the short term, but not likely to become a successful long-term strategy.*†

* For a discussion of the redistribution of income through taxes, social transfers (social insurance, pensions, and unemployment insurance), and social expenditures (education, health, water, and other social services) – see Prasad (2008). *Policies for Redistribution: The Uses of Taxes and Social Transfers*. Geneva: International Institute for Labour Studies, International Labour Organisation. Looking over the previous fifteen years in a large number of both developed and developing countries, Prasad (2008) found that the redistributive impact of taxes and social transfers, which have become increasingly regressive over time, have thus not been able to reverse income inequality. On the other hand, as experience in Mauritius, Malaysia, Nordic countries, and for low-income people in Brazil has shown, social policy can be used more aggressively without adversely affecting growth or employment objectives. Both tax and social policy are needed to support employment objectives specifically.

† For details of options for fiscal interventions to increase economic growth and employment assembled by the U.S. Congressional Budget Office, see CBO (2010a, 2010b). Also see the previous footnote. Sources: CBO (2010a). *Policies for Increasing Economic Growth and Employment in 2010 and 2011*. Available at www.cbo.gov/ftpdocs/108xx/doc10803/01-14-Employment.pdf and CBO (2010b). *Policies for Increasing Economic Growth and Employment in the Short Term*. Statement of Douglas W. Elmendorf, Director, CBO, February 23, 2010. Available at www.cbo.gov/ftpdocs/112xx/doc11255/02-23-Employment_Testimony.pdf

- 3 Spread existing work out over a larger population by shortening the workweek, but *without* maintaining wage parity. *A redistribution of wage income from existing workers to a larger pool of potential workers, an initiative that involves no wealth transfers to labor as a whole, nor a transfer from the owners of capital to labor.*
- 4 In contrast, spread out existing work over a larger population by shortening the workweek, but with the *maintenance of wage parity. More of the fruits of industrial production and services going to labor; requires a redistribution of income from either profits or the tax base.*
- 5 Limit the elimination of jobs during economic downturns; supplement the shortfall in paid wages for workers on furlough or working shorter weeks from a government-administered, employer-financed fund. *Allowing a quicker recovery of fuller employment when demand – especially foreign demand – increases; used in Germany.**
- 6 Increase labor's contribution and therefore its claim on the profits from production and services by upskilling and redesigning work back into production and services. *Requires a redesign of labor's role in commercial activities that will reverse the decades-old trend in replacing labor with capital.†*
- 7 Meet essential human needs in a less-expensive and less resource-intensive way by redesigning products, production, services, and systems. *Requires a re-conceptualized national industrial policy and restrictive trade practices.*
- 8 Change the nature of consumer and human-centered demand by encouraging cultural change more focused on using disposable income on services with significantly less capital and energy intensiveness and much more labor-intensiveness. *Requires a shift of demand from "stuff" to human services.*
- 9 Promote the creation of a cooperative economy to broaden ownership among employees and members of communities. *Requires business models that include cooperatives, employee-owned firms, credit unions, community land trusts, foundation-owned companies, and any form of organization that is owned and controlled by its workers or community.*
- 10 Enable poor and middle-class people to become owners by *extending to them competitive market opportunities to acquire capital with the future earnings of capital, based on binary economics.* This approach is discussed in Section 3.6.1 in Chapter 3.

The 2008 financial crisis has exacerbated income inequality (Eichhorst et al. 2010; Faux 2016; Piketty 2016). However, looking at the G20 countries, labor-market institutions (employment protection legislation, unemployment benefits, and active labor market/job creation programs), which provided strong internal flexibility in combination with relatively strict employment protection (like Germany), were able to stabilize employment, however, with the marginal workforce bearing the brunt of the crisis.

Deliberately focusing on these options, rather than attempting to return to a growth-based, export-led economy, allows for creative experimentation with what is likely to

* For a detailed explanation of stable employment in Germany, even in the face of decreasing export activity, see Eichhorst, W., Escudero, V., Marx, P. and Tobin, S., (2010). "The Impact of the Crisis on Employment and the Role of the Labour Market Institutions," International Institute for Labour Studies, International Labour Organisation, Geneva, pp. 27–29.

† Knowledge applied in an iterative way (knowledge injected periodically or continuously over time) can have a cumulative effect, with new knowledge building on past knowledge acquisition and investment. This is akin to adding financial flows to previous investments that have accumulated and appreciated in value and is unlike investments in physical capital that depreciate in value over time because functionality decreases due to regular utilization. Knowledge capital, even if it sometimes becomes less valuable over time, may nonetheless grow (accumulate) from using it and adding to it over time – see Foray, D. (2006) *The Economics of Knowledge*. MIT Press, Cambridge. This observation has direct relevance for the choices that are made as to which factor endowments to invest in to produce a product or provide a service. Hardware deteriorates, but knowledge held by a skilled person who continues to learn can appreciate in value for many years. This calls into question the replacement of labor by physical capital as a growth strategy.

become the major social concern of government, without subordinating the interests of poor and middle-class people to the more affluent. Such subordination causes redistributions that exacerbate the disparity among economic winners and losers, with many people ending up as the losers. Some of these options have the potential to limit wasteful growth (7, 8, and 9) and limit underutilized human capital (4, 5, and 6). Some options (1, 2, 3, 4, 5, 6, and 10) require other complementary policies to limit wasteful consumption as well.

The alternatives are to act as if the crises will soon be over, to assume that recovery without transformation is possible, to continue the failed policies of the past, to assume that technology and ingenuity will be sufficient to save us, to accept the inevitable that there will be winners and losers, and to fail to distinguish policies which aid the financial sector from those that improve the real economy.

0.10 The necessity of solving problems on a comprehensive basis

Figure 0.3 has been created to help visualize the need to broaden the current discourse on sustainable development to include all the societal concerns influencing sustainable development. The figure highlights all four of the critical environmental concerns related to sustainable development. In addition, it captures important social concerns such as the need for peace and security, equality, and environmental justice. Employment is placed alongside these concerns, given its critical role in raising purchasing power and providing sufficient income to make essential goods and services accessible to all. The “competitiveness” wedge was included in the diagram to account for the economic challenge of delivering effective and efficient goods and services* – a challenge that is central to Europe’s Lisbon Strategy, succeeded by Europe 2020, and most recently by Europe 2030. The rationale is that competitiveness is a critical factor of economic growth and one that is closely related to technological innovation – an issue of direct interest to virtually all government activity areas.

The three arrows that follow the circumference of the outer circle in Figure 0.3 identify which challenges relate to environmental protection, social development, and economic development. Figure 0.3 also highlights the critical need for integrated decision-making by representing several U.S. federal government activity areas (that is, those areas where government provides basic goods and services) with the major challenges confronting sustainable development. There is no hierarchy to the activity areas shown. Thus, those located near the center of the circle are not necessarily more or less important than those located near the edge.

Figure 0.3 shows that focusing on climate change as the major challenge confronting sustainable development ignores the importance of other environmental, social, and economic challenges. In addition, single-purpose policies designed to confront climate change may inadvertently worsen problems in other areas. For example, increasing the percentage of ethanol in gasoline to reduce CO₂ emissions might lead to the production of additional toxic air pollutants and to an increased use of pesticides, worsening the toxics problem, as well as raising the cost of food and actually increasing greenhouse emissions through additional land use (Searchinger et al. 2008). Thus, a major advance in confronting sustainable development would be the integration of government decision-making to address environmental, social, and economic problems that are not constrained by institutional missions or the fragmentation of activities within government agencies (Hall

* The decision to highlight competitiveness as an important issue rather than economic growth is intentional. The basic argument is that focusing on the competitive delivery of goods and services is more likely to lead to long-term economic benefits than a focus on short-term economic growth. See Chapter 7 for a discussion of how technological innovation can enhance competitiveness and lead to economic growth.

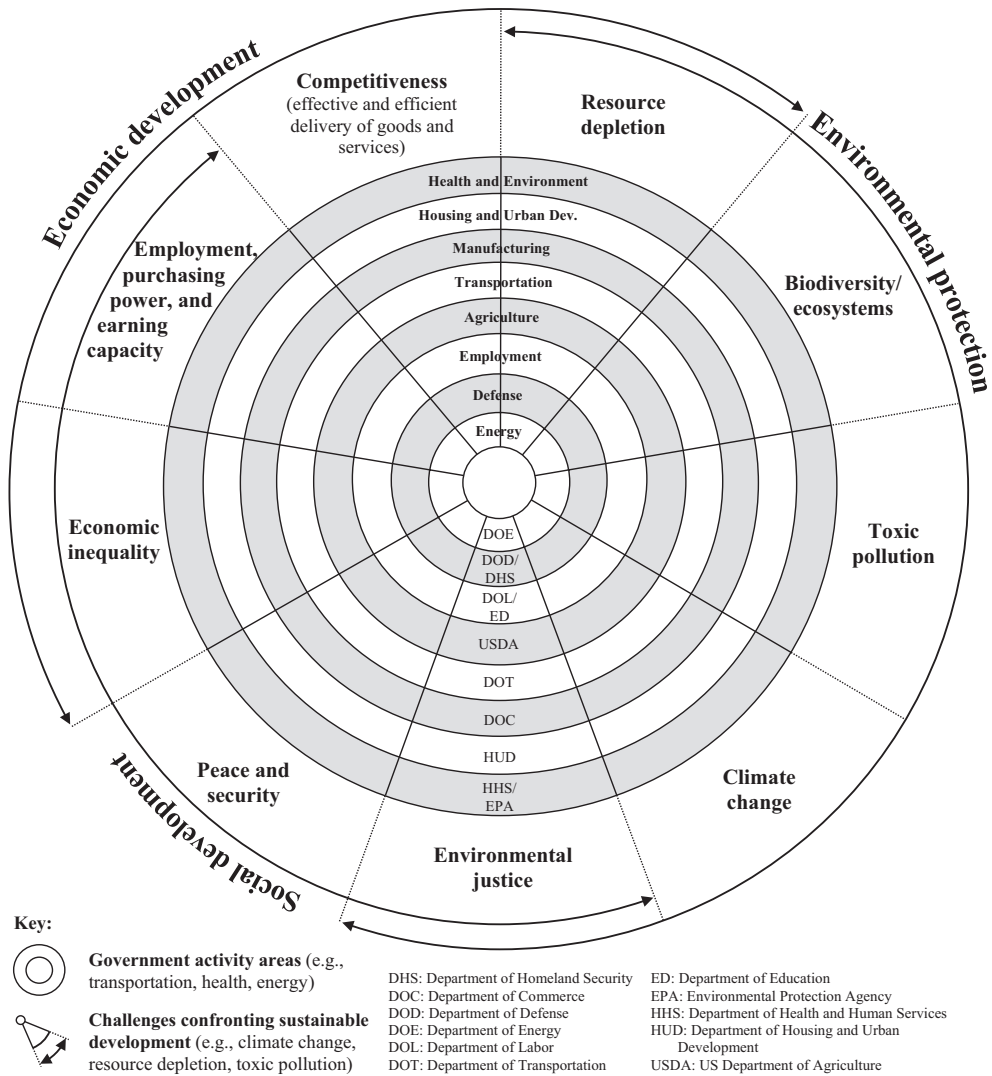


Figure 0.3 Government activity areas and challenges confronting sustainable development

2006). Specific recommendations for achieving policy integration are addressed in the last chapter of this work.

0.11 The way forward

If we recall that a sustainable future requires technological, organizational, institutional, and social changes, it is likely that an evolutionary pathway is insufficient to achieve the needed factor ten or greater improvements in ecological and energy efficiency and reductions in the production and use of, and exposure to, toxic substances. Nor are fundamental changes in the organization of work likely to emerge through evolutionary change.

Such improvements require more systemic, multidimensional, and disruptive changes. We have already asserted that the capacity to change can be the limiting factor. This is often a crucial missing factor in optimistic scenarios.

Significant industrial transformations occur less often from dominant technology firms – or in the case of unsustainable practices, problem firms’ capacity-enhancing strategies – than from new firms that displace existing products, processes, and technologies. This can be seen in examples of significant technological innovations over the last fifty years, including transistors, computers, and polychlorinated biphenyl (PCB) replacements.

Successful management of disruptive product innovation requires initiatives from outsiders that help expand the design space that is currently limited in scope by dominant technology firms (van de Poel 2000). Especially in sectors with an important public or collective involvement, such as construction and agriculture, intelligent government policies are required to bring about necessary change.

Rigid industries whose processes have remained stagnant also face considerable difficulties in becoming significantly more sustainable. Shifts from products to product-services rely on changes in the use, location, and ownership of products in which mature product manufacturers may participate, but this requires significant changes involving managerial, institutional, organizational, and social (customer) innovations. Changes in sociotechnical systems, such as transportation or agriculture, are even more difficult. This suggests that the creative use of government intervention is a more promising strategic approach for achieving sustainable industrial transformations than the more neoliberal policies relying on firms’ more short-term economic self-interest.

This is not to say that enhanced analytic and technical capabilities on the part of firms; cooperative efforts and improved communication with suppliers, customers, workers, and other industries; and environmental, consumer, and community groups are not valuable adjuncts in the transformation process. But in most cases, these means and strategies are unlikely to be sufficient by themselves for significant transformations, and they will not work without clear mandated targets to enhance the triple goals of economic development, environmental quality, and enhancement of employment and earning capacity.

The history of innovation has amply demonstrated that disruptive innovations are feasible, and they may bring substantial payoffs in terms of triple sustainability. They are within the available but unused *design space*. However, the general political environment, governmental dedication, and the incentive structure have to be right for the needed changes to occur.

We have already argued that government has a significant role to play, but the government cannot simply serve as a referee or arbiter of existing competing interests, because neither future generations nor future technologies are adequately represented by the existing stakeholders. Government should work with stakeholders to define far-future targets – but without allowing the agenda to be captured by the incumbents – and then use its position as trustee to represent the future generations and the future technologies to backcast what specific policies are necessary to produce the required technical, organizational, and social transformations. Backcasting enables policy makers to look back from a desirable future to create strategies that will, it is hoped, enable the future visions to materialize. This approach is in contrast to current planning processes that develop strategies based on forecasts. The backcasting approach adopted will have to be of a next-generation variety. It has to go beyond its historical focus on coordinating public and private-sector policies. It must be multidimensional and directly address the present fragmentation of governmental functions, not only at the national level but also among national, regional, and local governmental entities. In this book, we will argue that what is needed is stronger and smarter government. However, this does not necessarily mean

bigger government if integration and coordination of the functions that government can provide are achieved. (For a concise treatment of the role that government might play, based on this book, see Ashford and Hall 2011.)

There is a great deal of serendipity and uncertainty in the transformation process, and the long-term prospects may not always be sufficiently definable to suggest obvious pathways or trajectories for the needed transformations. Thus, it may be unreasonable to expect that government can always play a definitive futures-making role. What follows from this is that rather than attempting tight management of the pathways for the transformations that are sustainable in the broad sense, the government's role might be better conceived as one of enabling or facilitating change while at the same time lending visionary leadership to co-optimize competitiveness, the environment, and employment and earning capacity. This means that the various policies must be mutually reinforcing. This newly conceptualized leadership role – focused on opening up the problem space of the engineer, designer, or policy maker – is likely to require participation of more than one ministry or department. In parallel with this, the *participatory and political space* needs to be opened up to enable new voices to contribute to integrated thinking and solutions.

Increasingly, ministries or departments of commerce and economic affairs and of the environment are working together to fashion a vision of environmental sustainability. What has been missing is a similar proactive role of ministries or departments of labor to interface and integrate employment-related policies into the national and global policy agendas. Finally, in an increasingly global marketplace, the integration of trade, industrial, employment, and environmental policies has to receive major attention lest strictly national efforts are undercut by global economic and political forces.

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Part I

The multidimensional concept of sustainability

In Part I of this book, we discuss the nature (Chapter 1) and evolution (Chapter 2) of the multidimensional concepts of sustainability and sustainable development.

Chapter 1 begins by exploring two central components of sustainable development – meeting basic human needs and equality, which are discussed in the context of governance. We then consider the current economic growth model and the importance given to technological innovation as the key to solving the sustainability challenge. The chapter ends by highlighting several critical issues that we argue must be included in future development strategies. A narrow focus on one issue, such as climate change, or even a small group of concerns will limit options and ignore opportunities to develop cross-cutting approaches to address unsustainable trends in a comprehensive manner.

Chapter 2 provides a brief historical context for the ideas and themes discussed in Chapter 1. It identifies a number of important texts, national and international events, U.S. regulations from 1951 to 2018, and Multilateral Environmental Agreements (MEAs) that helped shape the current and continually evolving notion of sustainable development. It also discusses the 2015 Sustainable Development Goals (SDGs) and makes the argument that employment is a critical and overlooked component of sustainable development.



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At the beginning of the twenty-first century, the industrialized world might have been described as one of significant technological progress, industrialization, and globalization. In developed nations, energy systems supply power to our homes, places of work, and general environment. When we become ill, we find an abundance of modern drugs that can ease or cure our suffering, maintaining or improving our physical and emotional well-being. Global financial and commodity markets provide trillions of dollars a day to supply our investment and consumption needs. The agricultural sector, through mechanization and other technological and biological advances, has been able to supply our growing sustenance requirements. Telecommunications systems have enabled friends, families, businesses, organizations, and governments to communicate verbally and visually across thousands of miles. Combine these technologies with our modern transportation systems, and we remove the notion of the frontier.

Having achieved such progress, why should we now be concerned about the future of humankind on a global scale? Primarily, because this progress has not been equitable or sustainable. In 2013, 766 million people lived in extreme poverty on less than \$1.90 a day (UNDP 2016). It is estimated that some 3 billion people live below the “ethical poverty line,” which is defined as the income needed for someone to achieve a normal life expectancy of 70 years (Edward 2006; Oxfam 2017). Thus, a majority of the 7.3 billion people alive today may not have any meaningful access to the resources and quality of life described above. Even within the developed countries, many people do not have access to an adequate supply of essential goods, services, housing, health care, and other necessities and, in a financial crisis like the one in 2008, are at risk of losing their homes and/or their

jobs. Furthermore, inequality is increasing, leading toward a world of growing disparity both between industrialized and developing nations and among different segments of the population within those countries. In effect, the communities of less-developed regions and poor areas are held captive to the needs and wants of those who are well-off in industrialized (and some in industrializing) nations, whose living and consuming habits are in many ways condemning billions of people to a lower (material) quality of life. Put simply, if each member of the global community were to live the lifestyle of the average U.S. or UK citizen, holding technology constant, we would need the resources of somewhere between 1.5 and 8 planet Earths (McLaren et al. 1997; Wilson 2002; WWF 2006, 2016; McDonald 2015). It is clear that a global drive to reach the Westernized view of the good life, without a drastic change in production processes and consumption patterns, will soon bring us up against ecological and physical limits and force us to rethink what we mean by a secure and fulfilling lifestyle.

These introductory paragraphs present a highly simplified view of the world, and there is clearly a continuum of positions between those presented. The central argument of this book is that if we are interested in the well-being of current and future generations, we not only should be concerned for the future of the world but also should be actively searching for new ways to enable individuals, communities, and nations to live a sustainable life through sustainable livelihoods. If present trends continue and the structural forces driving them remain substantially unchanged, there is a strong possibility that within a few generations the world will be incapable of sustaining the human population at an adequate level of material well-being and health, and that it will lack sufficient and equitable opportunities for the realization of human potential. These trends include persistent (and often growing) inequalities between and within nations (including the United States) and persuasive evidence that we are living beyond our ecological and physical means.

Further, the social and political environment in which policy responses to these trends must be made is a difficult one. It is defined by globalization and rapid technological change, which are mutually reinforcing and create a set of conditions that shortens the necessary response time for policy, restricts national policy options, and possibly exacerbates distributional inequality and ecological damage. This chapter lays out the challenge of meeting human needs in a sustainable and equitable way, given these social and political conditions.

1.1 Human needs and sustainability

Understanding the fundamental needs of humans is essential if we are to develop strategies to transition society toward more sustainable forms of development. We define a human need as any need, both physiological and psychological, that is inherently universal, across both space and time, for our species. What it is not is a want or desire, nor is it the specific means with which we seek to fulfill a need. Furthermore, unlike Maslow's hierarchy of human need (1943), it is increasingly apparent that "human needs are irreducibly plural" and neither hierarchical nor substitutable (Gough 2015, p. 1201). Despite the universality of fundamental human needs, any individual, group, or society will develop *actions* and *value systems* in an effort to realize only their *perceived* needs, based on the information and opportunity available. This is especially important when considering differences in the needs of people in developed versus developing nations, where livelihoods and opportunities vary significantly. It also means that the satisfiers of needs will change over time and across cultures with socioeconomic change.

For example, if societal and cultural values perceive and nurture basic psychological needs, it is likely that the social fabric of a community will strengthen, which in turn will facilitate the well-being and integrity of individuals within that community (R. M. Ryan 1995). Not acknowledging or supporting basic psychological needs will likely result in the

opposite effect, as the underlying human need remains, whether perceived or not. Hence, if we are concerned for humankind, then we need to understand the difference between basic needs that are inherent in human nature and those that are a product of the socialization of humans. This understanding will optimize the economic, social, and political decision-making process we must undertake in order to create a sustainable future.

While historically the purpose of development was to develop *things* (for example, to transform resources into commodities/products), this was first rejected and redefined in the 1970s, shifting the focus of development to satisfying the *needs* of humankind. This process could be said to have begun with Schumacher's 1973 publication *Small Is Beautiful*, which challenged the prevailing patterns of development and approach to global economics. Schumacher (1999, p. 139) rejected the idea that what "is best for the rich must be best for the poor" and redirected the conventional view of development toward human needs. "Development does not start with goods; it starts with people and their education, organization, and discipline. Without these three, all resources remain latent, untapped, potential" (ibid.).

A year later, the Cocoyoc Declaration built on the ideas of Schumacher and placed basic human needs at the center of development efforts, stating that "any process of growth that does not lead to their fulfillment – or, even worse, disrupts them – is a travesty of the idea of development."^{*} The following year the Dag Hammarskjöld Foundation (1975) articulated a similar position on the objective of development in *What Now: Another Development*. It called for the "development of every man and woman – of the whole man and woman – and not just the growth of things, which are merely means" (ibid., p. 5). Further, the report emphasized the importance of satisfying the basic needs of the poor, as well as the universal "needs for expression, creativity, conviviality, and for deciding [. . . one's] own destiny" (ibid.). It continues: "Development is a whole; it is an integral, value-loaded, cultural process; it encompasses the natural environment, social relations, education, production, consumption and well-being" (ibid.).

In 1987, over a decade later, the World Commission on Environment and Development (WCED) published *Our Common Future*, which again placed "human needs" at the center of concerns for "sustainable" development.

Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs. It contains within it two key concepts:

- The concept of "needs," in particular the essential needs of the world's poor, to which overriding priority should be given; and
- The idea of limitations imposed by the state of technology and social organization on the environment's ability to meet present and future needs.

(WCED 1987, p. 43)

* The influence of Schumacher's work is clearly evident throughout the Cocoyoc Declaration. Schumacher's call for a "metaphysical reconstruction" (Schumacher 1999, p. xi) – the need to reconstruct the meaning of ideas such as development, economics, knowledge, wealth, employment, and technology – is present in the Cocoyoc Declaration's redefinition of development in terms of self-reliance. Like Schumacher, the declaration rejects economic development that maintains or increases the disparities between and within countries and argues for economic growth that benefits the poorest sections of each society. Further, the declaration also rejects what might be called the "developed-nation model" in favor of development that supports a nation-state's societal and cultural norms. In this sense, the declaration asks the international community to respect the diversity of each country and to accept that there is more than one type of development trajectory.

The WCED's conceptualization of sustainable development, which built on the development vision articulated in *What Now: Another Development*, made an influential case for "the need to integrate economic and ecological considerations in decision making" (WCED 1987, p. 62). The basic notion was that social and economic development must not undermine the natural environment on which they are based. Hence, sustainable development "requires views of human needs and well-being that incorporate such non-economic variables as education and health enjoyed for their own sake, clean air and water, and the protection of natural beauty" (ibid., p. 53).

In concert with both the Cocoyoc Declaration and *What Now: Another Development*, the WCED's *Our Common Future* spoke to the different needs of developed and less developed nations. For developing nations, the "principal development challenge is to meet the needs and aspirations of an expanding [. . .] population. The most basic of all needs is for a livelihood: that is, employment" (WCED 1987, p. 54). It follows that employment – "the opportunity to satisfy [. . .] aspirations for a better life" (ibid., p. 44) – will lead to the satisfaction of such basic human needs as food, clothing, and shelter. However, some observers expressed concern that the needs of people in less developed nations are much broader than employment and must "include the right to preserve their cultural identity, and their right not to be alienated from their own society, and their own community" (ibid., p. 31).

For developed nations, the focus was not on meeting basic human needs for food, clothing, and shelter per se, but instead on the ecological consequences of an overindulgent lifestyle.

Living standards that go beyond the basic minimum are sustainable only if consumption standards everywhere have regard for long-term sustainability [. . .]. Perceived needs are socially and culturally determined, and sustainable development requires the promotion of values that encourage consumption standards that are within the bounds of the ecologically possible and to which all can reasonably aspire.

(WCED 1987, p. 44)

Interestingly, both the Cocoyoc Declaration and *What Now: Another Development* expand the WCED's view of human needs (in relation to developed nations) to include the physiological and psychological consequences of overconsumption.

Clearly, understanding the fundamental needs of humans, in the context of both what is needed and what is not needed, is essential if we are to develop strategies to transition toward more sustainable forms of development. As a consequence of influential publications such as *Our Common Future*, the current discourse on sustainable development tends to center on trade-offs among economic development and environmental and social goals. Areas of contention frequently arise during such discussions because the *goals* of each nation, group, or individual – which are based on their *needs* – are often at odds with one another. In order to resolve these situations optimally, we must clarify the difference between basic needs inherent to human nature and those resulting from socialization.

A key argument of this book is that the satisfaction of essential needs should drive economic and (democratic) political systems. In the language of modern economics, a rational person will maximize his or her utility function when making a decision to buy a product or service to satisfy a need. Societal demand is therefore the canonical ensemble of everyone's individual utility function.* Similarly, in the political system, we satisfy our political needs by voting for the politician or political party that is most likely to support our lifestyle and beliefs. When the votes are aggregated, we believe that the candidate

* In a developed country, a consumer is a very sophisticated concept, but in a developing nation where no markets exist, people cannot be called consumers in an organizational sense.

or party whose views align more closely with the needs and wants of society should be elected.* Indeed, for many, free markets and democracy are intertwined.†

This demand-side notion of how needs drive economic and political systems, however, raises a number of concerns. First, if we make decisions on the basis of our individual needs, then it can be argued that a society is likely to address unsustainable activities only once the individual is negatively affected. Second, the assumption that individuals act solely in self-interest does not account for the very human behavior of caring for others.‡ Third, neoclassical economics argues that each person should act in his or her own interest and let the market allocate resources accordingly, but this assumes that each person is receiving perfect or good information, is able to make informed, rational decisions, and is not subject to manipulation and deception (Akerlof and Shiller 2016). It also assumes that the “invisible hand” of the market will generate outcomes that maximize social welfare.§

Many have argued that reliance on the market is inherently likely to result in overconsumption and environmental harm due to inadequate consumer information. Manno (2002) argues that the industrial capitalist system of incentives and disincentives is invariably directed toward increasing levels of consumption. The environmental problems associated with increasing consumption are further compounded by the fact that as commodity chains grow in length and become more complex and more international, the spatial and social distances between production and consumption are widened (Conca 2002; Princen 2002). The result of this *distancing effect* is that consumers lack the information and incentives to behave in a more sustainable manner even if they wish to do so.

These concerns are at the root of a growing perception in Western culture that our concept of the good life has been affected (or put out of balance) by the forces of the market economy (through advertising, as well as social competition for conspicuous consumption). The result of this imbalance is that an individual’s behavior is being *externally regulated* – that is, it is aimed at obtaining the approval of others. For example, we buy a certain type of product or strive for a high income to ensure that we gain the approval of our friends or maintain our perceived status in society. Such behavior is not likely to result in our ability to satisfy our intrinsic needs for competence, autonomy, and connectedness.

* This statement assumes that there is sufficient diversity between the political candidates to present an individual with a real choice. It also assumes that a large enough proportion of a society will vote so that it is possible to gauge societal demand accurately.

† For critiques that challenge this notion, see Soros (1997), Ayres (2006), and Stiglitz (2016). Soros (1997, p. 45) argues “the untrammelled intensification of laissez-faire capitalism and the spread of market values into all areas of life is endangering our open and democratic society.” His main concern lies with the assumption that individuals (or consumers) have “perfect knowledge” and that by acting in their own self-interest, they will promote the common (or greater) good. Because our understanding of the world is inherently imperfect, promoting laissez-faire capitalism at the expense of the values and institutions that underlie an open and democratic society is what Soros refers to as the “capitalist threat.” His concern is that the free market is changing society’s perception of what is right and wrong by, for example, focusing on financial success and overlooking how that success was achieved. Soros (1997, 1998) argues that a better approach would be to create an open society that accepts our fallibility – i.e., that we will never have perfect information – and enables different ideological perspectives to inform and be reconciled in the political and social arena. Thus, put simply, an open society is “a society open to improvement” (Soros 1998, p. 24).

‡ A growing movement around the “Caring Economy” attempts to include this notion in economic thought (Eisler and Speth 2016).

§ One criticism of a utility-oriented system is that it does not incorporate concern for others. People vote their interests in the marketplace, but people do not express (in the market) their valuation of other people, relationships, and global equity and security. The market exists to satisfy individual, not social, wants.

Supporting this, the neoclassical assumption that each person is receiving good information and is able to make informed, rational decisions does not appear to be the case for consumers aged 45 and over in the United States, who are finding it increasingly difficult to use their spending power effectively (AARP 2004).^{*} In addition, today's youth have become the most targeted audience for advertising in history, primarily because of their future spending power.[†] It is well established that alcohol (Center on Alcohol Marketing and Youth 2002, 2005; Jones and Donovan 2001)[‡] and tobacco (Cummings et al. 2002) companies have targeted products at youth with the intention of creating lifelong consumers. But beyond these arguably harmful products, encouraging youth to buy music, sports equipment, automobiles, electronics, and other products is also considered a major force for consumption. The "burgeoning youth marketing industry" not only is raising important ethical questions (Kasser and Linn 2004, p. 1), but is also reinforcing producer-created demand and the throughput economy. These two outcomes have the potential to lead to significant negative psychological and environmental impacts, respectively. One solution is the re-conceptualizing of advertising to provide (less intrusive) "information" on products and services rather than messages designed to encourage lifestyles geared to consumption (Victor 2008). Achieving such a shift in the approach of the advertising industry would be no simple feat.

Imperfect information is not the only threat to the existing framework for the meeting of human needs in a sustainable way. The industries that operate within the market economy provide an essential and often overlooked function: the provision of *employment*. Holding a well-paid and meaningful job not only enables an individual to purchase goods and services but also provides opportunities to enhance psychological well-being. However, growing trends of within-nation wage and income inequality in the United States and many other developed nations, combined with low income mobility and job loss, are undermining the ability of the poor to access important services, such as health care. Further, the changing nature of work – for example, the growing number of contingent workers – is reducing the potential value derived from employment. If these trends are left unchecked, they could lead to growing feelings of deprivation and a declining satisfaction with life among the workforce, as well as declining access to meaningful employment. Many attribute the 2016 election of Donald Trump to these types of trends (Winston 2017); although, fear among white Americans' of losing their dominant status may have played a more influential role (Mutz 2018).

Both regulation of advertising and the resolution of negative workforce trends bring up the role of government in meeting basic human needs. Relying on the market (and government solely to protect the market) to ensure that basic human needs are met is clearly not a viable option if sustainability is to be achieved – who would provide education and primary health care for the poor? Government has an essential role to play in

* A survey by the American Association of Retired Persons (AARP 2004) asked whether spending power is all that an individual requires to achieve "consumer sovereignty" i.e., the successful selection of a product or service. The survey concluded that consumers – aged 45 and over and who represent 52 percent of consumer spending – were finding it increasingly difficult to use their spending power effectively because of (1) "less time and more decisions"; (2) the "increasing complexity of products and services"; and (3) "low levels of financial literacy" (ibid., pp. 2–3). Hence, many were unable to exercise consumer sovereignty because they were not receiving good information and, therefore, could not make informed, rational decisions. To solve this problem, the AARP called on business and government to improve the quality of consumer information, to increase financial literacy, and to increase options for banking and credit in segmented markets that often suffer from predatory financial practices. However, over a decade later, many of these same challenges persist.

† Media Awareness Network, *Marketing and Consumerism – Overview*, <http://mediasmarts.ca/marketing-consumerism/marketing-and-consumerism-overview> (accessed October 12, 2017).

‡ Center on Alcohol Marketing and Youth, <http://camy.org/> (accessed October 12, 2017).

ensuring that markets function for the benefit of society and intervening where they fall short. To enable an acceptable balance of responsibility to be achieved, there needs to be a willingness on the part of governments, society, and industry to engage in discussion and analysis of the connection between freedom, regulation, and control – and its relationship to overall societal good – if and when radical changes to our social and physical systems become necessary (Haland 1999). Further, reliance on social influence (or goodwill) to initiate change ignores evidence that unless the right environment and resources are made available, society will be asked to act beyond its capacity (Schmuck and Schultz 2002). In many ways, what is needed in order for human society to respond to the challenges of this century is a co-evolutionary approach to change, in which the values held by government, society, and industry evolve to support human needs and the objectives of sustainable development.

In order to create a more sustainable society, resolving the root causes of diverse issues such as consumerism, growing inequalities, and changing employment opportunities is extremely difficult. What is clear is that human needs and behavior are common to all these issues. As Pol (2002, p. x) argues, “The sustainability problem is a result of individual and collective human behaviour. It cannot be treated as an economic or technical problem, without considering the mechanics that intervene on the behavioral side of it.”

Placing human needs at the center of sustainable development strategies is therefore a positive step forward. See Figure 1.1 for a representation of such an approach. Such strategies would mean that government, society (that is, communities and individuals), and industry would need to promote values that center on innate human needs. In the context of employment, this is already recognized in the use of the term “anthropocentric production” (Brödner 1990; Lehner 1992), which distinguishes people-centered employment from the use of human resources in the most profitable or efficient production schemes, to the detriment of workers. Equally important is the promotion of levels of consumption and manufacturing processes that do not exceed ecological limits. Ultimately, turning our focus to meeting human needs is likely to “make fewer demands on our environmental resources, but much greater demands on our moral resources” (Brown 1981, p. 359). A term such as “anthropocentric consumption” as an analogue to anthropocentric production sounds inappropriate because almost all consumption is intended for human consumption. “Sustainable consumption” is a better term.

Even with an engaged government and human needs at the center of sustainable development strategies, a single-purpose policy design approach is unlikely to address these multidimensional sustainable development problems adequately. Instead, it is likely that fundamental human needs, which are by definition satiable, can best be met through policies that seek to co-optimize (or even better, integrate) multiple concerns. For example, identifying ways to combine national competitiveness with employment opportunities – for example, through the creation of intelligent production systems or new product-services – is one approach that would not only strengthen the economy but also improve the quality and (potentially) the availability of well-paid employment. Accepting the complexity of sustainable development and focusing on the design of policies that bring together competitiveness, employment, and environmental protection,* while meeting human needs, further requires that we: measure our progress (Section 1.1.1), understand the relationships between consumption and well-being (Section 1.1.2), and understand the role of employment (Section 1.1.3) in this complex system.

* For example, enhancing purchasing power by increasing commercial activity may inadvertently create environmental problems. Thus, in this situation a physical standard of living needs to be co-optimized with environmental quality and employment.

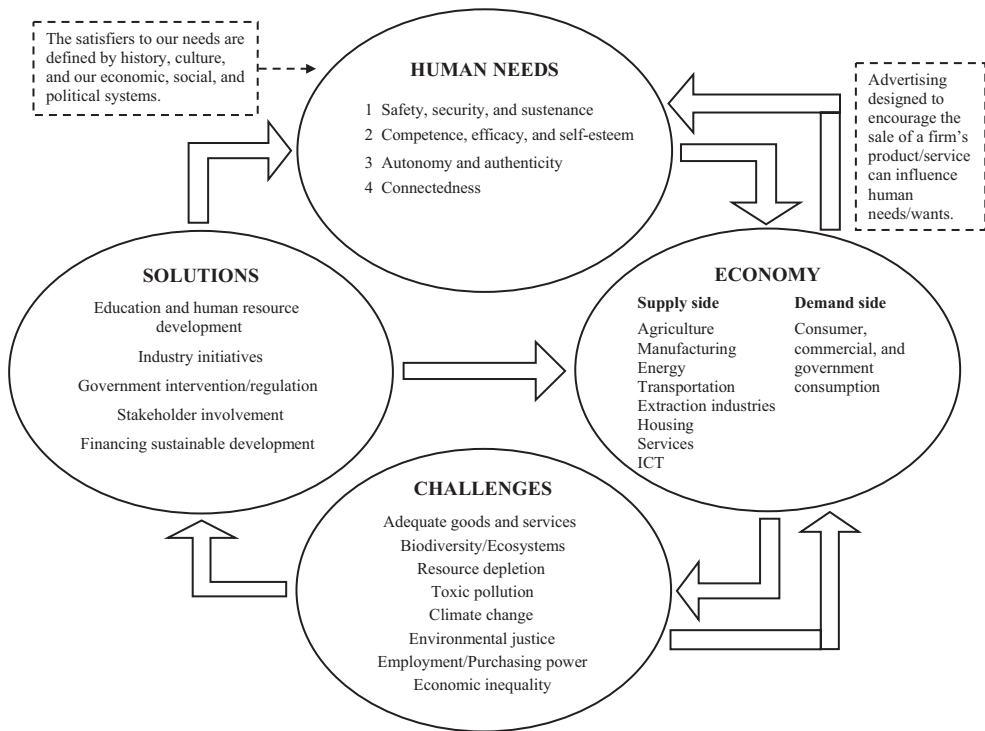


Figure 1.1 Drivers, challenges, and solutions for globalization within a context of human needs

1.1.1 The measurement of (human) development

What we choose to measure is both an expression of underlying societal values and a driver of the evolving structure and values of our society, and as such requires careful attention. As the use of information technology has expanded globally, there has been an increased emphasis on the use and availability of data and statistical indicators to inform decision-making, with mixed outcomes. Inadequate measurement can have wide consequences, ranging from a public lack of confidence in government to the missing of indicators signaling impending economic crisis (Stiglitz et al. 2009a; 2009b).

The first widely adopted measures, GNP (gross national product) and GDP (gross domestic product), were developed in the 1940s, together with the Systems of National Accounts (SNAs), to measure *total economic output* (Hodge 1997; Neumayer 2004; Vanoli 2004). GDP has since become the most widely used measure globally and, more recently, the most widely criticized measure as well, partly as a result of overuse and inappropriate use. Total economic output does not distinguish between “good” and “bad” forms of spending, take forgone opportunities into account, consider non-market goods and services, or account for unpaid work and leisure activities, and is therefore arguably not an accurate measure of economic welfare (Glasser and Craig 1994). It is also not a measurement of income or of well-being but has frequently been used as both.

Furthermore, Liagouras (2005) suggests that as developed nations transition to a service economy, these measures of quantity must give way to measures of quality and variety in order to capture real change. (See Section 3.3.1.2 in Chapter 3 for a more

detailed discussion.) Government services are also an increasingly large portion of economies, yet government output is very poorly captured by the GDP approach (Stiglitz, Sen, and Fitoussi 2009a, 2009b). Finally, our failure to charge for environmental degradation, including carbon emissions, cause market distortions, which result in false choices between the promotion of GDP and the protection of the environment. Despite its continued use and global importance, GDP is widely accepted to be a limited metric of progress.* See Table 1.1 for a more complete list of limitations and challenges.

Concerns about the consequences of GDP's limitations led to the formation of the Commission on the Measurement of Economic Performance and Social Progress (CMESPP) in 2008, commonly referred to as the Stiglitz, Sen, and Fitoussi Commission. The commission's initial report in 2009 encouraged a shift from production-oriented measurement systems to a well-being-oriented measurement system (of current and future generations). The report concludes that in order to evaluate material well-being, one should look at income and consumption instead of production, consider income and consumption jointly with wealth, and consider the distribution of each across different groups. It further suggests a shift to focus on the household and to include non-market activities such as household production.† The measurement of material well-being is only one of the eight suggested dimensions of well-being to be assessed together with health, education, personal activities/work, political voice/governance, social connections/relationships, environment (past and future conditions), and insecurity (economic and physical). In assessment, both objective and subjective measures and the interdependence and possible adverse synergism between these eight dimensions are important (Stiglitz et al. 2009a; 2009b).

The commission, however, separates the measurement of sustainability from well-being or economic performance. As they explain, if your car had a dial showing a number that was the sum of your current speed and the remaining fuel, it would be no help at all. "Both pieces of information are critical and need to be displayed in distinct, clearly visible areas of the dashboard" (Stiglitz et al. 2009a; 2009b). Their recommended "dashboard of indicators" separates environmental aspects of sustainability and includes clear indicators of tipping points (see Section 1.3.4). Measurement of sustainability follows clearly from the accurate measurement of current well-being, as whatever is necessary (human needs) for current well-being must not be depleted over time in order for future generations to have the same standard of well-being. If the stock is decreasing, then we must either reduce consumption or well-being, unless consumption can be retained by changing the relationship between consumption and stock through innovation (see Section 1.1.2).

The Stiglitz, Sen, and Fitoussi report has fueled both new and ongoing efforts to seek better metrics of well-being and to capture more accurately the forms of progress we collectively value. All such efforts must grapple with the complex challenges involved either by altering and amending the GDP/GNP and SNA system or by developing entirely new indexes. Any new approach must be able to explain contrasts such as Ponting's (2007, p. 338) observations that "in the 1990s the GDP per head in the United States was 40 percent higher than in Italy but life expectancy was lower by almost two years because of the poor [U.S.] Health System" and that "the life expectancy of African Americans is lower

* GDP's flaws are well captured by the example of commuting to work. A longer commute is lost time and a cost to the environment, but an increase in driving and traffic jams leads to an increase in oil consumption, so longer commutes are good for GDP. This is why we need to measure well-being instead – everyone knows that more traffic is worse, but GDP as a measure fails to capture this reality.

† Households produce food, cook, and provide childcare and "insurance" services, and when these unmeasured activities are monetized, they create a rise in economic activity that does not necessarily correlate to an improvement in living standards. The non-measurement of household production also affects women unequally, increasing gender inequality.

Table 1.1 Limitations of GDP as a measure of (human) development

$GDP = C + I + G + (X - M)$ or consumption + investment + government expenditure + (exports – imports)			
<i>GDP is the total annual value of all goods and services produced within a nation's borders, whereas GNP is the total annual value of all goods and services produced by a nation's residents (or firms), wherever they are located. A third related measure, gross national income or GNI, adds income received from other countries such as dividends and interest payments less similar transfers to other countries.</i>			
LIMITATION	WHY?	EXAMPLE	EFFECT
Transfer payments are not included in calculations of government expenditure GDP does not capture wealth distribution	Not considered "output producing" because "no direct production takes place in exchange for a transfer payment" (Heilbroner and Thurow 1998, p. 75). GDP is a straight total. When evaluated at the per capita level, GDP is simply divided by the population of a country.	In the U.S., this means that Social Security payments are not included in government expenditure. Saudi Arabia and South Korea have similar GDPs per capita. However, Saudi Arabia has widely disparate personal incomes (fueled by oil reserve-based growth) while South Korea has significantly lower income disparity (driven by growth based on technological innovation).	Transfer payments increasingly augment the quality of life of the citizenry, yet excluding them from a measure of progress/development incentivizes a reduction in this kind of progress. A reduction in inequality is essential for human development, health, and economic growth (Stiglitz 2016), yet GDP neither measures nor values advances in inequality.
Environmental quality is not a product in the GDP equation	Neoclassical economics fails to account for environmental "externalities" – put differently, the environment (air, water, land, climate, etc.) is typically not considered as a limited resource.	Without appropriate environmental regulations or their enforcement, firms are able to emit pollution into the environment without needing to consider the costs of that pollution.	Without considering the environment, a product which destroys a drinking water supply of 10 million people is measured as equal to one that does not, creating an incentive for neglect of the environmental commons in the pursuit of measurable product.
GDP does not include "underground" economic activity	Hard to measure.	Profits from the illegal drug trade are not considered as part of GDP.	Underground economic transactions significantly affect the quality of life of the citizens of a country, both positively and negatively.
GDP does not capture non-monetary activities, including unpaid and volunteer work	Hard to measure and value not fully understood.	The value of time invested by family members in caring for children and/or the elderly.	Social capital is central to development and economic success (Putnam et al. 1993) and its neglect disadvantages those groups engaged in it, including women.

Many economic activities captured by GDP are not “real” economic development	There is no categorization of expenditures – all are lumped together.	An oil spill can increase GDP because the enormous cleanup costs are included in GDP metrics. Yet an oil spill diminishes well-being and GDP-enhancing activities such as fishing.	Costanza et al. (2009) point out that increased crime, sickness, war, pollution, fires, storms, and pestilence are all positive for GDP, yet are not progress or human development.
GDP fails to capture/measure/distinguish the quality of the goods sold	The quality of a good/service is not important when measuring GDP; the only metric that matters is the final price of a good/service.	To GDP, there is no difference between producing disposable pens and producing pens that will last a lifetime – in fact, the disposable pens create more continuing need for the product, increasing GDP.	This dynamic incentivizes a reduction in quality, increasing waste, inefficiency, and environmental impact and results in corporate strategies like “planned obsolescence.”
GDP does not question whether the source of growth is sustainable	GDP does not consider whether an economic activity is enabled by, for example, renewable or nonrenewable resources. It is concerned only with measuring the scale of economic activity.	Russia’s growth model in 2009 required a \$70/barrel price to balance the budget.	Since growth in GDP is not adjusted to take unsustainable activities into account, it does not provide any information about whether a nation’s development is sustainable or not.
GDP includes no measure of societal opportunity costs	GDP does not take into account the future value of a foregone option.	Costs associated with remediation of harm (i.e., natural disasters) divert funding from wealth-generating activities and investments.	Without considering societal opportunity costs, GDP provides no indication of whether current growth could actually be undermining future growth.
GDP does not capture the essence of product (and possibly process) innovation	GDP measures the price of the final good/service, which could decline as a result of a product or process innovation.	Pharmaceutical and technological innovations have increased the quality – and life – of goods dramatically, but are not counted any differently than the production of oil from a disappearing reserve.	A desire to simply grow GDP (via sales of a product/service) may incentivize firms to focus on cutting costs rather than innovation-led growth strategies. The latter is likely to be far more important from a sustainability perspective, providing that appropriate environmental and worker health and safety standards are in place to frame the “design space.”

than the average in China and infant mortality rates in cities such as Washington, DC, Baltimore, and St. Louis is higher than in cities such as Bangkok and Cairo.” See Table 1.2 for a list of some prominent approaches to measuring (human) development. Whether the new approaches provide utility is of some debate. One analysis found that despite different measurement approaches the Human Development Index (HDI) and Ecological Footprint (EF) correlated with GDP (Szigeti et al. 2013), raising questions as to whether the effort to substitute them has utility. The same analysis showed that the Happy Planet Index (HPI) and Environmental Performance Index (EPI) were independent of GDP, increasing their potential value as a substitute for GDP.

Each of the measurement approaches can be evaluated in detail as well as compared and contrasted with each other, and it is possible to find both supporting and discrediting arguments for each measure or index presented in Table 1.2.* Opponents of indexes argue that the subjective selection of indicators (from one or more domains of sustainable development) that are adjusted and aggregated into a single value makes the final output difficult to use in a meaningful way (Becker 1997). Further, combining indicators that measure both short and long-term concerns and processes hides difficult decisions associated with intergenerational equity (Huetting and Reijnders 2004).

The above concern was addressed in the OECD Better Life Index, which was a direct result of the Stiglitz, Sen, and Fitoussi Commission. The Better Life Index chose not to aggregate the components into a single index. However, a subsequent effort by Nikolopoulos (2014) did represent the different measures multidimensionally (Figure 1.2). Further development of this kind of multidimensional measurement and visualization is likely to improve our capacity to assess and design sustainable development.

The Sustainable Development Goals (SDGs) (UN 2015) also aimed to improve our capacity to assess and design a sustainable future (see Section 2.3 in Chapter 2). By articulating goals first, then creating indicators and measuring progress towards those goals, the approach focuses on assessing the multidimensional nature of human progress while motivating socio-political change. This approach was demonstrated with the Millennium Development Goals (MDGs), the predecessor of the SDGs. The SDGs consist of seventeen interconnected goals (see Table 2.4 in Chapter 2), including climate change, economic inequality, sustainable consumption, and peace and justice, all with targets to be met by 2030. The goals assume that what is desired is to advance a technologically optimistic and growth-oriented system and state clearly the need for a decoupling of growth from environmental damage. In Section 1.3.1, we question whether it is possible for a growth-oriented society to achieve sustainability, but regardless of feasibility, the success of the SDGs as measures and policy drivers will rely on their implementation.

While all approaches to measuring human progress have some form of shortcoming, they serve an essential role in guiding our economies and policy making, raising awareness

* As an example, using HDI 2010, the best place to live from a human development perspective would appear to be Norway, and the worst place would appear to be Zimbabwe. The HDI addresses the complexity of human development by including a suite of supplementary indicators covering areas such as infrastructure, energy usage, ecological footprint, subjective well-being and happiness, employment, empowerment, freedom, community safety, and financial flows. Furthermore, the IHDI adjusts the three dimensions of HDI for the extent of inequality experienced in a dimension – thus, a nation without inequality would have an HDI = IHDI. (The U.S. HDI rank falls by nine positions once adjusted for inequalities, reducing the income index by 24 percent.) Yet despite all this careful valuation, the HPI, which also considers many of the same indicators, places Costa Rica as the best place to live, with no industrialized nations, including Norway, in the top ten. Which should you move to, Norway or Costa Rica? That depends on, for example, how much you value the intergenerational sustainability of human development achievements. See Section 3.4.2 in Chapter 3 for a discussion of Costa Rica’s approach to development.

Table 1.2 Alternatives to GDP as a measure of (human) development

NAME	CONTEXT & USE	ADVANTAGES	DISADVANTAGES
<i>Approaches based on System of National Accounts:</i>			
ISEW – Index of Sustainable Economic Welfare (Daly and Cobb 1994)	Both use the principle of weak sustainability and make adjustments to GDP/GNP accounting for unequal income distribution using the Gini coefficient and adding and subtracting elements to account for ecological and social benefits and costs.	Works with GDP but adds a measure of inequality and begins to consider other human development factors as well. Can be seen as valuable tools to broaden policy prescriptions beyond a reliance on economic growth (Clarke 2004; Hamilton 1999; Lawn 2003; Patterson and Jollands 2004).	Levett (1998, p. 297) argues that “as soon as we try to modify GDP to bring it closer to some conception of welfare [...] we are back to subjectivity in deciding which things need to be added to and subtracted from GDP.” These types of measures also assume that the total stock of natural, human, and social capital remains constant over time.
GPI – Genuine Progress Indicator (Talberth et al. 2006; Venetoulis and Cobb 2004)			
GS – Genuine Savings, also referred to as Adjusted Net Savings (K. Hamilton 1994, 2000)	Developed in the World Bank’s Environment Department and is an annual measurement of changes in national wealth, where “national wealth” is defined as the total amount of natural, human-made, and human capital (Bolt et al. 2002).	Neoclassical economists are more comfortable with the approach and the GS formula is relatively straightforward: $GS = \text{net investment in produced capital} - \text{net depreciation in natural capital} + \text{investment in human capital}$	Does not account for Social Capital and, like ISEW and GPI, uses the Hartwick–Solow weak sustainability principle.
SEEA – System of Integrated Environmental and Economic Accounting (UN et al. 2003)	Developed by the UN Statistical Commission with support from IMF, World Bank, EC, and OECD.	Provides a platform to combine economic and environmental data using consistent classifications and definitions. SEEA is based on the System of National Accounts (SNA) and theoretically can be used with either weak or strong sustainability principles.	Cannot account for social and institutional dimensions of sustainability (UNDESA 2007).

(Continued)

Table 1.2 (Continued)

NAME	CONTEXT & USE	ADVANTAGES	DISADVANTAGES
<i>Approaches to measure the condition of the environment:</i>			
LPI – Living Planet Index (WWF 2016)	Measures biodiversity by gathering data from 14,152 monitored populations of 3,706 vertebrate species (mammals, birds, fishes, amphibians, reptiles) from around the world to indicate the impact of human activity on habitats.	Provides a way to monitor the state of nature.	Does not account for social or economic factors and the distribution of locations represented by the data is currently uneven, which means that not all species groups and regions are covered.
EPI – Environmental Performance Index (Yale Center for Environmental Policy and Law et al. 2018)	The EPI ranks 180 countries on 24 performance indicators across ten issue categories covering environmental health and ecosystem vitality. This approach enables countries to compare their environmental performance and identify best practices. The metrics also provide countries with a way to identify environmental policies that could move them towards greater environmental sustainability.	The EPI offers an empirical approach to tracking environmental problems, which enables countries to identify and track problems, and develop and evaluate policy responses.	Does not account for social or economic factors and currently has data gaps relating to sustainable agriculture, water resources, waste management, and threats to biodiversity.
EF – Ecological Footprint (Wackernagel and Rees 1995a, 1997; Collins and Flynn 2015)	Translates human activity (<i>demand</i>) into corresponding ecological area (<i>supply</i>) – or the environmental carrying capacity – required to sustain that activity. The EF is typically based on six categories of productive surface areas: cropland, grazing land, fishing grounds, built-up land, forest area, and carbon demand on land.	EF provides a simple measure (in global hectares) that can be used to assess whether a city, region, or nation is living within its biocapacity (i.e., whether it has an ecological reserve or deficit). This information can then inform practices and policy designed to reduce the EF of a target region.	Does not consider interactions between system components and ignores processes that can dramatically affect carrying capacity (Becker 1997; Hueting and Reijnders 2004). EF also fails to reveal underlying causes of overshoot (van den Bergh and Verbruggen 1999) and does not consider the impacts of international and regional trade, making an implicit assumption that living within a nation's available biocapacity is the desired objective.

Novel approaches to measure human development:

HDI – Human Development Index (UNDP 1990)	Developed in 1975 by the UNDP, the HDI has three components in all of its iterations: (1) life expectancy at birth; (2) educational attainment; and (3) income (UNDP 1995, 2016). The latest improvements allow comparison over time, improved “sister indexes,” and a shift to calculating the HDI using geometric mean rather than simple averages.	Serves as important complement to GDP/GNP by placing health and education alongside income for a more complete measure of development. As the UNDP (2016, p. 25) argues, “Economic growth and income are means to human development but not ends in themselves – because it is the richness of people’s lives, not the richness of economies, that ultimately is valuable to people.”	The HDI is not a comprehensive measure of human development and its focus on longer-term measures means it does not measure short-term improvements. However, when combined with its sister indexes, a more complete view of human development can be obtained.
HPI – Happy Planet Index	Combines four elements – well-being, life expectancy, inequality of outcomes, and ecological footprint – to provide a measure of the ecological efficiency of delivering human well-being (Jeffrey et al. 2016).	Rejects GDP/GNI and leverages EF to reveal the poor environmental performance of industrialized nations – exposing the unsustainable nature of the long and happy lives many have achieved.	The HPI does not take a nation’s political situation or stability/fragility into account. Thus, an unstable/fragile developing country (with a small EF) could rank higher than a developed nation (with a large EF). Thus, while the HPI presents an interesting measure of environmental impact and well-being, translating the results in practice/policy can be challenging.

(Continued)

Table 1.2 (Continued)

NAME	CONTEXT & USE	ADVANTAGES	DISADVANTAGES
SEDA – Boston Consulting Group’s Sustainable Economic Development Assessment (Beal et al. 2015)	SEDA is based on three elements – <i>economics</i> (including income, economic stability, and employment creation), <i>investments</i> (health, education, and infrastructure), and <i>sustainability</i> (focusing on social inclusion and the environment). SEDA uses 43 indicators across these three elements to develop a relative well-being score for 149 countries.	When combined with a country’s per capita income, SEDA highlights how a country is translating – over time – its wealth into well-being for their citizens.	When compared to other indexes, there is less emphasis on environment, and metrics such as resource depletion are not included.
SA-GCI – Sustainability Adjusted Global Competitiveness Index (World Economic Forum 2014b)	SA-GCI was developed from the World Economic Forum’s (2014b, p. 55) notion of sustainable competitiveness, defined as “the set of institutions, policies, and factors that make a nation productive over the longer term while ensuring social and environmental sustainability.” SA-GCI is based on the Global Competitiveness Index, which is adjusted to take social and environmental sustainability factors into account. SA-GCI has been calculated for 113 economies.	SA-GCI provides a way to assess the connection between productivity and social and environmental sustainability. The index allows a nation to consider how to promote social and environmental sustainability in a way that does not undermine its competitiveness.	Since SA-GCI is an adjustment of the GCI, it does not weight competitiveness, social, and environmental pillars equally, so favors countries that score high in competitiveness.

OECD Better Life Index Tool (OECD 2017)	The Better Life Index is an online interactive tool with 11 dimensions (each based on four indicators) that covers 38 countries. It has no aggregate index.	The online tool allows users to interact with the data, which is disaggregated by gender. By adjusting the relative importance of each dimension, users can see how their preferences impact the performance of each country and how this may change by gender. The jobs dimension is based on four separate measures – the employment rate; personal earnings; the long-term unemployment rate; and job security – making it one of the more robust treatments of employment in these indexes. The index is thorough and innovative. It measures country performance on a wide range of indicators and can be used by governments to design policy and target investments to turn economic gains into social and environmental progress.	The environment dimension is not assessed thoroughly, and primarily measures air pollution and water quality indicators. The tool does not provide one overall ranking of a country's performance, but instead aims to inform citizens so that they can become more engaged in the policy-making process related to their lives.
Social Progress Index (Porter et al. 2017; Stern et al. 2017)	The Social Progress Index is an aggregate index of social and environmental indicators that focuses on three dimensions of social progress – basic human needs, foundations of well-being, and opportunity. Under each dimension are a range of components that are each supported by indicators considered to matter for the lives of real people. The index uses free, publicly available data to preserve transparency. It covers 128 countries.	Does not include elements of equality, employment, and innovation.	

(Continued)

Table 1.2 (Continued)

NAME	CONTEXT & USE	ADVANTAGES	DISADVANTAGES
FEEM SI – Fondazione Eni Enrico Mattei Sustainability Index	FEEM SI is calculated using a recursive–dynamic computable general equilibrium model. The model uses 23 indicators that are related to economic, social, and environmental dimensions. The weights for each indicator are derived from a survey of experts that reveals how the different components of sustainability relate to one another. This approach enables the index to capture the synergies or conflicts that accompany the multidimensional concept of sustainable development.	The modeling approach means that the index can be calculated for a nation in a specific year, in relation to specific policy scenarios. This <i>dynamic</i> feature of the index differentiates it from the more static indexes.	The modeling approach does not provide a single outcome, but rather a set of projections that can inform decision-makers. However, the reliance on experts to provide objective and unbiased weightings may raise concerns about the validity of the results.
SSI – Sustainable Society Index	SSI is based on 21 indicators that form seven categories across three economic, environmental, and social well-being dimensions. Since 2006, SSI has been calculated every two years for 154 countries, which reveals where nations are making progress towards sustainable development.	The three well-being dimensions provide a unique way to track economic, environmental, and social progress over time.	While SSI covers a wide range of indicators, it does not include measures of rights and (environmental) justice, peace and security, and competitiveness.

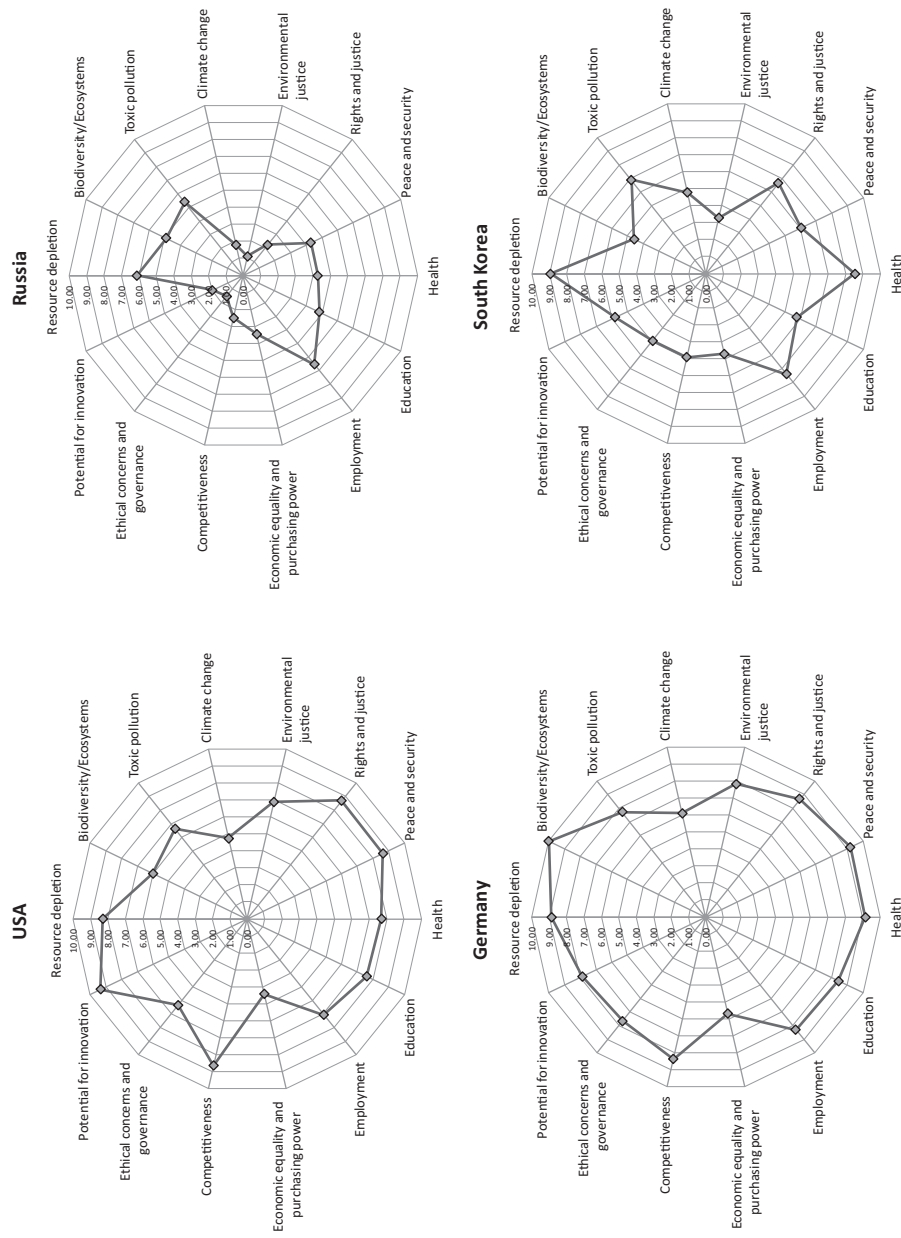


Figure 1.2 A multidimensional representation of sustainable development in four countries

Source: Adapted from Nikolopoulos (2014, pp. 71–19).

about unsustainable development patterns. Indexes, however, do not reveal the processes that are driving these unsustainable trends; therefore, it is clearly unwise to base decision-making solely on any numerical index regardless of its strengths or complexity. Having introduced several indexes of human development and other measures of progress and reviewed their utility, we now turn to the challenges raised by the predominant *laissez-faire* (market-oriented) approach to development and its effect on human well-being.

1.1.2 Consumption and well-being

As globalization proceeds, it could be argued that increasing knowledge of the lifestyles of others around the world is motivating material standards of living. Until we reached the era of global media, people did not feel deprived in relation to other nations. Now that the differences in consumption are conspicuously visible, poverty and its effect on culture become important issues – that is, people “feel” economically and materially poor. If we assume that the satisfaction of needs drives economic and political systems, one quickly realizes that if basic human needs become confused with materialistic wants on a global scale, the rapid expansion of the throughput society could lead to serious environmental consequences.

A throughput (or high-waste) society, by definition, depends on increasing rates of consumption (or throughput) (Daly 1996; Princen et al. 2002). To the extent to that we are losing jobs as a result of production efficiencies (or innovation), one way to create more jobs is to expand the economy and increase throughput. A critical question, therefore, is whether basic human needs drive our throughput society or whether this drive stems from a *conditioned* response.

In neoclassical economics, human needs/wants drive systems of exchange and markets. Although many economists might argue that consumer demand – derived from the purchasing habits of consumers – is an accurate representation of what people desire, they often forget to mention the \$589 billion worldwide that corporations spend annually on advertising with the sole purpose of creating demand (eMarketer 2017). Hence, a concern is that the world of industrialization and commerce has made the distinction between basic human needs and wants unclear (Michaelis 2000). Indeed, one could argue, as Galbraith (1958) did, that if a want is to be urgent, it should be the result of a need that originates within the individual. This position was later supported by economist Nicholas Georgescu-Roegen (1971, p. 324; 1993), who argued that “only those goods and services an individual can enjoy personally influences his satisfaction.” If a want is externally contrived, it cannot be an urgent (or basic) need. Hence, satisfying that want will occur only through behavior that is led by extrinsic motivation, which is not likely to result in the enhancement of an individual’s well-being.* See Tatzel (2014) for an extensive treatment of consumption and well-being.

The inference from these remarks is that in promoting economic growth, companies entice people to buy their services or products. The primary way for the value or benefit of a product or service to be conveyed to the consumer is through advertising. M. R. Smith (1994, p. 13) describes how American advertising “became the instrument by which big business, in need of ever-expanding markets for its mass produced products, imprinted instrumental values – and with them, the ethos of mass consumption – on the populace.” Hence, it can be argued that advertising leads to *producer-created demand* – that is, what we

* The idea that capitalist economies have been successful in achieving intermediate goals of increasing material wealth, but that this has been accomplished at the expense of underlying human values (and the environment), is becoming more widely accepted by economists (Ackerman et al. 1997). Indeed, the field of ecological economics is a good example of a branch of economics that is attempting to integrate human values into economic analysis (Krishnan, Harris, and Goodwin 1995).

need/want is conditioned by advertising. Galbraith (1967, p. 207) provides a succinct example of this idea:

Were there but one manufacturer of automobiles in the United States, it would still be essential that it enter extensively on the management of its demand. Otherwise consumers, exercising the sovereignty that would be inconsistent with the company's planning, might resort to other forms of transportation and other ways of spending their income.

Further, Soros (1997, p. 52, emphasis added) argues that the notion of producer-created demand has established money as *the* measure that identifies a product or an individual's value:

Advertising, marketing, even packaging aim at shaping people's preferences rather than, as laissez-faire theory holds, merely responding to them. Unsure of what they stand for, people increasingly rely on money as the criterion of value. What is more expensive is considered better. The value of a work of art can be judged by the price it fetches. People may believe that they deserve respect and admiration because they are rich. What used to be a medium of exchange has usurped the place of the fundamental values, revising the relationship postulated by economic theory.

Michaelis (2000) takes the concept of producer-created demand one step further by extrapolating it to other areas. In particular, she asks whether a government's failure to regulate advertising may inhibit our ability to satisfy our intrinsic need for autonomy.

The market economy contains structural incentives for businesses to market conceptions of the good life that support sales of their own products. Many other circumstances, including social norms, work culture, and infrastructure constraints, provide strong pressures for individuals to adopt particular conceptions of the good life. Hence, by adopting a hands-off approach, governments may actually be failing to protect an important freedom.

(Michaelis 2000, p. 26)

A major problem with the current form of advertising is that people start to live their lives believing that a high level of income and material wealth are essential to their happiness (Jacobson and Mazur 1995; Klein 1999).

Similarly, Sanne (2002) argues that a focus on the social and psychological factors of consumer behavior neglects to consider how producers and businesses create consumption to satisfy their own interests.^{*} It also neglects the role of the state and how business has a tendency to co-opt or lobby government for market conditions that favor consumption. This latter issue creates what Sanne (2002, p. 282) calls "structural lock-in effects." These effects are the following (in order of impact):

- The pattern of work-and-spend promoted by naturalizing paid work as "full time" with continuous, lifelong occupation supported by a legal structure of social insurance, eligibility to social benefits, etc.;

^{*} For an insightful discussion of the historical and theoretical foundations of the consumer society and consumerism, see Firat and Dholakia (1998); Krishnan et al. (1995); Miles (1998); Miles et al. (2002); and Stearns (2001).

- The making of a consumer culture where marketable goods are forwarded as the means to satisfy not only material needs but also needs of social stratification* and cultural identification;†
- The promotion of individual means of transport, in particular cars, which presuppose heavy investments in road infrastructure, a classical aim of much business lobbying;
- New communication infrastructures which force a technology shift on consumers (Sanne 2002, p. 282).

Sanne (2002) argues that governments and businesses tend to counter incentives to curb consumption with deference to consumer sovereignty. This position passes the responsibility to the consumer, whose purchasing behavior then becomes subject to moral inquiry. The basic argument is that firms would provide environmentally friendly products if consumers demanded them. Hence, we must first address the values that support present lifestyles by educating consumers about the effects of their behavior. The problem is that there is a fine line between education and persuasion or coercion; the latter is an infringement on an individual's freedom to choose (Akerlof and Shiller 2016). But one could argue that an individual's freedom to choose is affected by advertising targeted directly at our insecurities. A reliance on consumer sovereignty is further complicated by the fact that a growing number of consumers in America seem paralyzed by an inability to speak out against materialistic tendencies because this would go against our core belief that people should have the freedom to make their own decisions (Harwood Group 1995). Hence, people turn away from questioning their behavior and that of others, undermining any argument that society will act responsibly if it is provided with sufficient information about the problems associated with its consumption. Thus, one pathway to a sustainable future may be to counter the pattern of work-and-spend by establishing shorter working hours or building in work arrangements that anticipate more holidays and leisure time (Kenny 1999; Sanne 2002; Hayden and Shandra 2009; Hayden 2013).‡ The notion here is that

* The differentialist view of consumption is that of social stratification, i.e., the use of wealth to conspicuously consume, to display artifacts of taste or expense commensurate with one's position in society (Sanne 2002). See also Thorstein Veblen's (1994 [1902]) classic work *The Theory of the Leisure Class*, which introduced the phrase "conspicuous consumption."

† The culturalist view of consumption connects the individual to his/her own self-understanding (Sanne 2002). Consumption is seen as a reflection of the self; what you buy supports your understanding of who you are. Both differentialist and culturalist views are part of utilitarianism because in both cases the objective is to increase overall well-being.

‡ In 1998, France's ruling left-wing coalition introduced a law to reduce the legal workweek from thirty-nine to thirty-five hours for most employees, effective January 1, 2000. The objectives of the law were to create jobs, enhance competitiveness, and establish a better balance between work and personal life (Ministère de l'emploi, de la cohésion sociale et du logement 2002). The basic idea was that capping working hours would force employers to hire more workers to cover any loss in productivity. However, since the law was enacted, it has failed to deliver on its promises: unemployment remains high and productivity has declined. A study by Estevão and Sá (2006) concluded that the law also caused an overall decline in welfare. Their conclusion was based on subjective measures of satisfaction with work hours, an increase in the number of workers holding two jobs, and data indicating that workers tried to circumvent the law by transitioning from large to small firms with fewer than twenty people. These small firms were required to implement the thirty-five-hour week by January 1, 2002. There was also concern that the law would reduce working conditions by, for example, increasing the amount of staggered hours worked, with a corresponding increase in task splitting and hand-over procedures (Bulard 1999). Given concerns such as those mentioned here, the current French administration is reconsidering the regulations affecting the length of the workweek under French labor law. For a brief discussion of the global history and arguments for and against a shorter work week, see www.shorterworkweek.com/history&arguments.html. For a more extensive discussion, see Hayden (2013) and Coote and Franklin (2013).

with less income and fewer working hours, we will consume less and be able to enjoy more leisure time (see Ashford and Kallis 2015 for arguments for and against that notion). However, there are those who question whether more leisure time would lead to a better quality of life:

The psychological underpinnings of capitalism have enabled the leisure time which technology affords us to be converted into yet another opportunity for the consumption of unnecessary goods. Inasmuch as capitalism has “freed” the worker from the worst excesses of the labor process, it has sought to occupy his free time with “compensatory needs” that bring neither happiness nor personal fulfillment.

(M. Redclift 1984, p. 53)

The psychological and environmental problems associated with advertising and the throughput (or consumer) society have been well documented (Brown 1981; de Graaf et al. 2002; Diener and Suh 2000; Durning 1992, 1994; Goodwin et al. 1997; Kasser 2002; Layard 2005; Princen et al. 2002; J. C. Ryan and Durning 1997; Schlosser 2002; P. C. Stern et al. 1997). However, calls for public recognition of the potential problems with a market economy, such as the PBS series and subsequent book *Affluenza: The All-Consuming Epidemic* (De Graaf et al. 2002), have failed to drive significant change. One possible reason for this is that we are so entrenched in the current economic paradigm that we are unable to recognize that we are in some way addicted to consuming (Ehrenfeld 2004). Although the consumption of products and services clearly improves our quality of life, we should be aware that our perception of the good life has been and is being manipulated by market actors whose primary incentive is profit. Hence, the line between consumption that satisfies intrinsic, and extrinsic needs, is becoming blurred.

The causal connection between unsustainable consumption and the global environmental crisis is becoming increasingly clear. The outcome document of Rio+20 in 2012, *The Future We Want*, declares the promotion of Sustainable Consumption and Production (SCP) as one of three critical overarching and essential objectives. In 2014, the Sustainable Development Goals included SCP as the twelfth goal, spurring an effort to create indicators to measure efforts to address the goal (UNEP 2015). SCP is seen as an effort

to “decouple” economic growth and environmental degradation by increasing the efficiency of resource use in the production, distribution and use of products, aiming to keep the energy, material and pollution intensity of all production and consumption functions within the carrying capacities of natural ecosystems.

(Voigt 2015, p. 246)

At the same time, a group of activists, scholars, and others, increasingly concerned with the effects of material consumption on the global environment, have catalyzed around a vocal group known as SCORAI (Sustainable Consumption Research and Action Initiative),* resulting in new activities and writings focusing on sustainable consumption (Cohen 2005; Cohen et al. 2010; Vergragt 2017). Parallel to this, there is an emerging discussion of “sufficiency,” of both materials goods and energy, as a societal norm (Schneidewind and Zahrt 2014). These activities identify with the “degrowth” movement (see the discussion in Section 3.7 in Chapter 3) and take on a distinctive anti-capitalism posture (Ashford 2017). These “bottom up” approaches, without government intervention and support, might not be strong enough on their own to cause a major shift in unsustainable consumption (Vergragt 2017), but some commentators are more optimistic, seeing a

* SCORAI has international participation and conferences (www.scorai.org), which fuel this discussion.

positive trend in the buying patterns of millennials, who are attracted to living in the cities rather than the suburbs, and who are somewhat constrained both in their living spaces and by not having large disposable incomes (Brown and Vergragt 2016). That there is movement to address the consumption issue at both the intergovernmental level with the SDGs (Bengtsson et al. 2018), and at the grassroots level with SCORAI, is encouraging.

This section began by asking whether focusing on industrialization and commerce is likely to enhance overall human well-being. While it seems clear that relying solely on economic growth (and consumption) to advance human well-being is too simplistic, and that there is an emerging understanding of this at the grassroots level, it is also clear that government has an important, if not critical, role to play in shaping the institutional structure of the economy to better accommodate non-consumption solutions to human needs (Kenny 1999; Manno 2002; Michaelis 2000; Sanne 2002). Thus, there is a need to consider innovative public policies to ensure that noncommercial values – such as the benefits received from family and community life – form an integral part of modern society and that the unintended consequences of unsustainable consumption do not limit society's capacity to ensure human well-being.

1.1.3 Employment and well-being

The income and wage aspects of employment and the factors behind growing trends in inequality in the United States and other developed nations will be addressed in Section 5.2 in Chapter 5. However, income and wages are only part of the overall benefit or satisfaction derived from employment. Beyond the creation of purchasing power and economic status, meaningful employment can provide social contacts/inclusion, enhance self-esteem, and lead to a better quality of life (Eurofound 2016). Further, our occupations and professions inform “our conception of self” and play an important role in shaping human character (Bertram and Sharpe 2000, p. 44).

European studies of living and working conditions consistently point to the critical importance of income and employment in life satisfaction (Eurofound 2002, 2004, 2005a, 2010, 2016). These studies also stress that life satisfaction improves when high levels of employment coexist with high-quality jobs. A number of factors combine to influence the quality of jobs and employment. These include career and employment security, skills development, issues relating to work–life balance, and worker health and safety (see Figure 1.3). In addition, increasing attention is being paid to the influence of work intensity and duration of job quality (Eurofound 2016) as well as the connection between occupations and wage inequality (Eurofound 2017).

During the turbulent period of social unrest in the 1960s, more highly educated industrial workers began to reject the routinization of jobs and the lack of creativity they represented and to call for more humane working conditions (Ashford 1976; Ashford and Caldart 1996; HEW 1973).^{*} At the center of their concerns lay the need for more autonomous and engaging work that enables the potential and capabilities of workers to flourish (Green 1980; Heckscher 1996; Walton 1985). Today, concerns about worker autonomy, working hours, the intensification of work, physical and psychological working conditions, employment equity, and the growth in contingent/temporary workers are important factors in the debate on life satisfaction. For example, a survey of workers in twenty-eight European countries, including the acceding and candidate countries as well as the current member states of the European Union, found that individuals with low levels of work autonomy are less satisfied with their lives than those with high levels of work autonomy (Eurofound 2005b).

^{*} For critiques of the Department of Health, Education, and Welfare's (HEW) influential report *Work in America*, see Koo (1973) and Karsh (1974).

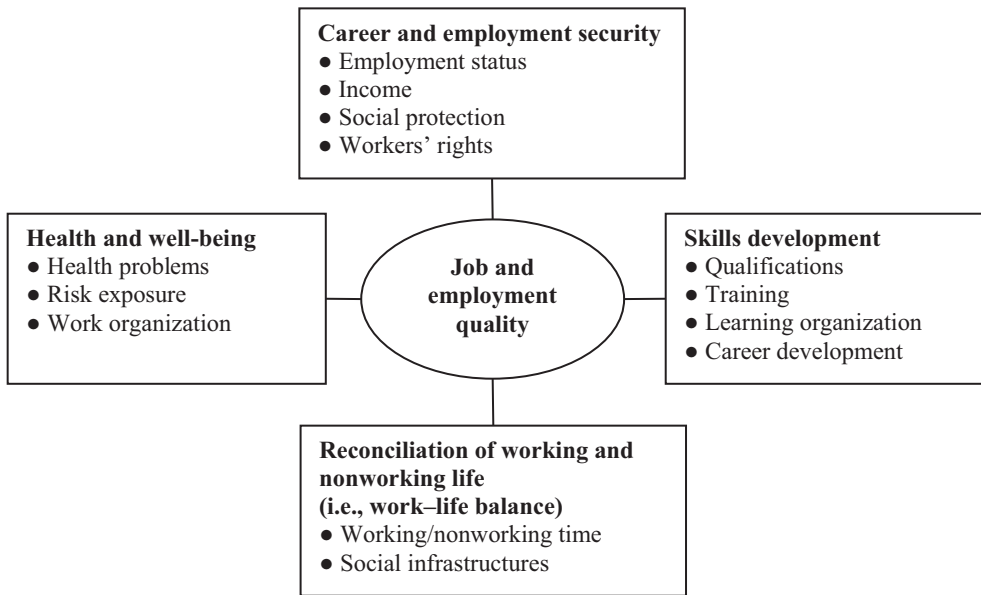


Figure 1.3 Factors that influence job and employment quality

In both Hochschild's *The Second Shift* (2012) and Schor's *The Overworked American* (2008), analysis of work patterns in America point to the negative impacts that the increase in daily working hours since the 1970s has had on many working families, especially on neglected children. Further, Boisard et al. (2003a) find that increased working time is clearly linked, by employees, to increasing health and safety risks. The perception of these employees is reinforced by the empirical evidence that links growing incidences of headaches, muscular pains, fatigue, anxiety, and insomnia to increasing daily working hours (ibid.).

Although policies designed to reduce daily hours worked might appear to be the logical way to enhance well-being – such as the French thirty-five-hour week – the European survey mentioned above (preliminarily) concluded that “reduced working time only has a minor impact on overall life satisfaction” (Eurofound 2005b, p. 54). This finding highlights the need to identify those factors that play a more significant role in enhancing the benefits of employment. The same European study found that long-term unemployment was the most significant factor affecting subjective quality of life, followed by adverse physical and psychological working conditions and low work autonomy. The number of hours worked and the intensification of work – that is, work carried out at a faster pace (see Boisard et al. 2003b) – were statistically significant but had a lower relative impact.* Studies of shorter work weeks must be reconciled with the salaries received by those workers that allow sufficient purchasing power of essential goods. In some cases, workers would gladly work less with or without the same take-home pay; in other cases, workers who are already hard-pressed to acquire necessities may balk at the prospect of a shorter week or even take on second jobs. Ashford and Kallis (2015) review the complexity of Europe

* Although these two last factors are found to be relatively less important, work intensity has been linked to stress (Dhondt 1997; Kompier and Levy 1994) and musculoskeletal disorders (Eurofound 2002), and the growing number of hours worked is commonly associated with the breakdown of family life (Hochschild 1997; Schor 1991).

adopting a shorter work week – see also Kallis et al. (2016), Hayden (2013), and Hayden and Shandra (2009).

It should be no surprise that long-term unemployment is the most important work-related factor affecting an individual's overall well-being. In addition to the obvious financial implications, extended periods of unemployment can damage self-esteem (Goldsmith et al. 1997), worsen symptoms of somatization, depression, and anxiety (Linn et al. 1985), and lead to social exclusion (Eurofound 2005a). More generally, people who have been unemployed for prolonged periods report lower levels of satisfaction with family life, social life, and health than those who have had continuous employment (Eurofound 2004). All these findings reinforce the view of many sociologists that work is an anchor point in life (between learning and retirement), and involuntary unemployment is detrimental to individual and family well-being. The negative impacts of unemployment also highlight the important benefits that meaningful employment can provide. In today's economic climate, these are particularly important observations.

Although the significance of unemployment points to the dilemma that a “bad” job is better than no access to a job over a prolonged period (Eurofound 2005a), adopting policies simply to create jobs with little concern for the value they provide workers seems unwise (Economist 2013). The idea of designing meaningful jobs that enrich lives is not new. For example, in *Design of Jobs*, L. E. Davis and Taylor (1972, p. 9) recognize that

we are faced with a new and serious responsibility for appropriately developing jobs and organizations, and linking them to the larger society. The requirement now is to design jobs and roles in a context having few external referents and in which all must be designed: the jobs, roles, and the technological and social systems that will provide meaning for individuals and institutions in the larger society.

With the nature of work continually changing, primarily in response to global competition (Ackerman et al. 1998; Carr and Chen 2004; Dougherty 1998; ILO 2015), creating jobs that provide workers with value beyond income becomes increasingly challenging. In the continual drive for competitive advantage, firms can search for improved performance by enhancing the skills and ability of their internal workforce to respond to rapid change or search for ways to cut costs by reducing their commitment to the workforce in favor of contingent workers who can be hired as needed (Cappelli 1998). These two strategies for competitiveness lie at opposite ends of a continuum, where the former approach tends to reinforce job security and meaningful employment and the latter approach tends to undermine it.

The recent growth in the number of contingent workers (ILO 2015), and in the rate at which workers move between firms (reducing job tenure), creates a number of problems. First, temporary workers are unlikely to form bonds of friendship, trust, and commitment if they are employed for a short period of time (Bertram and Sharpe 2000). This situation not only undermines these key elements of human character (Sennett 1998), but also reduces opportunities for social inclusion. Second, the growing mobility of workers and the transferability of skills discourage firms from investing in training because they may not see a return on their investment. If a large proportion of firms adopted a poaching rather than a nurturing approach to the acquisition of worker skills, workers would become more responsible for their own training and career development (Cappelli 1998). This development might also raise distributive justice concerns, because firms (that is, executives and shareholders) would reap the benefits of the additional educational burden put on society as a whole (ibid.). Further, those workers who might not see the value of education and skill development would face increased social exclusion due to reduced ability for participation.

The strain that the changing nature of work has placed on employees and their families and friends has elevated the debate on work–life balance (Woolley 2006). For example, improving living and working conditions in Europe is the primary mission of the European Foundation for the Improvement of Living and Working Conditions (Eurofound).^{*} Eurofound (2006b, p. 110) argues that employment “issues of flexitime and flexicurity should be systematically integrated with those of equal opportunity, and with those of good quality and affordable child and frail elderly care” and that “family-friendly employment policies might be defined as the basis for a new family policy, in which not only income, but time (time to care, to develop relationships) is conceptualized as a crucial resource” (ibid.).

In the United States, the concept of work–life balance has been adopted by many firms, keen to create a working environment more conducive to family life. For example, *Working Mother* magazine annually compiles a list of the top one hundred companies in America that offer the best work–life-balance programs.[†]

In summary, although paid employment provides an essential resource to help satisfy basic human needs for safety, security, and sustenance, employment (both paid and unpaid) is also a critical factor in the satisfaction of our human needs relating to competence, efficacy, and self-esteem; autonomy and authenticity; and connectedness. This section emphasizes the importance of thinking beyond policies that focus only on job creation to strategies that encourage the creation of *meaningful* jobs that ultimately enhance our general well-being and satisfaction with life. The growing interest in work–life balance in many firms and institutions across the world is encouraging, but the real challenge lies in developing jobs that enhance competitiveness without undermining the value employees derive from workforce participation (see Section 7.7 in Chapter 7 for a related discussion of values for sustainable employment).

Even if gainful and fulfilling employment is achieved, it may still not provide sufficient purchasing power for the employed. Expansion of capital ownership options for people through binary economics and other ownership vehicles may be necessary (see Section 3.6.1 in Chapter 3) to ensure that employment maximizes well-being. The provision of a universal basic income or UBI (see Section 3.7 in Chapter 3) is also increasingly being discussed (Van Parijs 1995, 2000; Colson, 2017) and small pilot programs have begun in 2017 in California, Canada, and elsewhere (Weller 2017). However, any approach that potentially reduces the number of people employed must not just provide an income sufficient to meet material needs, but must also consider how to replace the less-tangible benefits of employment to an individual’s well-being.

1.2 Social justice, inequality, and the social contract between the governed and the government

The test of our progress is not whether we add more to the abundance of those who have much; it is whether we provide enough for those who have too little.

– Franklin Delano Roosevelt, Second Inaugural Address, January 20, 1937

An important conclusion drawn previously is that government should act as a trustee to ensure that basic human needs are met in an equitable and just manner. However,

^{*} For more information, see the website for the European Foundation for the Improvement of Living and Working Conditions (Eurofound), www.eurofound.europa.eu/ (accessed October 16, 2017).

[†] See Working Mother Media (2017), *Working Mothers 100 Best Companies*, www.workingmother.com/best-companies-for-women (accessed October 16, 2017).

governments cannot provide the whole answer; competitive markets will also continue to play a vital role in meeting human needs. The challenge is to find a tolerable balance between government regulation and economic (and other forms of) freedom.*

Historically, economists have rejected the notion that the government should interfere with the market and argued that we should let people express their utility in the marketplace. However, as discussed in the previous section, consumers are finding it increasingly difficult to use their spending power effectively, let alone sustainably. Hence, it appears that there are two predominant views:

- 1 There are basic needs, and that is why we need *markets*; and
- 2 There are basic needs, and that is why we need *government*.

The focus of this section will be on the problems of equity within a country or region, equity between developed and developing nations, and intergenerational equity. The critical questions addressed here are what is fair within society and what role government should play. If the state is to play a role in needs satisfaction, we should have some understanding of the relative roles of the governed and the government. In this regard, we begin this section with a look at the *social contract*.

1.2.1 The social contract and the theory of justice

Man is born free; and everywhere he is in chains. One thinks himself the master of others, and still remains a greater slave than they.

– Jean-Jacques Rousseau 1762

The modern notion of the social contract can be traced back to the political and moral theories of Thomas Hobbes (1985 [1651]), John Locke (1988 [1690]), Jean-Jacques Rousseau (1968 [1762]), and Immanuel Kant (1989 [1785]), but the present-day interpretation rests most heavily on the work of John Rawls (1971).

The basic premise of the social contract is that an individual, in accepting that the pursuit of self-interest is ultimately self-defeating, relinquishes certain freedoms and rights to a system of collectively enforced social arrangements in exchange for peace and security (Friend 2004). Hence, he or she agrees to follow the “general will” of society and be held accountable if his or her “individual will” motivates behavior that breaks the social contract – that is, the law of the land (Rousseau 1968 [1762]). Whatever freedoms an individual loses in the transition from the state of nature[†] to the civil state are more than

* A reliance on markets is not likely to be sufficient, because if there is *producer-created demand*, then businesses influence both the supply and the demand side of the economy. Although such influence may not result in monopoly prices, it has the potential to reduce our ability to fulfill our basic human needs. Hence, government has a role to play in ensuring that a full range of products and services is provided for society.

† The “state of nature” refers to a hypothetical state of living that occurred before the establishment of society and the introduction of any form of government or social arrangements. Hence, in the state of nature, there are no restraints on how one can behave. The manner in which one defines the state of nature has implications for how the social contract is subsequently envisioned. For example, Hobbes’s (1985 [1651]) political philosophy was based on the idea that men in a state of nature (i.e., in a state without civil government) are in a state of constant war, which any rational and self-motivated individual would want to end. Hence, the solution is to establish a social contract to ensure peace and order and to enable individuals to live in a civil society, which suits their own interest. Hobbes’s hypothetical view of

compensated for by belonging to a civil society that ensures safety, liberties, and property rights. Hence, the social contract tries to balance individual freedom with being a member of a civil society that limits freedoms for the greater good.

During the nineteenth century, interest in the social contract declined as the utilitarian movement took hold (Rawls 1971). Utilitarianism argues that all moral judgments should aim to achieve the greatest good for the greatest number (Bentham 1970 [1781]; Mill 2002 [1863]). Hence, the objective of social institutions and human actions under a utilitarian framework is to develop and enforce laws that maximize the well-being and happiness of society. But utilitarianism suffers from two major problems (Brock 1973). First, the theory raises moral conflicts, particularly in regard to justice. For example, although reducing taxes might maximize the happiness (or material well-being) of society, it might also have the effect of reducing the availability of basic health or educational services for the disadvantaged. The aggregative character of utilitarianism means that it is not concerned about the pattern of distribution of welfare,* and therefore it provides no justification for inequality in its distribution (Cohen 1993). Further,

it would not only be morally right to sacrifice the interests of individuals or minority groups if this would serve to maximize common utility, but those who are sacrificed would even have a moral duty of benevolence to let this happen.

(Wetlesen 1999, p. 42)

Second, utilitarianism fails to support the more liberal nature of Western societies that emphasize liberty and individual rights. For example, slavery was a useful institution in the United States for promoting the success of agricultural advance, but it was ultimately rejected on moral and socio-political grounds. Similar arguments apply to the elimination of child labor in industrialization.

In an effort to address the shortcomings of utilitarianism, as well as those of intuitionism (that is, systems of philosophy that consider intuition the fundamental process of our knowledge), John Rawls published his seminal work in 1971, *A Theory of Justice*, which renewed the notion of the social contract by arguing that political and moral positions can be determined by using impartiality.

the state of nature was extreme in that he envisioned a world in which man would constantly fear for his life. Locke (1988 [1690]) built on Hobbes's notion of the social contract but constructed his theories on a different view of the state of nature. Locke (1988 [1690]) argued that without government to enforce social arrangements and laws, man is not free to do anything he pleases because he is constrained by a sense of morality. In this regard, the "state of Nature is pre-political, but it is not pre-moral. [. . .] It is therefore both the view of human nature, and the nature of morality itself, which account for the differences between Hobbes' and Locke's views of the social contract" (C. Friend [2004], "The Social Contract," *The Internet Encyclopedia of Philosophy*, www.iep.utm.edu/soc-cont/ [accessed October 16, 2017]).

* The Brundtland report, *Our Common Future*, interprets "welfare" as the "satisfaction of human needs and aspirations" (WCED 1987, p. 43). This interpretation rests on fundamental human needs for "primary goods," such as food, shelter, clothing, and employment, and the legitimate expectations for a better life. Wetlesen (1999) argues that we can reasonably interpret the Brundtland Commission's view of welfare in an *objective* and a *subjective* sense. The former is concerned with conditions and standards of living, and the latter with the perceived quality of life that an individual is able to achieve. The Brundtland report is also concerned about the equitable distribution of welfare. "The essential needs of vast numbers of people in developing countries – for food, clothing, shelter, jobs – are not being met, and beyond their basic needs these people have legitimate aspirations for an improved quality of life. A world in which poverty and inequality are endemic will always be prone to ecological and other crises. Sustainable development requires meeting the basic needs of all and extending to all the opportunity to satisfy their aspirations for a better life" (WCED 1987, pp. 43–44).

The traditional social contract (envisioned in its various forms by Hobbes, Locke, Rousseau, and Kant) revolved around the agreement of people in a state of nature to form a society and government that they will be obligated to obey (Brock 1973). In this regard, the social contract is “primarily a theory of political obligation” (ibid., p. 488). In contrast, Rawls developed a version of the contract in which the relevant agreement revolves around moral principles, the principles of justice (ibid.). These principles can be considered a set of game rules that must be followed in designing new social arrangements, such as policies and programs. Central to Rawls’s theory is the hypothetical situation, the “original position,” in which an individual’s knowledge is constrained by a “veil of ignorance.” Behind the veil of ignorance,

no one knows his place in society, his class position or social status; nor does he know his fortune in the distribution of natural assets and abilities, his intelligence and strength, and the like. Nor, again, does anyone know his conception of the good, the particulars of his rational plan of life, or even the special features of his psychology such as his aversion to risk or liability to optimism or pessimism. [. . .] The parties do not know the particular circumstances of their own society, [. . .] its economic or political situation, or the level of civilization and culture it has been able to achieve.
(Rawls 1971, p. 137)

Rawls argues that decisions made for society should be made as if the participants do not know in advance what their lot in life will be.

In essence, Rawls’s original position is an abstract version of the state of nature. It follows that from the original position people are able to identify what they must do individually and collectively (through social institutions) to realize the nature of justice. The simplicity of the veil of ignorance is its strength. By denying contracting parties the knowledge of their own characteristics or circumstances, they are forced to adopt the moral point of view and are unable to develop principles or policies that favor themselves. Rawls also states that contracting parties are assumed to be “rational and mutually disinterested” (Rawls 1971, p. 13): “rational” in the sense that the contracting party makes the most effective decision to reach a given end, and “mutually disinterested” in the sense that each person does not take “an interest in one another’s interests” (ibid.). Thus, the “rational” choice is to develop principles and strategies for a just society from initial conditions that are inherently fair. Justice, therefore, proceeds out of fairness, giving rise to Rawls’s formulation of “justice as fairness” (ibid., p. 17). Further, as Brock (1973, p. 489) notes, in Rawls’s theory there is no historical agreement, which means that contracting parties are able to adopt “the standpoint of someone in the original position, and so the moral point of view, at any time.” In theory, an individual in the original position is likely to adopt the same principles for justice as any other person, thereby establishing a robust set of principles and arrangements to regulate a just society.

A problem identified by Rawls when he is considering the design of the social institutions that form the basic structure of society is that individuals are born into the world with a wide range of circumstances and characteristics. Although it is not possible to alter many of the human characteristics that form our personalities and physical ability, Rawls argues that it is possible to adjust the social institutions to favor those who are disadvantaged. Hence, Rawls develops two principles of justice that he argues contracting parties would select in the original position – behind the veil of ignorance – to establish a just society:

First Principle: Each person is to have an equal right to the most extensive total system of equal basic liberties compatible with a similar system of liberty for all.

Second Principle: Social and economic inequalities are to be arranged so that they are both

- a) to the greatest benefit of the least advantaged, consistent with the just savings principle
- b) attached to offices and positions open to all under conditions of fair equality of opportunities.

(Rawls 1971, p. 302)

The first principle determines the distribution of civil liberties. It states that **each member of a society is to receive as much liberty (or personal freedom) as possible, as long as every other member of society receives the same**. The principle “implies that one person’s good can never be considered a good if it constitutes an obstacle to someone else’s pursuit of *their* good, even if that someone else comes a generation or two later” (Voorthuis and Gijbels 2010, p. 376). **The second principle states that social and economic inequalities are justified only if the most disadvantaged members of society are made relatively better off under new arrangements**. As Friend (2004, Section 3a) notes, “only if a rising tide truly does carry all boats upward, can economic inequalities be allowed for in a just society.”

Rawls (1971) developed the second principle (known as the *difference principle*) using the *maximin rule* – that is, the best outcome is one that minimizes the maximum loss. He argued that since people do not know their position in society when they are behind the veil of ignorance, they will select the difference principle because it will be to their benefit if it is possible that they end up in the most disadvantaged section of society.

In the latter part of principle 2(a), Rawls introduces the notion of “just savings,” which is the first comprehensive treatment of intergenerational equity (or justice). The basic idea is that when individuals are in the original position, behind the veil of ignorance, they do not know which generation or in what stage of socioeconomic development they might live and must, therefore, select “savings” principles that do not favor earlier generations over later ones.* In *A Theory of Justice*, Rawls’s formulation of the just savings principle was based on a “motivational assumption” that contracting parties would want to save for their successors, regardless of whether their ancestors saved for them.† This formulation runs counter to the notion of “mutually disinterested” contracting parties and has been criticized as being sexist and arbitrary (Barry 1978; Okin 1989).

In *Political Liberalism*, Rawls (1993) revised his notion of the just savings principle to address these inconsistencies. His revised assumption is that *generations* are mutually disinterested. Therefore, contracting parties in the original position, behind the veil of ignorance, should

agree to a savings principle subject to the further condition that they must want all previous generations to have followed it. Thus, the correct principle is that which the members of any generation (and so all generations) would adopt as the one their generation is to follow and as the principle they would want preceding generations to

* In the words of Rawls (1971, p. 287): “The parties do not know to which generation they belong or, what comes to the same thing, the stage of civilization of their society. They have no way of telling whether it is poor or relatively wealthy, largely agricultural or already industrialized, and so on. The veil of ignorance is complete in these respects. Thus, the persons in the original position are to ask themselves how much they would be willing to save at each stage on the assumption that all other generations are to save at the same rates. That is, they are to consider their willingness to save at any given phase of civilization with the understanding that the rates they propose are to regulate the whole span of accumulation. In effect, then, they must choose a just savings principle that assigns an appropriate rate of accumulation to each level of advance.”

† Stanford Encyclopedia of Philosophy, “Intergenerational Justice, Rawls’s Just Savings Principle,” <http://plato.stanford.edu/entries/justice-intergenerational/#RawJusSavPri> (accessed October 16, 2017).

have followed (and later generations to follow), no matter how far back (or forward) in time.

(ibid., p. 274)

In this formulation, the principle of just savings is considered as binding for all previous and future generations. A problem, however, with Rawls's restatement is that he does not consider the implications of an increasing number of people in the future,^{*} or that the current generation has a larger population than the previous generation – a fact that will clearly change how much society should save (Barry 1999; Casal and Williams 1995; P. Dasgupta 1994; Heyd 1992). Nevertheless, Rawls's ideas provide a useful starting point for discussions about intergenerational equity.

The two principles of justice are to be considered in a specific order. The first principle must be considered before the second principle because "liberty can only be restricted for the sake of liberty, not for other social and economic advantages" (Brock 1973, p. 490).[†] This ranking implies that society would rank the determination of civil liberties above that of economic advantage. Also, within the second principle, equality of opportunity (2b) is to be considered before the difference principle (2a), using the same rationale.

Before we progress further, it is worth mentioning that there are those who question these basic principles of justice. For example, Brock (1973) argues that people in the original position are likely to tolerate minor sacrifices in liberty for substantial economic gain, especially in situations of severe economic underdevelopment. Further, the difference principle assumes that all risk taking in the original position is irrational: "It allows no possible gain in one's life prospects, should one turn out to be among the better off members of society" (ibid., p. 491). This latter point reflects a common criticism of Rawls's decision to use a maximin rule (Harsanyi 1975). Rawls (1974) counters such arguments by stating that the original position masks the probabilities of outcomes, making alternative decision rules too risky. In addition, the difference principle acknowledges the fact that any good circumstances into which a person is born are "unearned and undeserved" (Brock 1973, p. 491). The benefits that are derived from these circumstances should therefore benefit all of society. Thus, whether a person is for or against Rawls's theory of justice will depend, to a certain extent, on that person's perceived position in society.

Rawls argues that his notion of justice as fairness begins with the adoption of the principles of a just society, which will guide all subsequent actions, including the reform of institutions.

Having chosen a conception of justice, we can suppose that [. . . the contracting parties] are to choose a constitution and a legislature to enact laws, and so on, all in accordance with the principles of justice initially agreed upon. [. . .] Moreover, assuming that the original position does determine a set of principles (that is, that a particular conception of justice would be chosen), it will then be true that whenever social institutions satisfy these principles those engaged in them can say to one another that they are cooperating on terms to which they would agree if they were free and equal persons whose relations with respect to one another were fair.

(Rawls 1971, p. 13)

* In contrast, in Northern industrialized societies there are implications of decreasing populations that cannot provide sufficient amenities for those retiring.

† It is possible to envisage a situation where liberty is constrained to protect liberty – i.e., "restrictions to individual freedoms are justified when the unfettered exercise of these freedoms conflicts with other freedoms" (Beatley 1994, p. 156). For example, the speed at which vehicles are allowed to drive is constrained to protect broader public freedoms such as individual safety.

Rawls argues that **the challenge raised by the difference principle is how to choose a social system (that is, a basic structure of government) that will ensure distributive justice in a capitalist market economy.** From the premise that the basic structure of government and its actions are regulated by a constitution protecting the liberties of equal citizenship, Rawls outlines four branches of government (Rawls 1971, pp. 274–284). The first is the *allocation branch*, required to keep markets competitive, prevent the formation of unreasonable market power, and correct for externalities. The second is the *stabilization branch*, needed to bring about strong effective demand (through the deployment of finance) and to maintain full employment and choice of occupation (that is, those who desire work can find it). The third is the *transfer branch*, essential to the formation and maintenance of a social minimum. By considering basic human needs, this branch determines the level of guaranteed minimum income that maximizes the long-term expectations of the least advantaged. Finally, there is the *distribution branch*, needed to enforce inheritance and gift taxes, in addition to general income or expenditure taxes. It follows that the allocation and stabilization branches are required to maintain an efficient economy; the transfer branch is designed to ensure that basic human needs are identified and met; and the distribution branch is needed to prevent the concentration of economic power.

As stated in the introduction to Section 9.7.2.1 in Chapter 9, we argue that **government has an important role as a trustee to ensure that basic human needs are met in an equitable and just manner.** The preceding discussion of the social contract and Rawls's theory of justice indicates how government could be structured to enable it to achieve this goal. But establishing a philosophy of government that ensures that basic human needs are met is a complex task.

Basic human needs can be categorized under the headings of *sustenance*, *competence*, *autonomy*, and *connectedness* (Kasser 2002). However, this formulation does not provide government with a clear directive on what actions are required to satisfy our basic needs. In this regard, Max-Neef et al.'s (1989) theory of human needs and satisfiers is of value in that it identifies the *qualities*, *things*, *actions*, and *settings* that are associated with fundamental needs such as protection, participation, and freedom. Further, because *satisfiers* are ultimately defined by society – an essential characteristic of the social contract – an interesting experiment would be for a representative group of contracting parties to complete Max-Neef et al.'s (1989) matrix of needs and satisfiers while behind the veil of ignorance. In theory, this action would develop the satisfiers of human needs that are culturally defined and impartial.

Once the basic human needs of a society are agreed on, the role of government (in a Rawlsian sense) is to develop laws, policies, and programs to assist those members of society who are unable to satisfy their basic needs. Opponents to the formation of such a welfare state argue that the only way to meet the needs of the disadvantaged is through economic regulation and taxation, which results in a loss of civil liberties (Nozick 1974).^{*} Hence, civil liberty and social welfare stand in constant tension with each other.[†]

* In 1974 the late Robert Nozick – a professor of philosophy at Harvard and a colleague of John Rawls – published *Anarchy, State, and Utopia* in opposition to the *nonminimal welfare* state proposed in *A Theory of Justice*. Nozick (1974, p. ix) defined the minimal state as follows: “Our main conclusions about the state are that a minimal state, limited to the narrow functions of protection against force, theft, fraud, enforcement of contracts, and so on, is justified; that any more extensive state will violate persons’ rights not to be forced to do certain things, and is unjustified; and that the minimal state is inspiring as well as right. Two noteworthy implications are that the state may not use its coercive apparatus for the purpose of getting some citizens to aid others, or in order to prohibit activities to people for their own good or protection.” Interestingly, although Nozick’s and Rawls’s philosophies of government were opposed, they both agreed that individual rights are more important than utilitarian considerations and that government should be neutral in respect to people’s right to choose and pursue their own vision of a good life (Sandel 1996).

† “The extent to which the needs theory dominates the philosophy of government [...] can be measured by the levels of taxation and regulation of economic activity. Government takes money out of the hands

One might question, however, whether a *laissez-faire* market is able to operate free from government intervention and supply the products and services that society needs. (See the discussion of Stiglitz in his *Rewriting the Rules* 2015 in Chapters 3 and 13.) In particular, Brulle (2000, p. 37) expresses concern that government is not able to operationalize the social contract, arguing “there is little public policy about policy.”

Brulle (2000) describes how since the Great Depression, the U.S. government has become an active participant in economic activity, primarily to stabilize the economic system and to compensate for the adverse effects of capital accumulation. This involvement in the economy means that the government assumes a level of responsibility to ensure the legitimacy of the market. Because economic growth is based on investment and consumption, the government plays an important role in furthering these two drivers of economic development. Brulle (2000, pp. 34–35) argues that the

inability of the market to maintain itself creates a politically maintained private market in which socialized production and private appropriation of production exist in a system legitimized by formal democratic rules. This creates a conflict between the normative justifications for collective decisions. Market outcomes are legitimized as the outcomes of democratic will formation. This leads to a series of contradictions and crises in Western society.

Brulle’s (2000) major concern is that the public sphere – “an arena in which the common good was debated and a democratic consensus was reached” (p. 37) – has been undermined by the insulation of government action from public input. This situation has had the effect of exposing the public sphere to “the manipulative deployment of media power to procure mass loyalty, consumer demand, and compliance with systemic imperatives” (Habermas 1992, p. 452, quoted in Brulle 2000, p. 37). In such an environment, it is difficult to envision how society can be an effective part of the decision-making process. Thus, the social contract between the governed and the government is undermined, thwarting efforts to establish a social order that enables “the communicative generation of legitimate power” (*ibid.*).*

Having outlined the notion of the social contract in this section, in Section 9.7.2.1 in Chapter 9 we attempt to operationalize the social contract by crafting a decision-making philosophy that can be applied within a trade-off analysis framework. Put differently, we have developed a *revised* Rawlsian decision-making philosophy to advance sustainable development. Our revision is the creation of a third principle of justice – the *environmental principle* – that seeks to connect the social and natural realms in a decision-making philosophy focus on sustainable development.

of individuals and spends it on what it considers are the needs priorities of the people. The more an individual is taxed, the greater the loss of his freedom to determine his own priorities and to satisfy his individual needs. In short, through taxation and regulation, government decides how a person should spend his money. Rather than leave a person’s resources to himself and permit him to make his own arrangements for the satisfaction of his needs, the government expropriates his wealth and in return seeks to provide him the necessities of life as determined by government. [. . .] It is clear that a needs based theory of human rights can be pursued only at the expense of the gradual loss of freedom and a gradual movement towards totalitarianism” (M. Cooray [1985], “Human Rights in Australia,” *The Basic Human Rights and the Needs Based Human Rights*, www.ourcivilisation.com/cooray/rights/chap5.htm [accessed February 1, 2018]).

* For the implications on the nature of jobs, see London (2013).

1.2.2 Equality of what?

The manner in which equality is defined and evaluated is directly linked to the types of inequalities one is trying to right. This section takes a brief look at the various ways in which equality is considered and how these considerations relate to the broader picture of sustainable development.

The major philosophies of government (or social arrangements), some of which are discussed in the previous section, all support the notion of equality in terms of a “focal variable” such as income, wealth, happiness, opportunities, rights, or needs fulfillment (Sen 1992, p. 2). The basic premise of these theories is that each individual should have *equality of opportunities* in regard to the variable(s) selected (see Rawls’s second principle of justice). For example, everyone should have an equal opportunity to gain employment or to have an education. In a world in which everyone’s circumstances and abilities are the same, focusing on equality of opportunity would suffice. But this is not the world in which we live, and adopting such a posture in decision-making often results in unequal treatment of the disadvantaged.

In the book *Inequality Reexamined*, Nobel Prize-winning economist Amartya Sen (1992) raises the question “equality of what?” and links it directly to the consideration of human diversity. In particular, he argues that social arrangements (for example, government policies and laws) should be assessed in relation to a person’s capability to achieve functionings.

Sen’s (1992) idea of *functionings* is Aristotelian in origin.* He defines functionings as the various things that a person has “reason to value,” from being well nourished or avoiding escapable morbidity to more complex realizations, such as having self-respect or being a valued member of a community (ibid., p. 5). Alkire (2003, p. 5) describes Sen’s idea of functionings as

an umbrella term for the resources and activities and attitudes people spontaneously recognize to be important – such as poise, knowledge, a warm friendship, an educated mind, a good job. What is centrally important varies in different places, which is why there is no rigid and inflexible set of specific capabilities – the priorities will have to be set and reset again and again in different ways.

It follows that an individual’s achieved *functionings* are those that the individual has successfully pursued and realized. However, Sen (1992) argues that focusing on achieved functionings (or focal variables) alone is not sufficient. The inherent diversity of external circumstances and psychological and physiological makeup among individuals means that the characteristics of inequality tend to diverge within the variable under analysis. In other words, differences in the circumstances and abilities of people mean that *equality of opportunity* will not lead to *equal* wealth or happiness, for example. In addition,

equality in terms of one variable may not coincide with equality in the scale of another. Equal opportunities can lead to very unequal incomes. Equal incomes can go with significant differences in wealth. Equal wealth can coexist with very unequal happiness. Equal happiness can go with widely divergent fulfillment of needs. Equal fulfillment of needs can be associated with very different freedoms of choice. And so on.

(ibid., p. 2)

* Aristotle believed that the attainment of the good life or happiness was the result of self-realizationism – i.e., the ability to realize one’s potentialities, character, or personality. To Aristotle, the person who has the greatest potentialities and is able to actualize this potential has the brightest prospect of happiness. Conversely, the person whose potential remains unfulfilled will ultimately be frustrated and unhappy.

Hence, Sen's core argument is that "the basic heterogeneity of human beings" and "the multiplicity of variables in terms of which equality can be judged" are two factors that complicate the idea of equality (ibid., p. 1). This means that a focus on individual functionings (or focal variables) does not necessarily incorporate an individual's *freedom** to achieve. Hence, Sen introduces the concept of *capability* to describe an individual's freedom to achieve "valuable" functionings.

It represents the various combinations of functionings (beings and doings) that the person can achieve. Capability is, thus, a set of vectors of functionings, reflecting the person's freedom to lead one type of life or another [. . .] to choose from possible livings.

(ibid., p. 40)[†]

Sen's focus on functionings and on the *capability* to achieve functionings differs from the traditional views of equality that tend to focus on variables such as income, wealth, or happiness (1992, p. 7). Instead of measuring equality using such focal variables, Sen argues that a "more adequate way of considering 'real' equality of opportunities must be through equality of capabilities (or through the elimination of unambiguous inequalities in capabilities, since capability comparisons are typically incomplete)" (ibid.).

A major difference between Sen's capabilities-based assessment of equality and Rawls's theory of "justice as fairness" lies in their assessment of the holdings of "primary goods" – that is, goods that are considered essential for the survival and self-respect of individuals (Rawls 1971).

Rawls's theory is that in the original position – behind the veil of ignorance – most people will be able to agree on a set of primary goods that are considered important regardless of an individual's circumstances. Rawls argues that social primary goods are "things that every rational man is presumed to want," such as "rights and liberties, powers and

* The freedom Sen (1992, p. 31) refers to is "the real *opportunity* that we have to accomplish what we value." Sen (1999, p. 36) also described development as the "process of expanding real freedoms." Sen views the expansion of freedom as both "(1) the *primary end* and (2) the *principal means* of development" (ibid.). The former is referred to as the "constitutive role" and the latter as the "instrumental role." The "constitutive role" refers to the basic premise that freedom must be regarded as a primary objective of the development process. The "instrumental role" refers to the various ways in which freedom can act as an "instrument" of development. Sen identifies five types of instrumental freedoms that tend to enhance the capability of an individual to live more freely (ibid., pp. 38–40): (1) *political freedoms* (the opportunities that individuals have to be a part of democratic processes); (2) *economic facilities* (the opportunities that individuals have to "utilize economic resources for the purposes of consumption, or production, or exchange"); (3) *social opportunities* (the access that individuals have to facilities such as basic education and health care, which are essential if a person is to have an effective role in economic and political activities); (4) *transparency guarantees* ("the freedom to deal with one another under guarantees of disclosure and lucidity"); and (5) *protective security* (the need to provide a social safety net to assist those individuals who face abject misery and possibly even starvation and death).

† Although Sen does not formally list capabilities, this has not prevented others from doing so. The most comprehensive attempt is presented by Nussbaum (2000), who developed a set of "central human functional capabilities." The major headings of Nussbaum's list of capabilities include the following: life; bodily health; bodily integrity; senses, imagination, thought; emotions; practical reason; affiliation; other species; and control over one's environment (ibid., pp. 78–80). Under each heading, Nussbaum defines the "combined" capabilities that a person should be able to achieve. For example, the capabilities for bodily health are defined as "being able to have good health, including reproductive health; to be adequately nourished; to have adequate shelter" (ibid., p. 78).

opportunities, income and wealth, [and] [. . .] self-respect" (Rawls 1971, p. 62).^{*} Hence, Rawls's general conception is that "all social primary goods [. . .] are to be distributed equally unless an unequal distribution of any or all of these goods is to the advantage of the least favored" (ibid., p. 303). The focus of Rawls's formulation is "equality of opportunity," which is captured within the difference principle (see Section 1.2.1).

Sen identified a fundamental problem with Rawls's formulation of the difference principle:

Two persons holding the same bundle of primary goods can have very different freedoms to pursue their respective conceptions of the [greater] good (whether or not these conceptions coincide). To judge equality – or for that matter efficiency – in the space of primary goods amounts to giving priority to the means of freedom over any assessment of the extents of freedom, and this can be a drawback in many contexts.

(Sen 1992, pp. 8–9)

Thus, Sen argues that equality in the holdings of primary goods or resources ignores the fact that disadvantaged members of society may not have the capability or freedom to convert these goods/resources into the things that they value. Therefore, if a government were to use primary goods as a measure of well-being for purposes of justice, there is a concern that disadvantaged members of society might suffer from unjust (or unequal) treatment. To put it another way, these people are likely to have an unfair share of opportunity. Thus, Sen's capability-based assessment of equality forms the foundation for affirmative action, for empowering the powerless, and for positive discrimination (Bidwai 1998).

Sen's theories of capabilities and functionings and Rawls's theory of "justice as fairness" have had a significant impact on how governments have shaped social arrangements to establish equitable and just societies.[†] Sen's theories have also provided a strong conceptual foundation for the UN's work on human development (Fukuda-Parr 2002, 2003). In particular, his ideas shaped the UN *Human Development Reports* (HDRs) and the Human Development Index (HDI), including its extensions. More recently the Stiglitz, Sen, and Fitoussi Commission (2009), discussed in Section 1.1.1, has integrated Sen's ethics into the measurement of human progress and this has led directly to the creation of the OECD Better Life Index as well as influencing the Sustainable Development Goals.

The essence of Sen's conception of equality is that "a person's capability to achieve does indeed stand for the opportunity to pursue his or her objectives" (Sen 1992, p. 7). From this premise, the UN defined human development as the "process of enlarging people's choices" (UNDP 1995, p. 11) and sought the removal of obstacles – "such as illiteracy, ill health, lack of access to resources, or lack of civil and political freedoms" (Fukuda-Parr 2003, p. 303) – that prevent an individual from achieving his or her valued objectives in life. Thus, the intention of the UN HDI was to shift international attention to the expansion of basic human capabilities, especially the capability to (1) have a healthy life, (2) acquire knowledge, and (3) reach a decent standard of living.[‡] Because the purpose of the HDRs is the "global evaluation of development," these three indexes

* Rawls (1971, p. 62) states that other primary goods, such as health and vigor or intelligence and imagination, are "natural" primary goods. Although natural primary goods can be influenced by social arrangements, they are not directly under their control.

† Incidentally, it was Sen (1993, p. 43) who once said "it is significant that no democratic country with a relatively free press has ever experienced a major famine." That is, there are no famines in democracies.

‡ Although the HDI's focus is on "evaluating" human development, Sen (2003) argues that the human development perspective also contains an "agency perspective" that is often overlooked. When one has identified where improvement to human lives can be made through the HDI, it is necessary to turn to the agency perspective to develop policy and political strategies to realize the necessary changes.

were selected for their universal value since they form the basis on which many choices in life depend (Fukuda-Parr 2002, p. 6). The notion of investing in health and education in particular maps closely with *physical health* and *learning*, two essential attributes an individual requires to attain a high level of well-being.

To provide a context for the preceding discussion, Table 1.3 compares and contrasts the human development approach with the neoliberal (utilitarian) alternative and its precursor, the basic-needs approach (first espoused by Paul Streeten [1982] and Frances Stewart [1985]).^{*} Table 1.3 also presents an idealized framework from which public policy formulation can be considered. For example, by looking at the “evaluative” and “agency” aspects of a set of policies, it should be possible to determine whether the government supports a *human development* approach (that is, its policies are just and fair and consider human capabilities) or a *neoliberal* approach (that is, its policies are utilitarian in nature) to the process of development. It is interesting to note that none of the approaches contain an explicit concern for the environment, on which human activity and development depend.[†] It is clear that if we are to transition toward sustainable development, the need to protect the environment must be added to the need to ensure that we live in an equitable and just society that recognizes human capabilities (see the related discussion in Section 9.7.2.1 in Chapter 9).

Sen’s work has also had an important influence on the formulation of the concept of sustainable development, which he defines as “development that promotes the capabilities of present people without compromising capabilities of future generations” (Sen 2000, p. 5). Sen believes that the Brundtland (need-centered) view of development is “illuminating” but “incomplete” (ibid., p. 2). He argues that individuals must be seen as “agents who can think and act, not just as patients who have needs that require catering” (ibid.). His basic premise is that by treating people as agents, they will – given the opportunity – be able to “think, assess, evaluate, resolve, inspire, agitate, and through these means, reshape the world” (ibid., p. 1). Hence, Sen advocates a capability-centered approach to sustainable development. The objective of Sen’s ideas is to “integrate the idea of sustainability with the perspective of freedom, so that we see human beings not merely as creatures who have needs but primarily as people whose freedoms really matter” (ibid., p. 6). (See Section 9.7.2.1 in Chapter 9 for a discussion of how Rawls’s theory of justice could advance individual freedom and sustainable development.) Sen’s contribution to our understanding of equality and his notion of development as “a momentous engagement with freedom’s possibilities” (Sen 1999, p. 298) provided one of the few credible challenges to the neoliberal (or utilitarian) orthodoxy that guided development efforts since the 1980s (Saha 2002). If neoliberalism is “dead,” as Stiglitz declared in 2016, then it is in part thanks to Sen’s contributions.[‡]

As mentioned earlier, one of Sen’s major contributions to sustainable development is his influence on the UN’s conceptualization of human development that formed the basis for the HDRs and the HDI. Fukuda-Parr (2002), the director of the HDRs from

^{*} It is worth noting that Sen’s theories on capabilities and functionings grew from the basic-needs approach to international development (Alkire 2005). Sen’s main reason for rethinking the basic-needs approach was to introduce a greater role for individual freedom. His concern was that the basic-needs approach tended to focus on commodities, as opposed to human beings and their functionings. See Section 1.1 for a discussion of human needs and sustainability.

[†] However, they do implicitly incorporate employment and purchasing power. This highlights the two different strands of sustainability scholarship, one focusing on the environment and the other on economic empowerment.

[‡] While there are still many proponents of neoliberalism, the combination of low growth and rising inequality since the 2008 financial crisis has given an increasing relevance to the arguments against neoliberalism.

Table 1.3 Comparison of key features of the human development approach with the neoliberal alternative and the basic-needs antecedent

	<i>Human development^a</i>	<i>Neoliberalism</i>	<i>Basic needs</i>
Philosophical underpinnings			
Normative assumptions	Explicit	Implicit	Not fully specified
Concept of well-being	Functionings and capabilities	Utility	Meeting basic needs
Evaluative aspect			
Leading criterion for evaluating development progress	Human capabilities; equality of outcomes; fairness and justice in institutional arrangements	Economic well-being; economic growth; efficiency	Poverty reduction in terms of income; access to basic social services
Measurement tools favored	Human outcomes, deprivational and distributional measures	Economic activity and conditions, averages and aggregate measures	Access to material means; deprivational measures
Agency aspect			
People in development as ends and/or means	Ends and means: beneficiaries and agents	Means: human resources for economic activity	Ends: beneficiaries
Mobilizing agency	Individual action and collective action	Individual action	Concern with political will and political base
Development strategy			
Key operational goals	Expanding people's choices (social, economic, and political)	Economic growth	Expanding basic social services
Policy concerns			
Distribution of benefits and costs	Emphasis on equality and human rights of all individuals	Concern with poverty	Concern with poverty
Links between development and human rights and freedoms	Human rights and freedoms have intrinsic value and are development objectives; current research on their instrumental role through links to economic and social progress	No explicit connection; current search for link between political and civil freedoms and economic growth	No explicit connection

Source: Adapted from Fukuda-Parr (2002, 2003).

a This perspective is specifically and especially concerned with distributional equity. Neoliberalism and basic needs are not. For example, a neoliberal approach might focus on raising people above a poverty level, but it will still tolerate enormous levels of disparity.

1995 to 2006, argued that it is possible to describe the UN's general human development agenda using five core elements. Fukuda-Parr called these five elements the "New York Consensus"* because they are reflected in many of the UN agreements. It is interesting to note the similarities between Sen's ideas on human development and the ideas presented in the New York Consensus. The five elements of the UN's general human development agenda (or the New York Consensus) are as follows:

- Priority to "social development" with the goals of expansion of education and health opportunities;
- Economic growth that generates resources for human development in its many dimensions;
- Political and social reforms for democratic governance that secure human rights so that people can live in freedom and dignity, expanding [. . . collective] agency, participation and autonomy;
- Equity in above three elements with a concern with all individuals. Special attention to the downtrodden and the poor whose interests are often neglected in public policy;
- Policy and institutional reforms at the global level that create a more conducive economic environment for poor countries to have access to global markets, technology, information.

(Fukuda-Parr 2002, p. 10)

The preceding list presents a robust agenda (or paradigm) for *human* development, but human development is only a part – although an extremely vital part – of the broader notion of sustainable development. If we take a holistic look at all the UN agreements, it is possible to identify several elements that, if added to the New York Consensus, would transform it into a consensus of sustainable development. It is possible to describe the international community's notion of sustainable development as consisting of five critical components: (1) peace and security, (2) economic development, (3) social development, (4) national governance that ensures peace and development, and (5) environmental protection (Dernbach 1998, 2004). A comparison of these five components with the five elements listed previously reveals that national governance that ensures peace and security, environmental protection, and employment (an important objective of economic and social development) are not explicitly mentioned in Fukuda-Parr's New York Consensus. Hence, if we are to integrate human development with the broader notion of sustainable development, the following elements need to be added:

- The creation of secure, satisfying, and safe employment with adequate purchasing power;
- Environmental protection at local, regional, national, and global levels constitutes an integral part of the social and economic development process and is not to be considered in isolation from it;
- Extending equity considerations to future generations; and
- National governance that ensures peace and security.

The first additional element, employment, is key to this book's conception of sustainable development and is discussed in Section 1.1.3 and throughout Chapter 5. The remaining

* The New York Consensus stands in stark contrast to the Washington Consensus, which promotes market-liberalizing policies and a reduction in big government (ul Haque 2004). "Washington Consensus policies are sometimes referred to as 'neo-liberal,' based on 'market fundamentalism,' a resuscitation of the laissez-faire policies that were popular in some circles in the nineteenth century" (Stiglitz 2002, p. 74).

three additional elements might be called the “Rio elements” because they stem from the 1992 Rio Declaration on Environment and Development. The most significant challenge posed by these new elements lies not in the need to protect the environment or to provide peace and security (although achieving these objectives has proved far from easy), but in the idea of intergenerational equity. Put simply, we are unable to allocate resources equitably in the present, let alone across generations. Hence, we do not have a *near future* that is properly allocated.

The ability of governments to develop equitable social arrangements that also transition societies toward more sustainable forms of development will depend on how they, and society, view the purpose of development – either to establish a fair and just society (Rawlsianism) or to maximize the well-being of society in the neoclassical sense (utilitarianism). Regardless of the approach, there is consensus that change is needed, as inequality is rising and the perception of well-being is decreasing (Friedman and Hertz 2015).

1.2.3 *Rising inequality*

Though economic inequality is a hallmark of human civilization, the size of the gap between the haves and have-nots and what it is they “have” has varied throughout recorded history. How the gap is measured reflects underlying societal ethics, and in recent years has become increasingly sophisticated. The most common measure, the Gini coefficient, is a “relative” measure of inequality – capturing the relative proportion of an individual’s slice of cake, regardless of the size of the cake. In contrast, “absolute” measures consider that adding a fixed amount to each individual’s slice of cake would not affect inequality, whereas “centrist” measures attempt to account for the effect of both equi-proportional income increase and fixed or equal increases (Atkinson 2015; Subramanian 2014; Kolm 1975). Along with how we measure, there is also the question of what we measure: inequality of income, of wealth, of consumption, or of opportunity? Finally, with the advent of globalization* came the idea of measuring not only within country inequality (intranational) and between country inequality (international), but also global interpersonal inequality (Milanovic 2005; Atkinson and Brandolini 2010).

After WWII, inequality in the U.S. and EU shrank, but since the early 1980s† it has been increasing in both economic venues regardless of which inequality measure is used. Thomas Piketty’s (2014) *Capital in the 21st Century*, which builds on the work of Atkinson and others, has sparked a growing interest in such inequality trends, the data behind them, and the ethical and societal questions they raise.

While many social and physical goods can be distributed unequally, it is the distribution of capital ownership, capital income, and labor income both within and between countries that has ignited global concern. This concern has fueled grassroots movements and political shifts – including the Occupy Movement and the rise of Bernie Sanders in the U.S. and Diem25 in Europe – and put Piketty’s 700-page economics text on the *New York Times* bestseller list. It is not without reason that Piketty claims “Trump’s victory is primarily due to the explosion in economic and geographic inequality in the US over several decades and the inability of successive governments to deal with this” (Piketty 2016).

* In 1999, the UNDP called for policies to specifically address rising inequality caused by economic globalization.

† While inequality is also on the rise in other developed and developing countries across the world, and the U.S. is not considered to have the highest levels of inequality as captured by the Gini Coefficient (South Africa does), the dramatic increase of inequality in the U.S. and the EU has been driving the debate.

Piketty's data – a century of income data and two centuries of wealth data created in collaboration with Atkinson and Saez – does not support the neoclassical assumption that inequality naturally decreases as nations develop. Instead, it reveals that capitalism concentrates wealth at the top, because over time the rate of return on capital is greater than the rate of economic growth.* Furthermore, he shows that labor income or wage inequality is likely higher (in 2014) than at any time in the past, anywhere in the world. Finally, the complex relationship between the inequalities of capital ownership and income and labor income leads Piketty to conclude that income inequality is determined by a society's institutions and policies. While these factors surely play a dominant role, the role of innovation and digital technology in displacing jobs and creating a winner-takes-all economy must also be considered (Brynjolfsson and McAfee 2014).

We believe it is also optimistic that, as Milanovic (2002) argues, between country inequality has been steadily decreasing as a direct consequence of globalization, driving a steady decline in global (interpersonal) inequality. More recent analysis suggests that the global inequality decline only holds true using relative measures, but that with both absolute and centrist measures, global inequality has increased steadily (Niño-Zarazua et al. 2016).

The growing inequality trends are now raising serious questions about our economic systems and their underlying ethical frameworks. They are also raising concerns about social instability. For example, the 2014 report of the World Economic Forum's Global Risks ranked global income disparity as the risk most likely to manifest itself over the next ten years (World Economic Forum 2014a).

Outside of the growing academic literature and debate around inequality, the communication of information has also brought information on the lifestyles of others to every corner of the globe, increasing the awareness of the vast differences in wealth that exist. Inequality looks set to be a defining characteristic and challenge of the coming decade and beyond.

Intranational and international inequality represent both a social and moral problem, especially for those people and nations who do not have access to, and are deprived of, essential goods and services. Trade, as presently constructed, exacerbates inequality, as well as local and global environmental damage. So does the present financial system, which rewards wealth and income disproportionately and has created a quasi-permanent underclass of people and nations. Furthermore, inequality exacerbates environmental damage, and vice versa (Laurent 2013).

While there is much debate over the possible causes of rising inequality, there is a growing consensus that inequality is not the inevitable by-product of growth, but instead inhibits growth (Stiglitz 2016). Rising inequality has been associated with trends in developed countries for capital return to exceed economic growth (Piketty 2014), the poor design of legal and social structures (Stiglitz 2016), and unemployment since the Great Recession (Eurofound 2017) (see Section 3.5.2 in Chapter 3). To address such trends will require the restructuring of laws, regulations, and institutions in order to decrease inequality (see the discussion in Chapter 13). Emmanuel Saez (2016), Director of the Center for Equitable Growth at the University of California at Berkeley, has argued that the two countries with the greatest income inequality are the U.S. and the UK, and, in his view, this occurred as a result of their involvement in the financialization of the economy that led to the economic meltdown in 2008 (see Section 3.3.1 in Chapter 3). His recommendation is that these countries need to respond to the deficiencies in policies of corporate taxation and financial regulation, which began to be dismantled in the 1970s. In particular, capital and

* See Chapter 5 for a discussion on inequality and growth, including the view that reducing inequality could drive economic growth (Stiglitz 2016).

labor income and wealth need to be taxed appropriately (see the related discussion in Chapter 13).

David Autor, who has written extensively on U.S. wage inequality and the negative effect of the rise of China on the American worker, believes that inequalities in education drive current U.S. inequality, and that “the best policies we have involve investing in our citizenry [. . . and include] investments [in] preschool, good primary and secondary schools, [and] adequate nutrition and health care” (Autor 2014a, 2014b). These recommendations tie inequality directly to opportunity and Sen’s notion of capabilities. Given that ever-expanding consumption is not ecologically sustainable and is not directly correlated with well-being (see Section 1.1.2), and employment is correlated with well-being (see Section 1.1.3), a focus on increasing equality of opportunity rather than equality of income, wealth, or consumption may best address the decreased sense of well-being resulting from rising inequality, without putting at risk the well-being of future generations.

1.3 Living beyond our ecological means: the technology debate

Ethical decision-making relies not just on measurement of human progress and ethical frameworks but also on the question of the flexibility of ecological limits with respect to human activity and economic growth. This debate has continued since Thomas Malthus’s 1798 predictions of agricultural land constraining human population, through Ehrlich’s (1968) treatment of population growth, Meadows et al.’s 1972 book *Limits to Growth*, and Diamond’s 2004 book *Collapse*, and remains an increasingly urgent question today. Unfortunately, global ecological collapse is not an unimaginable scenario. The consequences of increased ecological damage as a result of economic growth has led to four optimistic scenarios:

- That ecological impacts of growth (from population growth *or* increases in per capita consumption) can be countered through the substitution of available existing technologies (see Solow’s notion of substitutability in Section 1.3.1);
- That increasing levels of wealth will be accompanied by environmental improvement as the perceived value of the environment increases with rising affluence (see the environmental Kuznets curve hypothesis in Section 1.3.2);
- That new technology can and will emerge to address even the most difficult environmental problems (see the discussion of technological optimism in Section 1.3.3); and
- That both social and technological responses will arise in time to prevent irreversible ecological damage (see the discussion of tipping points in Section 1.3.4).

The remaining alternative is that we pass an environmental tipping point beyond which no solution can be found to be adequate because of its late realization and response and that this results in ecosystem (and human population) collapse. Therefore, each of these scenarios is essential to evaluate and informs the scope and rate of change needed to avoid undesirable outcomes.

1.3.1 Growth, technology, and substitution versus a steady-state economy

The dominant neoclassical economic paradigm assumes the existence of utility functions, which constitute the foundation of production and consumption functions. These functions act as simplified abstractions of economic decisions. In the consumption production framework, every material product in the system is produced by other products made within the system, plus exogenous capital and labor (R. Ayres and Warr 2009). A particularly interesting observation made by R. Ayres and Warr (2009), but also by Georgescu-Roegen (1971; 1993), is that this model of the economy displays a characteristic neglect of

energy and material flows. In addition, there is an obvious need to relate changes in the economy and technology to environmental impacts.

One of the earliest, most intuitive approaches to understanding environmental problems came from the “I = PAT” formula (Ehrlich and Holdren 1971):

$$\text{Impact (environmental)} = \text{Population} \times \text{Affluence (GDP per capita)} \times \text{Technology (environmental impact per dollar of GDP)}$$

Since its publication, a number of revisions have been suggested. For example, Holdren et al. (1995) adjusted the formula to disaggregate affluence from resource use and to separate measures of the “stress” that technology imposes on the environment from measures of actual damage, which depend on stress and “susceptibility.” The measurement of susceptibility is predominantly a function of cumulative damage from previous environmental stress. Thus, the revised formula is:

$$\begin{aligned} \text{Damage (environmental)} = & \text{Population} \times \text{Economic activity per person (affluence)} \\ & \times \text{Resource use per economic activity (resources)} \times \text{Stress on the environmental per} \\ & \text{resource use (technology)} \times \text{Damage per stress (susceptibility)}. \end{aligned}$$

It is important to acknowledge that formulas such as these are a simple representation of a highly complex system. They are informative and can help stimulate discussions about the causes of environmental degradation, but to argue whether they are “right” is unwise (Holdren et al. 1995). What they indicate is that the magnitudes of all the factors need to be considered, because these factors have multiplicative effects on environmental damage. However, we should also recognize the limitations of these formulas. They do not take into account the interdependencies or nonlinearity that might exist between the factors, there is no explicit consideration of societal factors and how they can influence each variable, and they do not consider how each of the variables can change over time, which is especially critical for technological change (ibid.).

Given the political difficulty inherent in developing measures to curtail population growth or limit/reduce affluence and the associated levels of consumption, it seems that the easiest way to achieve a less environmentally destructive society is to focus on technological innovation. Indeed, the “technological fix” has become a major or integral aspect of many theories put forward on how society can live within its ecological means.

Two interesting (somewhat academic) developments in economics that treat technology differently are the ideas of *substitutability* (Solow 1993) and the *steady-state economy* (Czech and Daly 2004; Daly 1991, 1996, 2008),* which is part of the much broader view of ecological/green/natural/sustainability economics (R. U. Ayres 2008; Costanza 1991; Lawson 2006; Ruth 2006; Söderbaum 2008).†

* See the Center for the Advancement of the Steady State Economy, www.steadystate.org/sitemap/ (accessed October 16, 2017).

† In general, the emerging field of *ecological* (or *sustainability*) *economics*, which combines both the economy and technology with ecology, provides a holistic perspective of sustainable development (R. U. Ayres 2008; Costanza 1991; Söderbaum 2008). It studies the relationships between ecosystems and economic systems, encompassing both biological and cultural change. The human economy is seen as part of a larger whole. Its domain is the entire web of interactions between economic and ecological sectors. Ecological economics defines sustainability in terms of natural capital – the ability of natural systems to provide goods and services, including clean air and water and climatic stability. Ecological economists propose that the vital role of natural capital (e.g., mineral deposits, aquifers, and stratospheric ozone) should be made explicit in commodity production (Daly 1994b). Thus, consumption should not deplete natural capital at a faster rate than it can be replaced by human capital. Daly’s notion of the steady-state economy views natural ecosystems as being finite and, therefore, focuses on the scale of human activity (i.e., the economy) that can

Solow's (1993) approach to sustainability is rooted in the idea that technology can create high degrees of substitutability between one resource and another and, implicitly, that natural and human-made capital are in some sense "fungible." This is what R. U. Ayres (2007) describes as the "weak" sustainability position, which essentially argues that all kinds of natural capital can be substituted by human-made capital.* If resources are fungible, society has no obligation to save a resource for future generations as long as an alternative resource is made available. Solow (1993, p. 182) argues that "what we are obligated to leave behind is a generalized capacity to create well-being, not any particular thing or any particular resource." It follows that resources should be assessed as if they were savings and investments (that is, we have a choice between current consumption and providing for the future through the investment of nonrenewable resource rents).†

In contrast, Daly (1991) holds what R. U. Ayres (2007) calls a "strong" sustainability position, which entails that many of the most fundamental services provided by nature cannot be replaced by services produced by humans or human-made capital. Daly (1991) provides what is probably the best-developed vision of an economy that functions within ecological limits. Arguing from the first principle of thermodynamics, Daly describes a steady-state economy (SSE) as one in which births replace deaths and production replaces depreciation. **The objective of the SSE is to keep the throughput of raw materials (low entropy) and waste (high entropy) at levels within the regenerative and assimilative capacity of the ecosystem.** Whereas neoclassical economics views the growth economy as a continual expansion of production and consumption (Figure 1.4), the SSE considers these cycles to be in equilibrium with the ecosystem (Figure 1.5).‡

be supported. Living (and producing) within ecological limits is the major focus of ecological economics. *Green economics* (Lawson 2006) and *natural economics* (Ruth 2006) build on ecological economics but focus more explicitly on informing/shaping political views and policy for sustainable economic development.

* Neoclassical economics views *technological innovation* and *reproducible human-made capital* as providing "substitutes" for natural capital (Hartwick 1977, 1978a, 1978b; Solow 1974). Under these assumptions of *weak sustainability*, consumption can be sustained, environmental externalities can be overcome, and resource scarcity problems can be solved. Neoclassical economists argue that as prices increase because of scarcity, investment in technological innovation creates substitutes to replace the scarce resources. The idea that technological innovation will free society from concerns of resource scarcity, enabling economies to become less reliant on natural resources, has been rejected by some. R. U. Ayres (1978) presented a convincing case that the laws of thermodynamics place limits on the ability of human-made resources to replace or substitute natural capital. The basic argument is that human-made capital is built and maintained using natural capital. Thus, both forms of capital are complementary and cannot be substituted for one another. It follows that the maintenance of natural capital stock is *essential* for the economic process. A reduction in the availability of natural capital will reduce the productivity of human-made capital, which depends on ecosystem goods and services. The same argument is also made by Georgescu-Roegen (1993). Similarly, R. U. Ayres (1997) argues that the neoclassical view of externalities as exceptional occurrences in a larger economic context is incorrect. He considers environmental externalities pervasive because the real economy depends on extracting, processing, and converting materials (and energy), which create waste residuals that can have negative environmental and economic consequences. Because these consequences are not priced in the real economy, the environment is treated as a free good and medium for disposal.

† Solow (1993) describes resource rents as the investment of the pure return on a nonrenewable resource. For example, in using up a natural resource such as oil in the North Sea oil field, the revenues that are intrinsic to the oil itself should be invested in new technologies that will eventually replace oil. Hence, investing the "rent" from the nonrenewable resource is seen as an effective way to continue the current levels of consumption while providing for future generations.

‡ See Rees (1995a) for a useful review of the expansionist (neoclassical economic) and steady-state (ecological economic) views of development.

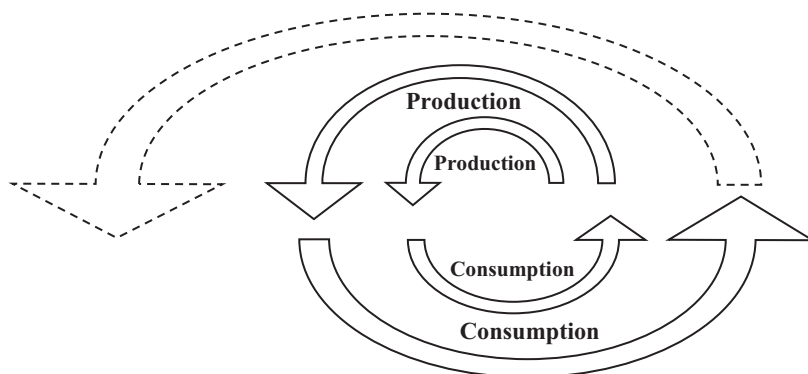


Figure 1.4 Neoclassical economics view of growing cycles of production and consumption

Source: Adapted from Daly (1991, p. 181).

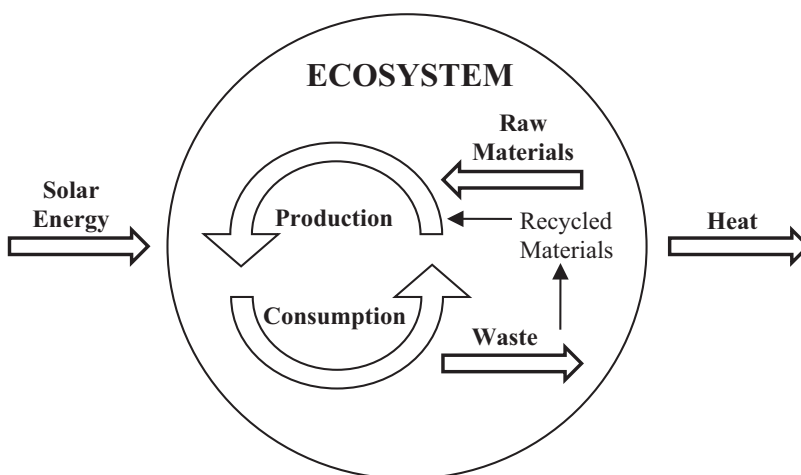


Figure 1.5 Steady-state economics view of production and consumption cycles in equilibrium with the ecosystem

Source: Adapted from Daly (1991, p. 181).

Within the SSE, technology, knowledge, the distribution of income, and the allocation of resources are fluid.* Because a fixed amount of resources will yield constant flows of goods and services (all else being equal), technological progress is one way in which more (or more highly valued) goods and services can be produced (Czech 2003; Czech and Daly 2004). However, given the laws of thermodynamics, there are limits to what is technologically feasible. Thus, there is a theoretical maximum size (an ecological carrying capacity) at which a steady-state economy may exist. This constraint implies that

* In general, ecological economists, especially those who focus on steady-state economics, are concerned with the size of the economy relative to the ecosystem. The efficient allocation of resources is a concern, but it is not the primary focus, as in neoclassical economics.

high-quality, long-lasting, and repairable goods are preferable to low-quality, short-lived, and disposable goods.*

To help describe the SSE, Daly (1991) compares it to a steady-state library, where the addition of a new book would mean the removal of an old book. Thus, although the quantitative physical scale remains constant, the library would continue to improve in a qualitative sense. In this regard, Daly's view of the necessary technological fixes for environmental degradation is more conservative than Solow's. Rather than continuing business as usual and investing in future alternatives, Daly's focus is to develop new science/technology that reduces the environmental burden to rates within ecosystem limits and also extends human lives. Daly's and Solow's viewpoints are quite different and represent contrasting views of the role that technology plays in development.

R. U. Ayres (2007) offers a critique of proponents of both strong and weak sustainability. In his view, although the mathematics of Solow's argument are "impeccable," the underlying assumptions, or what Ayres calls "the physics," are not. R. U. Ayres (2007, p. 116) believes that proponents of strong sustainability are right to point out the relevance of entropy law, the second law of thermodynamics, and the impossibility of perpetual-motion machines; however, they are wrong to assert that human civilization is totally dependent on a finite stock of high-quality (low entropy) resources stored in the earth's crust. As R. U. Ayres (*ibid.*) points out,

the fact that much of our industrial base currently utilizes fossil fuels and high quality metal ores is merely due to the ready availability of these resources at low cost. It does not follow from the entropy law that there are not substitutes.

Nonetheless, R. U. Ayres (2007, p. 126) concludes,

I have to reiterate that, while there is plenty of room for substitution and some possibility of major breakthroughs (e.g., in manufacturing room temperature superconductors or carbon nanotubes) the pessimists – those who espouse the notion of "strong sustainability" appear to be closer to the truth than the optimists who believe in more or less unlimited substitution possibilities.

In general, in this time of growing ecological and economic crisis, it becomes increasingly apparent that questions of ecology cannot be separated from questions of economics, and that building a truly sustainable future will necessarily involve new theories, new paradigms, and new policies. Ecological and steady-state economics provide the first step in thinking about the economy and the environment in different terms.

The financial crisis that began in 2008 is connected to the issue of ecological limits to growth. In tandem with the significant economic and financial disturbances, the ecological situation is particularly problematic and is a direct consequence of the workings of our industrial systems. Kallis et al. (2009) put forward an alternative framework for studying the financial crisis of 2008. According to their analysis, the economy must be analyzed at three levels (from top to bottom):

- The financial level;
- The real economy; and
- The "real-real" economy.

* Although one could argue that an effective recycling process reduces the need to extend the lifespan of goods, this argument is weakened by the fact that (1) recycling processes use energy that reduce the available stock of terrestrial resources (assuming that the recycling process is not powered by solar energy), and (2) most recycling involves the degradation of material, which means that it is suitable only for poorer-quality goods. The latter point is often referred to as "downcycling."

Kallis et al. (2009, p. 16) note:

At the top there is the financial level that can grow by loans made to the private sector or to the state, sometimes without any assurance of repayment as in the present crisis. The financial system borrows against the future, on the expectation that indefinite economic growth will give the means to repay the interests and the debts. Then there is what the economists describe as the real economy, the GDP at constant prices. When it grows, it indeed allows for paying back [. . .] some or all the debt, when it does not grow enough, debts are defaulted. Increasing the debts forces the economy to grow, up to some limits. Then, down below underneath the economists' real economy, there is what the ecological economists call the "real-real" economy, the flows of energy and materials whose growth depends partly on economic factors (types of markets, prices) and in part from physical and biological limits. The "real-real" economy also includes land and capacity of humans to do work.

The ecological approach to the present crisis states that the level of finance grew too large and too fast for the real economy to adapt. The financial system also increased debts too much, in the absence of coherent regulation, and this expansion of credit lines was mistaken for real wealth (Kallis et al. 2009). At the same time, the economy is not a closed system but operates within certain ecological limits and biophysical constraints, which condition the rate at which real wealth can increase. This analysis resembles that of Polanyi (1944), who placed markets within social systems rather than regarding them as independent "value-neutral" entities.

In general, energy resources appear to be of increasingly pivotal importance around the world. As Klare (2001, p. 13) notes, ever since the end of the Cold War, political analysts of different persuasions have attempted to identify the "defining principle of the new international environment." Although there have been many competing theories about this new defining paradigm, such as Samuel Huntington's "clash of civilizations," Robert Kaplan's return to Malthusian dynamics, and Tom Friedman's "flat world," Klare is correct to note that "the fervent pursuit of resource plenty in total disregard of any civilizational loyalties" appears to have much more significant explanatory power with regard to contemporary international dynamics (ibid.).

1.3.2 The environment and affluence: the environmental Kuznets curve

A somewhat academic idea – but one that seems to persist in many development/policy dialogues* – that focuses on the relationship between economic growth and environmental impact is the environmental Kuznets curve (EKC). The EKC hypothesis postulates

* For example, the WTO promotes an environmental Kuznets curve approach to development in its discussion of how trade liberalization and stable and predictable trade conditions support the environment. "An important element of the WTO's contribution to sustainable development and protection of the environment comes in the form of furthering trade opening in goods and services to promote economic development, and by providing stable and predictable conditions that enhance the possibility of innovation. This promotes the efficient allocation of resources, economic growth and increased income levels that in turn provide additional possibilities for protecting the environment." WTO, "An Introduction to Trade and Environment in the WTO," www.wto.org/english/tratop_e/envir_e/envt_intro_e.htm (accessed October 17, 2017). The WTO's statement implies that negative environmental impacts that result from economic growth can be addressed once income levels increase, which is clearly the opposite of a precautionary approach to development.

that the relationship between a specific environmental pollutant (such as sulfur dioxide) and per capita income follows an inverted-U shape (Figure 1.6). This relationship implies that as a nation's GDP per capita increases, environmental degradation will first increase up to a turning point that varies by pollutant (Barbier 1997a; Yandle, Bhattacharai, et al. 2004), after which it will begin to fall. See Box 1.1 for a summary of key points related to the EKC.

The EKC hypothesis effectively challenged the idea that the process of industrialization and economic development “inevitably hurts the environment” (IBRD 1992, p. 38). For example, Beckerman (1992, p. 482) claimed that

there is clear evidence that, although economic growth usually leads to environmental deterioration in the early stages of the process, in the end the best – and probably the only – way to attain a decent environment in most countries is to become rich.

Bartlett (1994, p. 18) even suggested “existing environmental regulation, by reducing economic growth, may actually be reducing environmental quality.” The clear focus of these “income deterministic” arguments was that economic growth is the best way to alleviate poverty and (eventually) address environmental degradation.

In a critique of the environmental Kuznets curve that is traditionally focused on a few specific pollutants as measures of total environmental pressure, Spangenberg (2001) finds no indication that an environmental Kuznets curve can be found for the total resource throughput in several advanced countries. The vast majority of man-made emissions of suspended particulate matter, SO_2 , and CO_2 all originate from the use of fossil fuels for which environmental laws eventually limit emissions through end-of-pipe abatement technologies. The modernization of pollution sources more generally requires substitution and more fundamental technological change than end-of-pipe traditional pollution control.

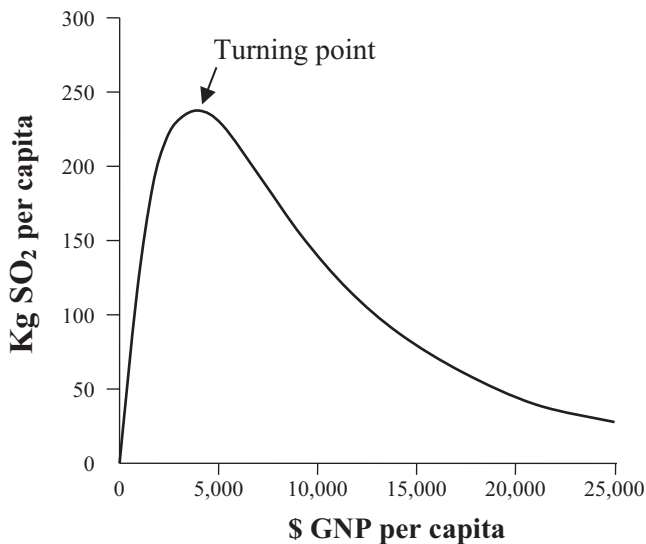


Figure 1.6 Environmental Kuznets curve for sulfur dioxide emissions

Source: Adapted from Panayotou (1997), from Stern et al. (1996, p. 1152).

Box 1.1 Key points relating to the environmental Kuznets curve (EKC)

The EKC hypothesis

The EKC hypothesis states that the relationship between a specific environmental pollutant – such as sulfur dioxide (SO₂) – and per capita income follows an inverted-U shape. This relationship implies that environmental degradation will first increase with rising income per capita up to a turning point, after which it will start to fall with higher levels of income. If one accepts the EKC hypothesis, the solution to global environmental degradation would appear to be rapid economic growth.

Points of concern

- The EKC does not seem to hold for CO₂ or for toxics associated with increasing industrialization and especially increasing consumption.
- The EKC may not even hold for regular pollutants like SO₂.
- The adoption of pollution-prevention and cleaner technology reflecting sustainable practices may explain Kuznets-type behavior, but such behavior depends on the constant application of these sustainable practices that are promoted by regulation, not laissez-faire policies.
- Late developers and those that decide to adopt cleaner technology late may seem to provide evidence for Kuznets-type behavior, but this action highlights a cultural shift in the importance of protecting a community's livelihood and not an income effect.
- The adoption of more efficient technology that initially reduces environmental degradation, resource usage, and overall costs might eventually lead to higher levels of environmental impact through the Jevons paradox or rebound effect – that is, the lower cost of using a more efficient technology increases its demand and (potentially) offsets the original efficiency gains.
- Even if per capita production of pollution declines, population increases could swamp any environmental gains.

Otherwise, increased wealth associated with economic growth increases the production of other kinds of pollution that can only be offset by technology modernization and improvements in resource productivity that lead to an absolute reduction in resource consumption. Commenting that “wealth is not green,” Spangenberg (2001) argues that the emphasis of ecological economics must be that resource productivity needs to improve well beyond the economic growth rate for there to be a future positive effect of growth on pollution reduction.

The validity and implications of the EKC hypothesis have been the subject of much critical debate (K. Arrow et al. 1995; Barbier 1997a; Cavlovic et al. 2000; de Bruyn et al. 1998; Dinda 2004; D. I. Stern 1998, 2003, 2004; D. I. Stern et al. 1996; Unruh and Moomaw 1998). Although the empirical support for the EKC relationship and its very existence have been disputed (Harbaugh et al. 2002; P. Lawn 2006; Perman and Stern 2003), a more general criticism is that EKCs have been shown to exist only for local air pollutants and not for long-lived measures such as carbon dioxide (CO₂),

municipal waste, and persistent toxic chemicals (M. A. Cole et al. 1997; S. Dasgupta et al. 2002; Hettige et al. 1992; Holtz-Eakin and Selden 1995; Rothman 1998). These mainly consumption-based measures are shown to increase monotonically with per capita income.

Other criticisms are that the EKC hypothesis is not directly concerned with the total impact of economic growth on the environment and whether this may (in some cases) be irreversible; that the earth's stock of resources may not be able to support indefinite economic growth (K. Arrow et al. 1995; Rothman 1998); and that the focus on economic growth ignores the more important issue of human well-being (Daly and Cobb 1994; Max-Neef 1995).

Even if one accepts that an EKC relationship may exist for specific pollutants such as local air pollutants, the vast majority of the world's population lies on the upward slope of EKC curves, which means that considerable environmental damage is likely to occur before any environmental improvement becomes visible (Ekins 1997). Similarly, any environmental improvements gained through production efficiencies can be overwhelmed by growing levels of consumption in both developed and developing economies. The deterministic nature of the EKC hypothesis raises the question whether developing nations can learn from developed nations and adopt initiatives to "tunnel through" or "flatten" the inverted-U relationship (S. Dasgupta et al. 2002; Munasinghe 1999; Panayotou 1997). These initiatives include the establishment and enforcement of sophisticated and anticipative environmental regulation and the adoption of cleaner technologies that allow developing nations to leapfrog over older, dirty technologies.* In general, the idea that developing nations could "escape the pattern of the EKC" is becoming more widely supported and finds some support in the literature (M. A. Cole and Neumayer 2005, p. 316). However, for greenhouse gas emissions, the evidence is clearly the other way (Ansuategi and Escapa 2002; Huang et al. 2008).

In conclusion, one can argue that (1) technological change is critical to enabling society to live within ecological limits, and (2) governments have a vital role in creating an innovative regulatory environment that protects critical ecological systems and spurs the necessary technological change.

1.3.3 *Technological optimism*

During the emergence of sustainable development, the environmental discourse was strongest between the technological optimists† on one side and the self-proclaimed Malthusians on the other, who could foresee no technological solution to the pending problems of pollution and scarcity (Krier and Gillette 1985). Although the technological optimists were concerned about the environment, they believed that human scientific and technological ingenuity would be able to extend any limits faced by society.

As discussed in Chapter 3, the growth of new (and successful) technology tends to follow an S-curve. Therefore, if we consider the entire field of technological advance, it

* Interestingly, the decision of developing nations to adopt cleaner technologies may not be due to an income effect but rather to a cultural shift in the importance of protecting a community's livelihood.

† Krier and Gillette (1985, p. 406) describe technological optimism as "a term of art, an article of faith, and a theory of politics." They argue that technological optimism obtained its precise meaning as a result of the limits-to-growth model, which assumed that factors such as population, industrial production, and pollution would continue to grow exponentially. Thus, it follows that the position of a technological optimist is "that *exponential technological* growth will allow us to expand resources ahead of exponentially increasing demands. This is the precise meaning of technological optimism as a term of art" (ibid., p. 407). There is also the implicit assumption that technological innovation will not cause any further pollution or social problems.

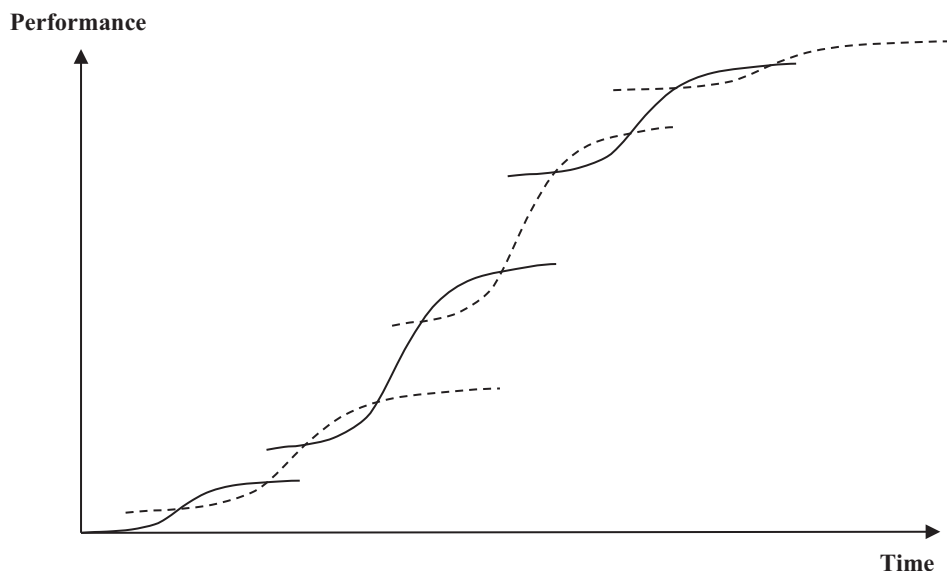


Figure 1.7 The accumulation of S-Curves for a technology set

follows that it will be composed of a series of such curves. The question is, however, what shape will this series of S-curves follow? Technological optimists responded to this question by arguing that technological innovation will continue to advance at a significantly higher exponential rate, thereby establishing a world of utopia as opposed to disaster (Boyd 1972; Kaysen 1972; Starr and Rudman 1973). Others, however, were not as convinced (K. J. Arrow 1969). Indeed, as Krier and Gillette (1985) argue, if the S-curve holds for a single technology, why should it not be true for a set of technologies (Figure 1.7)? And if it holds for a set, should it not also be true for the entire field of technology? Thus, if we are experiencing rapid growth in technological performance, it might simply be due to the fact that we are in the center of a series of S-curves that together also form an S-curve (Figure 1.7).

The problem with this type of debate, as recognized by Krier and Gillette (1985), is that the assertions made are most likely not provable. Although it is possible to assess individual technologies, it is extremely difficult to assess (in any rigorous manner) whether technology as a whole is progressing at a faster or slower rate than before and whether this means that we are reaching a plateau in performance (however “performance” is defined).

With the publication of *Our Common Future* (WCED 1987), it was clear to many that technological optimism had prevailed (Moser 1999). The WCED had chosen science and technological innovation – two mainstays of economic growth in industrial (expansionist) societies – as central pillars of the notion of sustainable development.* As Dryzek

* A retrospective analysis of *Our Common Future* concluded that the economic and environmental objectives put forward by the Brundtland Commission “cannot be achieved simultaneously” (Duchin and Lange 1994, p. 8). To address this problem, Duchin and Lange (1994) put forward two paths of action. First, much broader technological and social changes are needed than those espoused in *Our Common Future* if sustainable development is to be brought within reach. Second, “development economics” (which includes factors such as international lending and advisory practices) need to focus on specific

(1997, p. 136) notes, the concept of sustainable development would surely have been lost “unless it could be demonstrated that environmental conservation were obviously good for business profitability and economic growth everywhere, not just that these competing values can be reconciled.”

As a result of the decision to focus more heavily on science and technology – as opposed to market reforms and/or government policy to guide development – there has been a strong (European and Japanese) research interest in what has been termed “factor X” (Reijnders 1998). The idea of factor X is similar to that of dematerialization, eco-efficiency, and enhanced natural resource productivity, but whereas these measures of environmental impact tend to be more open-ended, the factor X debate attempts to put an exact number on the level of efficiency to be achieved (*ibid.*, p. 14). This willingness to quantify implies that (1) the environmental problem is in fact quantifiable, and (2) that technological improvements are required beyond what current technology is able to achieve.* The current set of factor X values ranges from 4 to 50 (Factor 10 Club 1995, 1997; Jansen and Vergragt 1992; Reijnders 1996; von Weizsäcker et al. 2010; von Weizsäcker et al. 1997); however, there is no overall agreement on the environmental impact to which factor X relates (Reijnders 1998). This fact, combined with differences in the perceived severity of the environmental threat, explains the wide range of factor X values.

It is helpful to connect the factor X debate to the $I = PAT$ formula because they are closely interlinked. The factor X approach is clearly a technologically optimistic view of development. But technology is only one factor that affects the environment. It is quite plausible that the environmental benefits achieved by technological innovation will be countered by growth in population and/or affluence leading to greater total consumption of materials and energy (Herman et al. 1989; Reijnders 1998; W. Sachs 1993).† In addition, there is also the problem that although technological improvements increase the efficiency with which resources are used, the total consumption of these resources might increase rather than decrease. This phenomenon is known as the *rebound effect* (Berkhout et al. 2000) or the *Jevons paradox* (Clark and Foster 2001; Jevons 1965 [1865]). William Stanley Jevons was a nineteenth-century economist who observed that efficiency gains in the use of coal did not necessarily lead to a reduction in

situations and move away from the conviction that there is only one development path – that of liberalized markets that situate all factors of production in the most privately profitable location for their exploitation. Duchin and Lange (1994) argue that a failure to consider national circumstances is likely to affect traditional social relationships in a way that (indirectly) leads to the rise of “both religious fundamentalism and urban misery in the developing world” (*ibid.*, p. 9).

* It is important to recognize that although the notion of a factor X economy recognizes the inherent unsustainability of prevailing human activities, its proponents’ conceptualization of development remains firmly grounded in the “growth ethic and technological fix paradigm” (Rees 1995a, p. 355). An alternative view of development is based on the idea of a steady-state economy (SSE), whereby economic (human) activity remains within fixed ecological limits.

† Here we should recognize that whereas the connection between population growth and ecological decline is widely understood, the same cannot be said for increasing levels of affluence and consumption and their associated impacts on the environment. Indeed, consumption “is almost universally seen as good, [...] and increasing it is the primary goal of national economic policy” (Durning 1994, p. 41). Although the environmental and psychological problems associated with consumption are well documented (de Graaf et al. 2002; Durning 1992, 1994; Goodwin et al. 1997; Kasser 2002; Princen et al. 2002; J. C. Ryan and Durning 1997; Schlosser 2002; P. C. Stern et al. 1997), they have yet to gain traction in mainstream political and economic decision-making. For an insightful debate on the effects of economic growth and consumption on the environment, see Sagoff’s (1997) article in the *Atlantic Monthly* and its rebuttal by Ehrlich et al. (1997).

its overall use.* More recently, it has been observed that increases in the fuel efficiency of vehicles have been accompanied by an increase in vehicle-miles traveled and by an increase in sales of larger vehicles (Goldberg 1998). Therefore, the implementation of factor X (or highly efficient) technology needs to be part of a more comprehensive process of environmental improvement or *ecological modernization* (Ashford et al. 1985; Kemp 1995; York et al. 2003).

When one is considering factor X targets, it is possible to focus on individual products/technologies or the economy as a whole. Although factor X advocates support the notion of setting informed and modifiable targets, it is recognized that the pace of rapid technological change and the presence of the Jevons paradox complicate the management of such a schema (Reijnders 1998). In this regard, *movement in a more sustainable direction* might provide an alternative. However, the problem here is what instrument will be used to encourage such movement. Examples of types of mechanisms that can be used to encourage the adoption of factor X technology are demonstration projects (for social learning), government-driven technology forcing (using legislation), financial incentives, ecotaxation,[†] and market mechanisms (such as tradable emissions permits) (ibid.). The role of government in stimulating technological change is discussed in Chapter 8.

1.3.4 The reformulation of sustainable development in terms of tipping points

A “tipping point” can be described as the point beyond which it becomes extremely difficult (if not impossible) to reverse a negative trend. An alternative way to think about tipping points is to consider the idea of “overshoot” – that is, to inadvertently go beyond a system’s limits, creating a situation that is nearly impossible to reverse (Meadows et al. 1972, 2004).

The current discourse on sustainable development is becoming dominated by concerns about global climate change (see Box 1.2). Within the climate-change debate, several possible tipping points have emerged. These include the sudden disintegration of the Greenland and Antarctic ice sheets (Alley et al. 2005; Feldmann and Levermann 2015), the collapse of coral reefs due to “coral bleaching” caused by rising sea temperatures (Knowlton 2001; Hughes et al. 2017), and the shutting down of the Atlantic thermohaline circulation that conveys warm surface water to northern Europe and returns cold, deep-ocean water south (Vellinga and Wood 2004; Meyer 2017). Although these potential system collapses are of great concern, there are other environmental tipping points not far

* Jevons (2001 [1865]) observed that the consumption of coal in England increased significantly when the efficiency of the steam engine was improved by James Watt. Watt’s innovations, the condenser and the expansive mode of working, reduced the amount of coal needed to fuel the steam engine’s furnace, making the engine a cost-effective power source that was soon adopted by industry. As the number of industries using steam engines grew, so too did the amount of coal required to fuel these engines, thereby increasing the overall usage of coal.

† See Daly (1994a) and Rees (1995b) for a discussion of how taxing the *bads* (such as resource extraction/depletion or pollution) and not the *goods* (such as labor and income) provides a good example of considering both the environment and employment in one macroeconomic framework. The basic idea is to shift the tax burden away from the goods and onto the bads in a revenue-neutral manner. In addition to promoting a more sustainable form of industrialization, ecotaxation would also reduce the price of labor, making it more attractive to retain existing workers or employ more workers. See also Green Innovations Inc., *Ecotaxation*, www.green-innovations.asn.au/ecotax.htm (accessed October 17, 2017).

on the horizon that deserve equal attention. Examples of these other modes of collapse include the following:

- Limits on the ability of conventional antibiotics and pesticides (through antibiotic and pesticide resistance) to prevent virulent disease and pestilence, leading to a rapid decline in population and food crops;
- Damage to reproductive health (through endocrine disruption) to the extent that all species (including humans) no longer reproduce or reproduce with reproductive anomalies, such as sterility and hermaphroditism (Colborn et al. 1996; Cordier 2008; Sacy 2008);
- The widespread decline of human health due to increasing levels of toxic chemical exposures that cause cancer, autoimmune diseases, neurological harm such as autism, attention-deficit/hyperactivity disorder, and general toxic-induced loss of tolerance (Ashford and Miller 1998; Sasco 2008); and
- Significant growth in the incidence of human disease and deaths in regions experiencing rapid population growth, worsening levels of malnutrition, and environmental degradation (D. H. Meadows et al. 2004; Pimentel et al. 2007).

Box 1.2 Concern with global climate change

In recent years, starting with the Kyoto Protocol in 1997, through negotiations in Copenhagen, and ultimately culminating in the Paris Agreement known as COP21, there has been a dramatic increase in the international visibility and international activities related to the climate problem. The release of Al Gore's documentary, *An Inconvenient Truth*, followed by his award of the 2007 Nobel Peace Prize – together with the International Panel on Climate Change “for their efforts to build up and disseminate greater knowledge about man-made climate change”^a – did much to raise global concern on the issue. Equally important was the publication of the *Stern Review on the Economics of Climate Change* (known as the “Stern Review”) by the UK Treasury on October 30, 2006 (Stern 2007). While the review was not the first economic analysis on climate change (Cline 1992; Mendelsohn et al. 1998; Nordhaus and Boyer 2000), its status as an official government document significantly raised its importance and made it one of the most widely known and debated studies of its kind.

The Stern Review focused on the impact of global climate change on the world economy. More specifically, it argued that if governments fail to take action today,

the overall costs and risks of climate change will be equivalent to losing at least 5% of global GDP each year, now and forever. If a wider range of risks and impacts is taken into account, the estimates of damage could rise to 20% of GDP or more.

(Stern 2007, p. vi)

The study equated the potential future impacts of inaction to social and economic systems as “on a scale similar to those associated with the great wars and the economic depression of the first half of the 20th century” (ibid, p. vi). The study concluded by arguing that these impacts could be significantly reduced if 1 percent of

global GDP is invested each year in mitigation activities. Such activities include the pricing of carbon (via taxes, carbon trading, and/or regulation), mechanisms to support innovation for low-carbon technologies, and actions to remove perverse incentives or barriers to energy efficiency gains.

The enthusiastic response by many politicians and environmental groups to the Stern Review was tempered somewhat by heavy criticism of the study from several well-known economists (Dasgupta 2006; Nordhaus 2006; Tol 2006; Tol and Yohe 2006; Yohe 2006; Mendelsohn 2006–2007; Yohe and Tol 2007). Others, while critical of the study's basic assumptions and analysis, gave more positive commentaries (Arrow 2007; Neumayer 2007; Weitzman 2007). The concerns with the study tended to center around several key issues. First, the review relied upon existing data sources and did not develop any new estimates on the impacts or costs of climate change. Thus, it was surprising to some that the review developed numbers that lay far outside the range of estimates found in previously published literature (Tol and Yohe 2006; Mendelsohn 2006–2007).

Second, a dual critique of the science and economic aspects of the Stern Review concluded that the study “greatly understates the extent of uncertainty, for there are strict limits to what can be said with assurance about the evolution of complex systems that are not well understood” (Carter et al. 2007, p. 168). These authors were also greatly concerned with the treatment of sources and evidence that they perceived as “persistently selective and biased” (ibid., p. 224). Their general opinion of the Stern Review is that it is a “a vehicle for speculative alarmism” (ibid., p. 224).

A final criticism worth mentioning, which is perhaps the most controversial issue, was the Stern Review's selection of a low discount rate. The study selected a rate that was 0.1 percent above the global rate of growth of consumption. Since the rate of consumption is assumed to increase at 1.3 percent per year, the chosen discount rate was 1.4 percent. This value falls below the conventional range used by many economists when considering measures to mitigate climate change (Weitzman 2001). It is also lower than the discount rates used by HM Treasury, which decline from 3.5 percent (for years 0 to 30) to 1 percent (after 300 years) (HM Treasury 2003). The Stern Review argued that selecting a higher discount rate would be unethical since it would reduce the importance given to the welfare of future generations who are likely to bear the brunt of climate change. A higher discount rate would also reduce the pressure for immediate and aggressive action to reduce greenhouse gas emissions. As Mendelsohn (2006–2007, p. 43) comments, “the low discount rate implies far future events are important in the near term.”

Analyses since the publication of the Stern Report only strengthened its message (IPCC 2014). The concern with global climate change has only become stronger over time, now dwarfing other environmental concerns with the risk that other critical environmental concerns might be excluded or marginalized – or even exacerbated – from sustainable development strategies.

a Source: www.nobelprize.org/nobel_prizes/peace/laureates/2007/press.html (accessed October 17, 2017)

Supporting or driving these modes of collapse are the processes of rapid technological change and economic globalization. These are increasing the ease with which diseases can be transmitted between populations. The significant growth in travel and trade between

regions has also exposed previously healthy populations to new health risk factors (Yach and Bettcher 1998a, 1998b; Drager and Sunderland 2016). Indigenous societies that are becoming interconnected with the global economy are now exposed to modern diets, additive products, pharmaceuticals, and toxic products that significantly increase cancer risks (Sasco 2008). In this context, the historic debate between economic development and environmental degradation (questioning the logic of the environmental Kuznets curve – see Section 1.3.2) must be expanded to include the impacts of economic development on human health. This new dimension is different from the impacts of environmental degradation on human health, which could be considered as a negative side effect of industrialization. The concern is that the products and services associated with the current form of industrialization are themselves directly causing harm.

A final mode of possible collapse relates to social systems, such as the global financial system, the ability of the nation–state to provide gainful employment, and the crisis created by migration accelerated by both economic and political factors. Although these tipping points are influenced by external environmental factors, the modes of failure are firmly embedded within social networks. Another example of a “social tipping point” could be increasing social tensions that lead to persistent regional/global conflicts due to increasing shortages of resources such as fresh water or oil (Myers 1993). Some see the Syrian War and resulting migrant crisis as a relevant example of this kind of driver, with its combination of water shortage with war and mass migration.

With this discussion of tipping points and drivers of collapse, it must also be mentioned that these same disruptive forces could drive our complex global system towards transformative systemic change. The Next System Project is, for example, bringing key thinkers together to design, model, and disseminate new sustainable political–economic possibilities for the twenty-first century in an effort to avoid collapse through transformation (Alperovitz et al. 2015).

1.4 Rationalizing the competing pressures on sustainability

This chapter has attempted to outline our concern for a global future. Since the focus of sustainable development is to meet human needs without compromising the ability of future generations to meet their own needs, we began by taking an anthropocentric look at development. We explored the notion of human needs and how they drive economic and democratic political systems, and how employment and income are essential to human well-being (via both the purchasing of basic goods and services, and other beneficial aspects of working). The growing trends of income inequality were then considered within the context of social justice and social contract theory, which help frame the role of government (as trustee of the people and the environment) in advancing a development agenda that ensures basic human needs are met. Since economic activity/growth is currently the underlying mechanism for enabling people to meet their needs, our focus then expanded to consider the impact of this mechanism on the natural environment. More specifically, we considered a series of approaches or theories that have been advanced to keep economic activity within ecosystem limits. For each approach, technology and innovation were considered to have a central role in advancing change.

A key question we raise throughout this work – which underlies our concern for the global future – is what impact will technology- and innovation-driven approaches to sustainable development have on meaningful and well-paid employment in the future? Further, if incomes from labor and/or capital ownership can be increased and people are able to purchase basic goods and services, will the technological/efficiency advances realized be sufficient to outpace a rebound effect – i.e., where the sheer scale of purchasing outpaces any reduction in environmental impacts (Brown 2016). Further, changes in what industrial or industrializing nations choose to produce – or incentivize the production

of – in order to meet human needs requires more thorough consideration, which we take up later in this work.

Poverty and inequality can be reduced by income transfers, by providing a guaranteed basic income, or by creating a larger base of ownership of productive physical capital and/or energy through binary economics or community-based ownership, but an egalitarian, environmentally sustainable society requires something much more. What is needed is a cultural transformation in which basic demands are altered, as the current conception of the good life neither matches what we know of basic human needs and well-being, nor is it feasible for our planet to meet these needs for everyone. This does not mean that meeting human needs and well-being and a sustainable future are mutually exclusive. On the contrary, there is increasing evidence that some drivers of human happiness are frequently experiential and of no environmental impact (Gilovich et al. 2015).

Despite the potential for law and economic instruments to be used to redistribute wealth and income, internalize environmental, employment, and societal externalities, and otherwise create a sustainable future, those who have the power to act often do not see it in their immediate interest to act, even if their longer-term interests would be better served. To overcome this barrier to action, it may be necessary for crises, such as financial collapse, environmental and public health catastrophes, and social disintegration to increase the urgency for action. Alternatively, we must hope for far-sighted and progressive leadership of institutions and organizations – public and private – that have long gained from, and gamed, the present system. The world instead could be on the road to a splintering of winner and loser populations within and among nation-states, although voiced resistance to this trend is rising. We hope this book will help chart new pathways towards sustainable development and be a valued resource for those who are also concerned for a sustainable global future.

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2 The emergence of sustainable development

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This chapter explores the emergence and evolution of sustainable development that ultimately obtained formal international recognition at the 1992 United Nations Conference on Environment and Development (UNCED) in Rio de Janeiro, Brazil. Our historical timeline begins in the 1950s with the start of the modern environmental movement, when developed nations – for example, the United States, Japan, and several nations in what is now the European Union – became increasingly aware that the local or regional environment was being stressed by rapid industrialization. While we focus on the early role of the United States in shaping a global concern for the environment,* we also document important international events, publications, declarations, and multilateral environmental agreements that can be linked to the concept (see Tables 2.1 to 2.3). The chapter ends with our perspective on the need to explicitly recognize employment (and its relevance for the reduction of poverty) as an essential component of sustainable development. As the driving forces of globalization and technological change continue to alter the nature of, and monetary rewards received from, work, advancing a sustainable development strategy that ensure families can earn or receive a livable income (to support a sustainable livelihood) will be increasingly important.

* Other countries in the European Union may now have advanced beyond the United States in certain areas with regard to innovative environmental policy and law designed to promote sustainable development (Vogel 2012).

2.1 Components of sustainable development

Over the past two decades, the sustainability literature has produced an extensive array of definitions, principles, and conceptual frameworks to describe the concept (Hall 2006; Holdren et al. 1995; Rees 1995; Costanza et al. 2014). At the core of most definitions is the need to meet or satisfy human needs without degrading the carrying capacity of the environment. Interestingly, the early formulation of sustainable development in the 1987 Brundtland report emphasized the needs of the poor in developing regions, but modern interpretations have broadened the focus to the needs of persons beyond that. In Chapter 1 (Section 1.1), the argument is made that our perspective of human needs and our view of a fulfilling life is being affected (or put out of balance) by the forces of the market economy (that is, advertising focused on manipulation and deception (Akerlof and Shiller 2016), as well as social competition for conspicuous consumption). As a result, industrialized society is increasingly becoming a throughput society in which the consumption of products and services – to satisfy intrinsic and externally created needs and wants (Kasser 2002; Cohen et al. 2017) – supports the growth of the economy.

In the Overview and Chapter 1, several important challenges are identified that have arisen from past and current economic activity. Taken together, these challenges fueled the emergence of sustainable development. From a social and economic perspective, there is the challenge of providing society with access to essential or basic goods and services – for example, shelter, food, health care, transportation, and security. A related challenge is the need to provide well-paying employment (and/or access to capital ownership/income), so that individuals/families have sufficient purchasing power to buy the essential goods and services. Since wage income has remained relatively flat since the 1970s when compared to the growth experienced in capital income, there has been a steady increase in inequality between the majority who rely mainly on wages and the few who have significant capital ownership or can extract excessive rents for their work (Stiglitz 2015).

From an environmental perspective, there are four different concerns that have emerged over the past fifty years: (1) ecosystem integrity and the loss of biodiversity; (2) resource depletion; (3) toxic pollution; and (4) climate change. The burden of these environmental problems is felt unequally within nations, among nations, and among generations, leading to concerns for intranational, international, and intergenerational equity. These concerns for equity are often expressed under the heading of “environmental justice.”

The disruption of ecosystems and the loss of biological diversity and the indirect effects these have on human health and well-being was initially raised in the early 1960s, when industrial processes and the use of pesticides led to environmental degradation and a loss of wildlife (Carson 1962). Several decades later, public concern began to focus on endocrine disruptors that affect reproductive health in all species (Colborn et al. 1996; Solomon and Schettler 1999). While significant progress has been made in improving industrial and agricultural practices, the negative impacts of these sectors still present a problem in both developed and developing countries.*

The second environmental concern relates to the world’s finite resources and energy supplies and asks whether there are sufficient resources to provide continuing economic growth as we know it, raising the idea of limits to growth (R. U. Ayres 1978; R. Ayres and Warr 2009; Georgescu-Roegen 1971; D. H. Meadows et al. 1972). A corollary concern is what the environmental impact will be from using a significant proportion of the existing resources.

* Poor environmental standards and under-resourced or nonexistent environmental agencies in developing countries mean that environmental problems from industrial processes and the mechanization of agriculture more frequently go unchecked in these regions.

The third concern is toxic pollution that directly adversely affects human health and the health of other species (Ashford and Miller 1998; Ashford and Caldart 2008; Baskin et al. 2001; Chivian et al. 1993; Colborn et al. 1996; Commoner et al. 2000; Fagin and Lavelle 1996; Geiser 2001; McCally 1999; Sasco 2008; Schettler et al. 1999). As scientists began to understand how ecosystems, humans, and other organisms were affected by industrial and agricultural processes, the issue of how toxic chemicals interact with biological systems grew in importance.

The final concern is that greenhouse gases from anthropocentric (human-driven) sources are leading to a disruption of the global climate (IPCC 2014). Scientists predict (with *high confidence*) that relative to 1850–1900, these gases will cause the globally averaged surface air temperature to increase by at least 1.5°C by the end of the twenty-first century (2081–2100) (IPCC 2014). For the scenarios that consider high cumulative concentrations of CO₂ by the end of the twenty-first century, the warming is *likely* to exceed 2.0°C. Such an increase in global average temperature is expected to be accompanied by dramatic changes in weather, droughts, and floods, with disadvantaged people, communities, and nations likely to bear a disproportionate share of the impacts. These dire scenarios have led to the acknowledgment that immediate action must be taken to minimize the significant long-term financial and social impacts of climate change (N. Stern 2007). Further, the 2015 Paris Climate Agreement (COP21) focuses on limiting a rise in global average temperature “to well below 2°C above pre-industrial levels,” with an aspirational target of limiting the increase to 1.5°C (UN 2015a, p. 2). See Chapter 12 for a discussion of global climate disruption and energy challenges.

The first, third, and fourth environmental concerns are connected with the unintended effects of human development/growth, while the second deals with increasing shortages of resources needed to fuel economic growth.

It is noteworthy that the causes of each of the four environmental concerns seem to have been established during the 1960s and 1970s. The 1960s was the decade when the destruction of ecosystems was recognized as a significant problem in the U.S. The emergence of the U.S. environmental movement is discussed in the following section. The other three environmental concerns began to emerge to varying degrees during the 1970s.* In the 1980s, chemical toxicity began to be downplayed as the chemical industry itself started to point the finger at climate change as the most important environmental problem, almost to the exclusion of toxicity and other environmental problems. The 1980s also mark a turning point when nations began to recognize that their environmental problems extended beyond national boundaries and were having impacts on a global scale. This realization spurred the formation of an international environmental agenda (see Section 2.2), and the actions taken in the following two decades as a result of this agenda (see Section 2.3) can be considered the first attempt at global environmental governance (Speth 2003).

It is our opinion that political agendas in different periods are almost always focused on one or two of the four major environmental concerns to the exclusion of the others. Such a nonintegrated planning approach means that nation-states and the

* The Stockholm Conference on the Human Environment in 1972 brought the topics of ecosystem integrity, biological diversity, and human health and the issue of ecological and resource limits to growth to the attention of the international community. Although the conference did raise the potential problem of toxic substances in its Action Plan, this third environmental concern remained the focus of national legislation during the 1970s. The passage of the 1976 Toxic Substances Control Act in the United States is a prime example. Toward the end of the 1970s, the international community began to discuss the related concerns of ozone depletion and greenhouse gas emissions – the fourth environmental concern. However, it was not until the second half of the 1980s and the 1990s that international action was taken to address ozone depletion and global climate change, respectively.

international community have been able to create only partial solutions to growing environmental problems.* This situation is further exacerbated by the fact that each nation is at a different level of development and therefore has different needs, resulting in different political agendas. In addition, even if two nations are alike from a development perspective, their values and beliefs might lead to disagreement over what constitutes an appropriate solution. The importance of developing integrated solutions (in an expanded design space) to advance progress towards sustainable development is a theme throughout this book.

2.2 The U.S. environment and development agenda

The U.S. environmental movement began when the nation's communities became increasingly aware that the industrial and agricultural processes that contributed to the nation's economic growth were simultaneously distressing ecosystem integrity and biological diversity (Table 2.1). In essence, as largescale productive capacities in industry and agriculture increased, so did the rates at which these sectors discharged pollution and waste into the environment. Once the environment surrounding the industrial and agricultural land was no longer able to assimilate or store this waste, negative impacts soon began to emerge. In some cases, the pollution was clearly visible; in others, its manifestation occurred through the gradual loss or deterioration of wildlife and the destruction of ecosystems. Hence the concern for the environment was driven primarily by local issues, such as air, water, and noise pollution, toxic-waste disposal sites, oil spills, highway construction, and suburban sprawl, and by a concern for the integrity of local ecosystems.

Before the 1960s, communities had turned somewhat of a blind eye to pollution from industrial activities because of the perception that economic gains were considered to outweigh the environmental and health costs. This perception began to change in 1962 with the publication of Rachel Carson's book *Silent Spring*. Carson described the potential dangers of the pesticide DDT (dichlorodiphenyl trichloroethane) and argued that its development and continued use served the interests of chemical companies, industrial agriculture, the military, and universities. The fierce opposition to her book by the chemical industry had the effect of strengthening the public resolve behind her work. "*Silent Spring* altered a balance of power in the world. No one since would be able to sell pollution as the necessary underside of progress so easily or uncritically" (Hynes 1989, p. 3).

The growing concern about the adverse effects on the environment was paralleled by an increasing concern that available national resources might not be sufficient to sustain economic growth into the future. Although this concern was tempered by several influential studies (Barnett and Morse 1963; President's Material Policy Commission 1952; RFF 1954), the issue returned with a vengeance in 1972 with the publication of *The Limits to Growth* (Meadows, Meadows, et al. 1972).

Accompanied by a growing distrust of government-industrial coziness during the 1960s, arguments warning of the environmental problems associated with the prevailing development model of rapid industrialization and economic growth began to surface. Two classic publications which supported this movement were "The Tragedy of the Commons" by Garrett Hardin and *The Population Bomb* by Paul Ehrlich, both written in 1968. In addition to these publications, the late 1960s experienced two environmental disasters – the Santa Barbara oil spill and the oil fire on the Cuyahoga River – that increased the pressure on the U.S. government for action.

* Indeed, all "environmental" problems are related. Large transformations of materials and use of energy create resource shortages, toxic pollution, and greenhouse gases that lead to climate change and the destruction of ecosystems and biodiversity.

Table 2.1 The creation of a national environment and development agenda – 1951 to 1970

YEAR	EVENTS	PUBLICATIONS	U.S. LEGISLATION	MULTILATERAL ENVIRONMENTAL AGREEMENTS
1951	President Truman appoints the <i>Paley Commission</i> to study the long-range aspects of the national resource base.			International Plant Protection Convention
1952	<i>Resources for the Future</i> is established.	<i>Resources for Freedom</i> – the President's Material Policy Commission		International Convention for the High Seas Fisheries of the North Pacific Ocean (see also 1978 Protocol)
1954		<i>The Nation Looks at Its Resources: Report of the Mid-century Conference on Resources for the Future</i> – Resources for the Future		
1958				Convention on the Continental Shelf Convention on the High Seas Convention on Fishing and Conservation of the Living Resources of the High Seas International Convention for the Prevention of Pollution of the Sea by Oil (OILPOL) (see also 1962 Amendment and 1969 Amendments)
1959				Agreement Concerning Co-operation in the Quarantine of Plants and Their Protection against Pests and Diseases Convention Concerning the Protection of Workers against Ionising Radiations Convention on Third Party Liability in the Field of Nuclear Energy
1960	<i>World population – 3 billion.</i> The World Bank creates the International Development Association (IDA).	<i>Energy in the American Economy, 1850–1975: An Economic Study of Its History and Prospects</i> – S. H. Schurr and B. C. Netschert		

(Continued)

Table 2.1 (Continued)

YEAR	EVENTS	PUBLICATIONS	U.S. LEGISLATION	MULTILATERAL ENVIRONMENTAL AGREEMENTS
1961	The OECD (Organisation for Economic Co-operation and Development) is created from the OEEC (Organisation for European Economic Co-operation).			International Convention on the Protection of New Varieties of Plants
1962	The World Wildlife Fund (WWF) is established.	<i>Silent Spring</i> – R. Carson <i>Resources in America's Future: Patterns of Requirements and Availabilities, 1960–2000</i> – H. H. Landsberg, L. L. Fischman, and J. L. Fisher <i>Scarcity and Growth: The Economics of Natural Resource Availability</i> – H. J. Barnett and C. Morse		Agreement Concerning Co-operation in Marine Fishing
1963				Vienna Convention on Civil Liability for Nuclear Damage Treaty Banning Nuclear Weapon Tests in the Atmosphere, in Outer Space and under Water Convention for the International Council for the Exploration of the Sea
1964	The UN Conference on Trade and Development (UNCTAD) is established.			
1965		<i>Unsafe at Any Speed: The Designed-in Dangers of the American Automobile</i> – R. Nader <i>Environmental Quality in a Growing Economy: Essays from the Sixth RFF Forum</i> – K. E. Boulding, H. J. Barnett, R. Dubos, L. J. Duhl, R. Turvey, R. N. McKean, A. V. Kneese, M. M. Gaffney, G. F. White, D. Lowenthal, N. E. Long, J. H. Beuscher, and J. Jarrett (eds.) [Note: This publication contained K. E. Boulding's classic essay, "The Economics of the Coming Spaceship Earth"]	The Freedom of Information Act (FOIA)	
1966				
1967	The Environmental Defense Fund (EDF) is created.			

1968	The Biosphere Conference is held in Paris under the auspices of the UN Educational, Scientific, and Cultural Organization (UNESCO). The topic of “the human environment” is addressed by the UN Economic and Social Council (ECOSOC). ECOSOC Resolution 1364 (XLV) eventually leads to the 1972 Stockholm Conference. An explosion occurs at a mine in Farmington, West Virginia, killing seventy-eight people.	<i>The Tragedy of the Commons</i> – G. Hardin <i>The Population Bomb</i> – P. Ehrlich		
1969	An oil spill on the Cuyahoga River in Ohio catches fire. An oil spill occurs off the coast of Santa Barbara, California, discharging some 200,000 gallons of crude oil into the sea. United Mine Workers strike over coal workers’ pneumoconiosis, or “black lung.”	<i>Partners in Development</i> – Report prepared by the Commission on International Development	The Coal Mine Health and Safety Act The National Environmental Policy Act (NEPA) International Convention Relating to Intervention on the High Seas in Cases of Oil Pollution Casualties Oil Pollution Convention on Civil Liability for Pollution Damage (see also 1976 and 1992 Protocols)	
1970	Friends of the Earth is formed. First Earth Day – April 22. The Natural Resources Defense Council (NRDC) is formed. President Nixon creates the Environmental Protection Agency (EPA) in the United States by executive order.	<i>Economics and the Environment: A Materials Balance Approach</i> – R. U. Ayres, R. C. D’Arge, and A. V. Kneese <i>Man’s Impact on the Global Environment</i> – Report prepared by a scientific group assembled at MIT	The Clean Air Act (CAA) The Occupational and Safety Health Act (OSH Act)	

In response to the growing public concern, the U.S. Congress passed the National Environmental Policy Act (NEPA), which was signed by President Nixon in 1970.* This act was followed by other key environmental and worker health and safety regulations, shown in Tables 2.1 and 2.2 (see Section 9.6 in Chapter 9 for a discussion of the U.S. regulatory system).† These pieces of legislation directly reflect three of four environmental concerns that can be associated with sustainable development – (1) that industrialization negatively affects ecosystem integrity and biological diversity and indirectly affects human health; (2) that the world’s resources and energy supplies are finite; and (3) that toxic pollution directly affects human health and the health of other species. The fourth environmental concern – that greenhouse gases from anthropocentric sources are leading to the disruption of the global climate – is somewhat loosely connected to the Clean Air Act Amendments (CAAA) of 1977 and 1990.‡

On April 22, 1970, almost four months after the signing of the NEPA, the first Earth Day was held. Some 20 million Americans peacefully demonstrated in streets, parks, and auditoriums for a healthy environment and in support of environmental reform.§ The event crystallized the views of those who had been protesting against harm to the environment and to humans and enabled them to articulate a shared set of common values.

2.3 The creation of an international environmental agenda

It has been argued that the 1960s’ influence on modern environmentalism is what the 1970s were to the formulation of sustainable development (Speth 2002, 2003). As national environmental agendas began to be established throughout the world, the 1970s

* See Sections 9.6.1 and 9.6.2 in Chapter 9 for a discussion of environmental and occupational health and safety regulation, respectively.

† In addition to environmental, natural resource, and human health regulation, Dernbach (2011) makes a compelling argument that laws relating to *economic development* need to also be retooled to enable or incentivize investments that reduce negative impacts on the environment and society. In particular, he identifies seven types of economic development law that could be used to advance sustainable development. These include (1) laws requiring an increase in more sustainable activities (e.g., energy efficiency laws); (2) laws that create a legal structure that enables sustainable activities to flourish (e.g., electricity net metering laws); (3) laws that remove legal impediments to sustainability (e.g., laws that favor unsustainable modes of transportation); (4) laws that can be refocused to attract clean rather than dirty industry into a state or region; (5) laws and policies that overcome market barriers to more sustainable activities (e.g., providing consumers with high-quality information on the energy efficiency of products or services); (6) laws that protect the environment while creating green jobs; and (7) laws that support the development of green in infrastructure (ibid., pp. 629–641).

‡ In the mid-1970s, scientists concluded that chlorofluorocarbons (CFCs) had the potential to deplete stratospheric ozone that provides an essential barrier to the damaging UV-B radiation emitted from the sun (Molina and Rowland 1974). In response to this research, the CAAA of 1977 included a congressional directive to undertake further research on ozone depletion, and the later CAAA of 1990 called for a reduction in the amount of CFCs being used. The Montreal Protocol was a multilateral environmental agreement that recognized the global nature of the problem with all nations contributing to its seriousness. The recognition that human activity could change the thermal radiative process of the atmosphere led scientists to consider the potential impact of the vast amount of carbon dioxide (CO₂) that had entered (and continues to enter) the atmosphere since the start of the Industrial Revolution. A 2007 Supreme Court decision found that greenhouse gases such as CO₂ could be regulated under the Clean Air Act (Ashford and Caldart 2008), and in December 2009 (at the beginning of the UN climate change conference in Copenhagen, COP-15), the Environmental Protection Agency (EPA) issued a final ruling that greenhouse gases (GHGs) were a danger to human health and the environment, paving the way for regulation of carbon dioxide and other GHG emissions.

§ Earth Day Network, www.earthday.org/ (accessed August 15, 2017).

witnessed the emergence of a concern for the human environment in the international arena (Table 2.2).

The impetus for this development was the UN Conference on the Human Environment that was held in Stockholm on June 5–16, 1972 (McEntire 2005). Caldwell and Weiland (1996) attribute such importance to the Stockholm Conference for two reasons. First, it legitimized the critical need for all nation-states to establish environmental policy at the national level. Second, it informed the world society of the vital role that a healthy biosphere plays in sustaining life, and hence it placed a concern for the environment on national agendas. Both of these developments were deemed necessary for the international community to address environmental concerns legitimately (*ibid.*).

Although the Stockholm Conference and its agreements were influential in advancing concerns for the human environment, many suggest that the conference's major impact came from the intense preconference deliberations and the explosion of literature that raised the world's consciousness about the natural environment (Emmelin 1972; Dernbach 1998; Strong 1972; UNEP 1982b, 1982c). One notable example was the preconference deliberation that occurred at Founex, Switzerland (UN 1972), on the relationship between the environment and development. The meeting recognized that because almost all nations needed to undergo some form of development, sound approaches to environmental planning needed to be established (UNEP 1982c). The meeting broadened the dialogue beyond environmental concerns in industrialized regions by making an explicit link between poverty and environmental degradation, highlighting the need for economic growth in developing regions. This latter recognition is considered a key reason that many developing nations participated in the Stockholm Conference (UNEP 1982d).

From the deliberations at Founex and the debates that ensued during the Stockholm Conference, the term "ecodevelopment" emerged to describe the process of "ecologically sound development," which included the "positive management of the environment for human benefit" (UNEP 1982c, p. 7). The prefix "eco" is used to signify both "economic" and "ecological" since both words stem from the Greek root *oikos*, meaning house or home (Colby 1991). The term "ecodevelopment" was subsequently adopted and advocated by the UNEP during the 1970s.* In a sense, ecodevelopment could be described as the predecessor to sustainable development. The UNEP defined ecodevelopment as "development at regional and local levels [. . .] consistent with the potentials of the area involved, with attention given to the adequate and rational use of the natural resources, and to applications of technological styles" (UNEP 1975, quoted in Redclift 1987, p. 34). Hence, ecodevelopment focused on satisfying basic human needs in an "environmentally sound [regional] production system" (Nayar 1994, p. 1327).

Although the Stockholm Conference placed a concern for the environment on the international agenda, its official agreements sidestepped a number of important issues raised by developing nations. A notable case is the call by developed nations for global economic reforms to address the declining terms of trade faced by many raw-commodity exporters in developing economies (Clapp and Dauvergne 2005). By enabling developing nations to realize higher returns on their exports, poverty and the related environmental degradation could be addressed. The issue of global economic reforms continued to be debated during the 1970s, but calls for a new international economic order did not lead to substantive changes.

* Although the UNEP was an advocate of ecodevelopment, Colby (1991, p. 200) argues that its predominant practices were still locked in the realm of environmental protection that focused on "damage control: on repairing and setting limits to harmful activity. Rather than focusing on ways to *improve* both development actions and ecological resilience, this approach was inherently *remedial* in practice."

Table 2.2 The creation of an international environmental agenda – 1971 to 1980

YEAR	EVENTS	PUBLICATIONS	U.S. LEGISLATION	MULTILATERAL ENVIRONMENTAL AGREEMENTS
1971	The Man and the Biosphere program (MAB) is founded by UNESCO (UN Educational, Scientific, and Cultural Organization). Greenpeace starts in Canada. The OECD creates the Environment Committee (now the Environment Policy Committee – EPOC) and the Environment Directorate. President Nixon closes the gold window and unilaterally terminates the international gold exchange standard established by the Bretton Woods agreements. Thus, the dollar is no longer effectively linked – directly or indirectly – to gold.	<i>Founex Report</i> – Report by the Preparatory Committee for the United Nations Conference on the Human Environment <i>Only One Earth</i> – B. Ward and R. Dubos <i>The Closing Circle: Nature, Man, and Technology</i> – B. Commoner <i>The Entropy Law and the Economic Process</i> – N. Georgescu-Roegen		Convention on Wetlands of International Importance Especially as Waterfowl Habitat (Ramsar) Treaty on the Prohibition of the Emplacement of Nuclear Weapons and Other Weapons of Mass Destruction on the Sea-bed and the Ocean Floor and in the Subsoil Thereof Convention Concerning Protection against Hazards of Poisoning Arising from Benzene Convention Relating to Civil Liability in the Field of Maritime Carriage of Nuclear Material International Convention on the Establishment of an International Fund for Compensation for Oil Pollution Damage

1972	The UN Conference on the Human Environment is held in Stockholm, Sweden (known as the Stockholm Conference). The United Nations Environment Programme (UNEP) is formed following the Stockholm Conference.	<i>The Limits to Growth: A Report for the Club of Rome's Project on the Predicament of Mankind</i> – D. H. Meadows, D. L. Meadows, J. Randers, and W. W. Behrens III <i>Blueprint for Survival</i> – The Ecologist <i>Exploring New Ethics for Survival: The Voyage of the Spaceship Beagle</i> – G. J. Hardin <i>Only One Earth: The Care and Maintenance of a Small Planet</i> – B. Ward	The Federal Water Pollution Control Act Amendments (this law is amended in 1977 and becomes known as the Clean Water Act – CWA) The Federal Environmental Pesticide Control Act, which amended the 1947 Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) The Endangered Species Act (ESA)	Stockholm Declaration of the United Nations Conference on the Human Environment Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons, and on Their Destruction Convention for the Protection of the World Cultural and Natural Heritage Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (London Convention; see also 1996 Protocol)
1973	OPEC oil embargo begins.	<i>Small Is Beautiful</i> – E. F. Schumacher		Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) International Convention for the Prevention of Pollution from Ships, 1973, and Protocols (MARPOL 73/78) (see also 1996 Amendments and 1997 Protocol) Protocol Relating to Intervention on the High Seas in Cases of Marine Pollution by Substances Other than Oil

(Continued)

Table 2.2 (Continued)

YEAR	EVENTS	PUBLICATIONS	U.S. LEGISLATION	MULTILATERAL ENVIRONMENTAL AGREEMENTS
1974	World population – 4 billion. The World Food Council is formed and a reconstituted World Food Programme (WFP) is established following the World Food Conference in Rome. The Worldwatch Institute is established.	<i>Cocoyoc Declaration</i> – Prepared by a UN-sponsored meeting in Cocoyoc, Mexico, called to discuss how development can be focused on achieving basic human needs <i>Stratospheric Sink for Chlorofluoromethanes:</i> – F. S. Rowland and M. J. Molina <i>What Now: Another Development</i> – Report by the Dag Hammarskjöld Foundation, Sweden <i>Crisis in the Workplace: Occupational Disease and Injury</i> – N. A. Ashford	The Safe Drinking Water Act (SDWA)	Convention for the Prevention of Marine Pollution from Land-Based Sources, Paris (revised by 1992 OSPAR Convention) Agreement on an International Energy Program
1975				
1976	The UN Habitat program is created following the UN Conference on Human Settlements (Habitat I) in Vancouver, Canada.		The Resource Conservation and Recovery Act (RCRA) The Toxic Substances Control Act (TSCA)	Convention Concerning the Protection of Workers against Occupational Hazards in the Working Environment Due to Air Pollution, Noise and Vibration (ILO Convention No. 148)
1977	The UN adopts a Plan of Action to Combat Desertification (PACD) following the UN Conference on Desertification in Nairobi, Kenya.			

1978		<i>World Development Report (WDR)</i> – The WDR is first published by the World Bank <i>The Human Future Revisited</i> – H. Brown <i>The Twenty-Ninth Day</i> – L. Brown <i>Banking on the Biosphere</i> – International Institute of Environment and Development (IIED) <i>Progress for a Small Planet</i> – B. Ward <i>Scarcity and Growth Reconsidered</i> – V. K. Smith (ed.)	Protection of New Varieties of Plants (Revision of 1961 Agreement) Convention on the Conservation of Migratory Species of Wild Animals Convention on Long-Range Transboundary Air Pollution
1979	The World Meteorological Organization (WMO) sponsors the first World Climate Conference held in Geneva, Switzerland. Three Mile Island nuclear accident occurs in Pennsylvania. Second oil shock occurs as the Iranian oil sector reduces its oil exports.		
1980		<i>World Conservation Strategy</i> – Published by the IUCN (International Union for Conservation of Nature and Natural Resources), the UNEP, and the WWF <i>North–South: A Program for Survival</i> – Report by the Independent Commission on International Development Issues <i>The Global 2000 Report to the President</i> – Report by the U.S. Council on Environmental Quality and the Department of State	Convention on the Physical Protection of Nuclear Material, Vienna and New York The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) – also known as Superfund

2.3.1 *Stockholm+10*

Ten years after Stockholm, the UN held a meeting in Nairobi to review progress in implementing the Stockholm Action Plan and to make recommendations with respect to prevailing environmental trends for the future actions of the UNEP. The preconference reports prepared by the UNEP (1982b, 1982d) and the Nairobi Declaration presented a clear message that although nation-states had made progress toward environmental protection, their actions were insufficient to reverse the rate of environmental degradation occurring throughout the world.

The Nairobi meeting raised several important issues that warrant discussion. First, the negative impacts of overpopulation were formally recognized as a growing problem. Whereas population had been largely overlooked at the Stockholm Conference, it played a much more prominent role at the Nairobi meeting. In particular, the Nairobi Declaration made an explicit connection between population, resources, and the health of the environment:

During the last decade, new perceptions have emerged: the need for environmental management and assessment, the [proposition of a . . .] complex interrelationship between environment, development, population and resources and the strain on the environment generated, particularly in urban areas, by increasing population have become widely recognized.

(UNEP 1982a)

Second, during the decade since Stockholm, developing countries that had previously rejected the imposition of strict environmental standards had now become worried about the damage that was being done to their environment (Redclift 1984, p. 49). Their concern was that this environmental damage was affecting both the health of their people and their future development prospects. This transition in opinion is most clearly reflected in the report of the Governing Council of the UNEP on the general debate at the Nairobi meeting:

Differences of views between developed and developing countries with regard to environmental perceptions had to a large extent faded over the last 10 years, and the concepts of sustainable development and rational management of natural resources were now widely accepted as the cornerstones of environmental policies.*

Hence, it was unlikely that developing nations would continue to disagree in principle with the creation of standards to protect the environment on which their livelihoods depended.

Finally, and most important, the Nairobi meeting highlighted a reversal of the perceived impacts of economic growth. The UNEP report titled *The Environment in 1982: Retrospect and Prospect* provides a succinct description of the turnaround in opinion:

A decade ago the desirability of further economic growth was questioned in some quarters, but the negative effects of the recent slow-down in economic growth have reinforced the view that it is an essential instrument in achieving social goals. In developing countries particularly, economic growth is vitally important and remains a

* UNEP, *Report of the Governing Council on Its Tenth Session, General Debate*, paragraph 36, https://wedocs.unep.org/bitstream/handle/20.500.11822/17274/82_05_GC10_%20special_character_report_of_the_GC_10_1982.pdf?sequence=10&isAllowed=y (accessed August 15, 2017).

major force for improving the health and welfare of people. It is now perceived that economic growth can often be managed not only to avoid environmental degradation but also, in many cases, to improve the environment.*

(UNEP 1982b, p. 37)

Because the initial concerns for the human environment grew from the negative impacts of industrialization in developed countries, the shift in the international focus toward the environmental problems faced by developing nations is significant. The identification of poverty as a major contributor to environmental degradation increased the importance of economic growth because it was the only pragmatic way to alleviate poverty.† Developing countries argued that if poverty and underdevelopment were made a priority, this would enable them to break free from the poverty trap in which poverty and environmental degradation were continually worsening. However, because no progress had been made during the 1970s in creating a new form of environmentally sound development, the only way to grow the economy was to follow the path of conventional development. This meant a reliance on technology that was fueled by nonrenewable resources and generated a significant amount of pollution, which would likely damage ecosystems and human health. Whereas developing nations made the case in the 1971 Founex report that because their environment had not been burdened by industrial pollution they could carry a certain amount of industrial activity (UN 1972), their position changed during the next decade as studies revealed the worsening condition of their environment (UNEP 1982c, 1982d). **Thus, developing countries faced a paradox. They needed to develop to protect and improve their environment – on which their future depended – but in doing so, they would ultimately damage the very environment they wished to safeguard. This contradiction led to the birth of sustainable development, the idea that development and environmental protection could advance in unison.** Hence, sustainable development would be able not only to meet the needs of the present but also to do so in a manner that did not damage the environment and compromise the ability of future generations to meet their needs (WCED 1987, p. 43). The WCED (Brundtland) definition of sustainable development is discussed in more detail in the following section.

2.3.2 The limits to growth debate

During the emergence of the environmental movement in the 1960s and 1970s, a central question was debated about whether sustained economic growth would eventually lead to the “overshoot and collapse” of critical ecosystems – that is, human activity moves beyond an ecological “tipping point.” The predominant views linked the prevailing and perceived

* The slow growth of the world economy during the early 1980s, combined with rising debt-service obligations and a reduction in the inflow of finance, meant that many developing nations faced severe economic crises and were forced to reduce social spending and curtail environmental protection efforts (Redclift 1996; WCED 1987). The 1991 UNEP report *The State of the World Environment* described the 1980s as being the “lost decade” (UNEP 1991, p. 2). The report criticized the structural adjustment policies of developing nations that were designed to dampen demand, devalue currencies, remove subsidies from fuel and foodstuffs, and reduce government spending (ibid., p. 3). In particular, it stated that the poor tended to bear the brunt of such policies, which had the result of increasing malnutrition and reducing health services and school enrollment rates. It concluded that these negative effects of structural adjustment were “inhuman and ultimately inefficient” and that future adjustment policies must have a “human face – which protects the poor” (ibid., p. 4). Thirty years later, the 2008 global financial crisis has created a situation where history may repeat itself.

† In an insightful article, Laurent (2013) observes that inequality [i.e., poverty] is both a cause and a consequence of environmental degradation.

future ecological crisis to the failure to internalize environmental externalities (Pigou 1932);* the use of pesticides/chemicals (Carson 1962); inadequate property rights (Coase 1960; Hardin 1968);† ‡ population growth (Ehrlich 1968);§ flawed technology (Commoner 1971); the exploitation of nonrenewable energy (R. U. Ayres 1978; Georgescu-Roegen 1971); the fixation on economic growth (Ecologist 1972); and prevailing world trends in population growth, capital investment, resource usage, agricultural productivity, and pollution rates (D. H. Meadows et al. 1972). It was not only the increase in the volume of chemicals used and the consequential pollution that were of concern. The nature of chemical production, use, and disposal had shifted toward halogenated synthetic chemicals that were considered to be particularly hazardous (Commoner 1979; Ashford and Caldart 2008, Chapter 2).

Perhaps the most well-known “ecological limits” argument was articulated by the classic work *Limits to Growth*. Using system dynamics techniques developed by Jay Forrester at

* Pigou (1932) argued that an externality occurs when an individual’s decision to buy a product/service results in costs or benefits to other individuals or groups who are not part of the transaction. Thus, the individual does not bear all the costs or receive all the benefits from his or her action. To address this problem, Pigou argued that the costs of “negative” externalities need to be “internalized” in the end price of a product/service to reflect its true social costs. This internalization of costs could be achieved by matching a firm’s marginal cost of environmental damage with the marginal benefit received from the product/service provided. One mechanism for doing this is to use a Pigouvian tax to correct for the negative effects of externalities. Pigou’s notion of internalizing external costs is also commonly known as the “polluter pays principle.” See Chapter 9 for a discussion of the effectiveness of pollution taxes versus mandatory environmental standards, and Chapter 12 for a discussion of a carbon tax versus a cap-and-trade system for fossil fuels.

† Coase (1960) rejected the idea that externalities can be addressed by internalizing external costs and argued that a close-to-optimal outcome could be achieved through private bargaining. Coase’s theorem states that if there are zero transaction costs and legal rights (land rights in particular) are well defined, then the socially efficient solution to negative externalities will occur regardless of legal entitlement. Hence, under these assumptions, environmental disputes, for example, will be resolved through *private* negotiations. The problem with Coase’s theory, however, is that transaction costs are almost never zero, property rights may be difficult to define, and identifying who is responsible for certain externalities can be complicated. Thus, one inference from Coase’s theorem is that government has a role in minimizing transaction costs to enable the market to function efficiently. See Section 9.5.1 in Chapter 9 for an additional discussion of the Coasean view.

‡ Garrett Hardin’s “Tragedy of the Commons” popularized the effect of different regimes of property rights on the exploitation of public-domain resources. The basic premise of this article is that without the private ownership of land or the governmental allocation of usage rights (i.e., regulation), the *free* commons creates an economic incentive for each user to exploit the resource to his or her advantage. The example Hardin uses is the overgrazing of a public common by cattle. Because there are no (grazing) costs to the farmer for adding one additional cow to his herd, the more cows that are added, the wealthier the farmer is likely to become through the produce from, and the eventual sale of, his livestock. The inherent problem with these activities is that the eventual overgrazing of a growing number of cattle will destroy the public common and bring ruin to all the farmers. In essence, Hardin saw the problem as overpopulation, a point often not mentioned in popular recitation of his work.

§ Paul Ehrlich’s book *The Population Bomb*, as indicated by its title, also saw the problem of the commons in terms of too many people. Ehrlich’s argument was the modern exposition of Malthus’s concern that living conditions in nineteenth-century England were likely to decline as a result of overpopulation. Ehrlich predicted that by the 1970s and 1980s hundreds of millions of people would starve to death as a result of overpopulation and a fixed amount of resources. Although Ehrlich’s predictions have yet to materialize, partly because of the success of the green revolution, his book was influential for the anti-growth movement.

MIT,* the 1972 *Limits to Growth* report discussed the results of a computer model (called “World 3”) designed to foresee the future if current development continued unabated. The report reached three salient conclusions:

- 1 If the present growth trends in world population, industrialization, pollution, food production, and resource depletion continue unchanged, the limits to growth on this planet will be reached sometime within the next one hundred years. The most probable result will be a rather sudden and uncontrollable decline in both population and industrial capacity.
- 2 It is possible to alter these growth trends and to establish a condition of ecological and economic stability that is sustainable far into the future. The state of global equilibrium could be designed so that the basic material needs of each person on earth are satisfied and each person has an equal opportunity to realize his individual human potential.
- 3 If the world’s people decide to strive for this second outcome rather than the first, the sooner they begin working to attain it, the greater will be their chances of success. (D. H. Meadows et al. 1972, pp. 23–24)

Limits to Growth raised the important idea of “overshoot and collapse” – that is, to go inadvertently beyond a system’s limits, creating a situation that is nearly impossible to reverse (D. H. Meadows et al. 1972, p. 144). Overshoot can occur, the study’s authors opined, because (1) growth can lead to rapid change within the system; (2) there is a limit to the system beyond which it becomes unstable; and (3) delays in feedback mechanisms mean that the system’s limits are exceeded before the problems are identified. For example,

pollution generated in exponentially increasing amounts can rise past the danger point, because the danger point is first perceived years after the offending pollution was released. A rapidly growing industrial system can build up a capital base

* In 1971, the book *World Dynamics* presented the results of a computer model developed by Professor Forrester and his colleagues at MIT, called “World 2.” Forrester describes how the model was created to support a two-week workshop at MIT in 1970 during which the Executive Committee from the Club of Rome was invited to learn the process of model formulation and computer simulation. The World 2 model was designed to analyze the problems facing the “world system,” which was defined as incorporating humankind, humankind’s social systems, humankind’s technology, and the natural environment. Using five key variables – population, capital investment, natural resources, the fraction of capital devoted to agriculture, and pollution – the model provided evidence that within the next one hundred years “man may face choices from a four-pronged dilemma – suppression of modern industrial society by a natural-resource shortage; decline of world population from changes wrought by pollution; population limitation by food shortage; or pollution collapse from war, disease, and social stresses caused by physical and psychological crowding” (Forrester 1971, p. 11).

In addition, the simulations indicated that the high standard of living in developed countries is likely to fall as industrialization reaches a “natural-resource limit,” and that developing countries might have “no realistic hope” of reaching the standard of living experienced in developed nations (Forrester 1971, p. 12). These predictions fueled the debate in developed and developing countries about the sovereign right to, and best process of, development. Following the workshop at MIT, the Club of Rome, convinced that Forrester’s model had identified many of the factors behind the “world problematique,” decided to launch Phase One of its study of the predicament of humankind. This phase, headed by Dennis Meadows, led to the creation of the World 3 model, on which the *Limits to Growth* report was based. The World 3 model contained about three times as many mathematical equations as its predecessor and used empirical data for many of its numerical relationships (H. S. D. Cole 1973). (The phrase “world problematique” was created by the Club of Rome to describe the set of crucial problems – political, social, economic, technological, environmental, psychological, and cultural – facing humanity.)

dependent on a given resource and then discover that the exponentially shrinking resources reserves cannot support it.*

(ibid., p. 145)

Although the legitimacy of D. H. Meadows et al.'s (1972) limits-to-growth argument was criticized (H. S. D. Cole et al. 1973; Kaysen 1972; Maddox 1972), the intellectual debate surrounding the topic clearly informed Daly's (1991, 1996) notion of the steady-state economy (SSE) (introduced in Section 1.3.1 in Chapter 1) and played an influential role in advancing an international concern for the environment.

In 1992, the authors of *Limits to Growth* published *Beyond the Limits*, which argued that the conclusions they had reached in 1972 were still valid, but the underlying logic needed to be strengthened (D. H. Meadows et al. 1992). The most common criticism of the first World 3 model was that it underestimated the influence of technology and did not adequately represent the adaptive nature of the market. In *Beyond the Limits*, D. H. Meadows et al. (1992) designed a new version of the model that did not rely solely on technology or solely on the market, but instead on a smooth interaction between the two. The outcome from the new model showed that in many cases, resource and pollution flows had already surpassed levels that are physically sustainable. Further, the work argued that the limits to growth are not physical limits, such as limits to population growth or to the number of automobiles on the road. Rather, they are limits to *throughput*, that is, limits to the flows of energy and materials required to keep people alive, to build more automobiles, and the like. By this they mean that the limits to growth are not only the limits to the earth's ability to provide the resource streams of energy and materials necessary to meet predicted consumption levels, but also limits to its ability to absorb the pollution and waste streams in natural sinks such as forests and oceans.

Some three decades after the publication of *Limits to Growth*, D. L. Meadows (2007, p. 405) underlined an important change that had occurred in the twenty-first century:

In 1972 we concluded that global population and industrial activity were still below the levels that could be supported indefinitely on earth. By 2004, it was clear to us that they had grown above sustainable levels. So in 1972 the main objective seemed to us to be finding ways of slowing down physical expansion on the planet. In 2004 the main objective had become getting physical flows that are propelled by population and industry back down below the carrying capacity of the planet.

Since the 1970s, our perspective of potentially devastating tipping points has broadened from a resource scarcity and environmental perspective, which now includes global climate change, to include a health perspective relating to chemically caused cancer (Sasco

* For a more recent study that explores whether it is possible to achieve a low- or no-growth economy, see Victor (2008). Victor developed an interactive model of the Canadian economy, called "LowGrow," which he used to explore different assumptions, objectives, and policy measures designed to transition the economy toward zero economic growth. To avoid the criticisms levied at the World 3 systems model supporting the work of *The Limits to Growth*, the LowGrow model was based firmly on standard economic theory. Victor concluded that the careless implementation of a "no-growth" strategy can be disastrous, bringing about significant hardship. However, if a low-growth strategy, followed by a no-growth strategy, is pursued with high investment, it is possible (in theory) to achieve (by 2035) a future of full employment with low levels of poverty, increased leisure time, reduced greenhouse gas emissions, and fiscal balance. Although the LowGrow model has limitations, such as its high level of aggregation, its value lies in its ability to enable analysts and decision-makers to explore potential pathways toward a "no economic growth" future. What is evident from Victor's (2008) work is that there are several pathways to achieving such a goal.

2008; Epstein et al. 2002; Ashford et al. 2015), reproductive health (Colborn et al. 1996), neurological and autoimmune diseases, and contagion (Diamond 2004). This broadening of scope highlights the critical importance of broadening the space in which solutions to these interconnected problems are designed.

2.4 The emergence of sustainable development

The 1980s marked a turning point when nations began to recognize that their environmental problems extended beyond national boundaries and were having impacts on a global scale (Table 2.3). This realization further spurred the development of an international environmental agenda, and the actions taken in the following two decades as a result of this agenda can be considered the first attempt at global environmental governance (Speth 2003).

One of the foundational texts on sustainable development, which was published two years before the Nairobi meeting, was the International Union for Conservation of Nature and Natural Resources (IUCN) et al.'s (1980) *World Conservation Strategy* (WCS). The WCS is an eloquent synthesis of a decade of intense debate in the international community over the need to protect the environment while continuing the process of development. The WCS used the term "sustainable" to describe development that takes "account of social and ecological factors, as well as economic ones; of the living and non-living resource base; and of the long term as well as short term advantages and disadvantages of alternative actions" (IUCN et al. 1980, p. 18). Acknowledging that "conservation and development have so seldom been combined that they often appear – and are sometimes represented as being – incompatible" (ibid.), the WCS proceeds to develop its case why conservation and economic and social development are mutually supportive endeavors. In using the word "sustainable" to describe the development process, the WCS effectively rechristened "ecodevelopment" (the term previously used to describe ecologically sound socioeconomic development) as "sustainable development" (Caldwell and Weiland 1996, p. 243). However, this rechristening was more than simply a name change.

A central aspect of ecodevelopment was *national self-reliance*, which focused on local and regional development to meet human needs. National self-reliance also implied that nation-states should be able to temporarily detach themselves from the international economic system if they were adversely affected by, for example, fluctuations in the world commodity market.* However, the oil shocks of the 1970s led to economic recessions throughout the world, drastically reducing trade and the availability of aid for developing nations. During this period, environmental degradation in developing nations worsened, highlighting the essential role that the international economy plays in national development (UNEP 1982b). Recognizing that conservation and development are closely interlinked, the WCS highlighted the importance of a "New International Development Strategy." The purpose of this strategy was

- (a) to redress the inequalities in the relations between richer and poorer; (b) to establish a more dynamic, more stable and less vulnerable world economy, in which all countries have opportunities to participate on a fuller and more equal basis; (c) to stimulate accelerated economic growth in the poorer countries of the world; and (d)

* Such fluctuations might occur because of the dumping of a heavily subsidized agricultural product onto the international market. This action reduces the price of the commodity, making it impossible for the farmers of nations that do not (or are unable to) subsidize the agricultural sector to compete.

Table 2.3 The emergence of sustainable development – 1981 to 2016

YEAR	EVENTS	PUBLICATIONS	U.S. LEGISLATION	MULTILATERAL ENVIRONMENTAL AGREEMENTS
1981		<i>Global Strategy for Health for All by the Year 2000</i> – Prepared by the World Health Organization		Convention Concerning Occupational Safety and Health and the Working Environment, Geneva (ILO Convention No. 155)
1982	The international debt crisis erupts and threatens the world financial system. World Resource Institute (WRI) is established.	<i>The Environment in 1982: Retrospect and Prospect</i> – UNEP <i>The World Environment: 1972–1982</i> – UNEP World Charter for Nature – Adopted by the UN General Assembly <i>Environmental Research and Management Priorities for the 1980s</i> – Report prepared by an international group of scientists on behalf of the Royal Swedish Academy of Sciences		United Nations Convention on the Law of the Sea, Montego Bay
1983	The World Commission on Environment and Development (WCED) is formed.			International Tropical Timber Agreement, Geneva
1984	Drought in Ethiopia – between 250,000 and 1 million people die from starvation. Bhopal incident – a leak of deadly methyl isocyanate at a Union Carbide pesticide plant in Bhopal, India, kills thousands of people.			Protocol to the 1979 Convention on Long-Range Transboundary Air Pollution on Long-Term Financing of the Co-operative Programme for Monitoring and Evaluation of the Long-Range Transmission of Air Pollutants in Europe (EMEP), Geneva
	The OECD International Conference on Environment and Economics is held in Paris, France.			

1985	British scientists discover an ozone hole over the Antarctic. The World Meteorological Society, the UNEP, and the International Council of Scientific Unions meet in Villach, Austria, to report on the build-up of CO₂ and other greenhouse gases in the atmosphere.	Protocol to the 1979 Convention on Long-Range Transboundary Air Pollution on the Reduction of Sulphur Emissions or Their Transboundary Fluxes by at Least 30 Per Cent, Helsinki Vienna Convention for the Protection of the Ozone Layer, Vienna Convention Concerning Occupational Health Services, Geneva (ILO Convention No. 161)
1986	A nuclear reactor meltdown at the Chernobyl power station releases radioactive material throughout the Northern Hemisphere. The IUCN (International Union for Conservation of Nature and Natural Resources) Conference on Environment and Development is held in Ottawa, Canada. The Uruguay Round of the General Agreement on Tariffs and Trade (GATT) lays the foundation for the establishment of the World Trade Organization (WTO) in 1995.	The Superfund Amendments and Reauthorization Act (SARA), which amended CERCLA The Emergency Planning and Community Right-to-Know Act (EPCRA) Convention Concerning Safety in the Use of Asbestos, Geneva (ILO Convention No. 162, Asbestos Convention) Convention on Early Notification of a Nuclear Accident, Vienna Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency, Vienna

(Continued)

Table 2.3 (Continued)

YEAR	EVENTS	PUBLICATIONS	U.S. LEGISLATION	MULTILATERAL ENVIRONMENTAL AGREEMENTS
1987	World population – 5 billion. The IMF (International Monetary Fund) establishes the Enhanced Structural Adjustment Facility (ESAF).	<i>Our Common Future</i> – WCED		Montreal Protocol on Substances That Deplete the Ozone Layer, Montreal
1988	The Intergovernmental Panel on Climate Change (IPCC) is established.			Protocol to the 1979 Convention on Long-Range Transboundary Air Pollution Concerning the Control of Emissions of Nitrogen Oxides or Their Transboundary Fluxes, Sofia Convention Concerning Safety and Health in Construction, Geneva (ILO Convention No. 167) Joint Protocol Relating to the Application of the Vienna Convention and the Paris Convention, Vienna Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal, Basel International Convention on Salvage, London Convention on Civil Liability for Damage Caused During Carriage of Dangerous Goods by Road, Rail and Inland Navigation Vessels, Geneva Convention Concerning Safety in the Use of Chemicals at Work, Geneva International Convention on Oil Pollution Preparedness, Response and Cooperation, London
1989	The Exxon Valdez oil tanker runs aground, spilling 11 million gallons of oil into Alaska's Prince William Sound.	<i>Valdez Principles</i> (later renamed the <i>CERES Principles</i>) – CERES		
1990	The International Institute for Sustainable Development (IISD) is established in Canada.		The Oil Pollution Act (OPA) The Pollution Prevention Act (PPA)	

1991	The Global Environmental Facility (GEF) is established. The European Bank for Reconstruction and Development (EBRD) is established.	<i>Caring for the Earth: A Strategy for Sustainable Living</i> – Published by the IUCN, the UNEP, and the WWF <i>Ecological Economics: The Science and Management of Sustainability</i> – R. Costanza	Convention on Environmental Impact Assessment in a Transboundary Context, Espoo (Note: the related Kiev Protocol on Strategic Environmental Assessment, 2003) Protocol to the 1979 Convention on Long-Range Transboundary Air Pollution Concerning the Control of Emissions of Volatile Organic Compounds or Their Transboundary Fluxes, Geneva United Nations Framework Convention on Climate Change, New York Rio Declaration on Environment and Development Convention on Biological Diversity, Rio de Janeiro Protocol of 1992 to Amend the International Convention on Civil Liability for Oil Pollution Damage, 1969, London Protocol of 1992 to Amend the International Convention on the Establishment of an International Fund for Compensation for Oil Pollution Damage, 1971, London Convention on the Prohibition of the Development, Production, Stockpiling and Use of Chemical Weapons and on Their Destruction, Paris Convention Concerning the Prevention of Major Industrial Accidents, Geneva Agreement to Promote Compliance with International Conservation and Management Measures by Fishing Vessels on the High Seas, Rome
1992	The UN Conference on Environment and Development (UNCED) is held in Rio de Janeiro, Brazil. The Earth Council is established in Costa Rica.	<i>Agenda 21</i> – UN Department of Economic and Social Affairs (DESA) <i>Changing Course</i> – S. Schmidheiny	
1993	The UN World Conference on Human Rights is held in Vienna, Austria. The UN Commission on Sustainable Development that was created at the UNCED holds its first meeting. The North American Free Trade Agreement (NAFTA) is signed by Canada, Mexico, and the United States. President Bill Clinton announces the creation of the President's Council for Sustainable Development (PCSD).	<i>Beyond the Limits: Confronting Global Collapse, Envisioning a Sustainable Future</i> – D. H. Meadows, D. L. Meadows, and J. Randers	

(Continued)

Table 2.3 (Continued)

YEAR	EVENTS	PUBLICATIONS	U.S. LEGISLATION	MULTILATERAL ENVIRONMENTAL AGREEMENTS
1994	The UN International Conference on Population and Development is held in Cairo, Egypt.			International Tropical Timber Agreement, 1994, Geneva Protocol to the 1979 Convention on Long-Range Transboundary Air Pollution on Further Reduction of Sulphur Emissions, Oslo United Nations Convention to Combat Desertification in Those Countries Experiencing Serious Drought and/or Desertification, Particularly in Africa, Paris Agreement Relating to the Implementation of Part XI of the United Nations Convention on the Law of the Sea of 10 December 1982, New York Convention on Nuclear Safety, Vienna Energy Charter Treaty, Lisbon Convention Concerning Safety and Health in Mines, Geneva Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 Relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks, New York Amendment to the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal, Geneva
1995	The UN World Summit for Social Development is held in Copenhagen, Denmark. The UN Fourth World Conference for Women is held in Beijing, China. The WTO is established. The World Business Council for Sustainable Development (WBCSD) is established in Geneva, Switzerland.			

1996	The Summit of the Americas on Sustainable Development is held in Santa Cruz, Bolivia. ISO 14001 is formally adopted as the voluntary international standard for corporate environmental management systems. The Second United Nations Conference on Human Settlements (Habitat II) is held in Istanbul, Turkey. The IMF establishes the Supplemental Reserve Facility (SRF). The Special Session of the UN General Assembly to Review and Appraise the Implementation of Agenda 21 is held.	<i>Sustainable America: A New Consensus for Prosperity, Opportunity, and a Healthy Environment for the Future</i> – Report by the President's Council for Sustainable Development <i>Beyond Growth</i> – H. E. Daly <i>How Much Is Enough?</i> – A. T. Durning <i>Our Stolen Future: Are We Threatening Our Fertility, Intelligence, and Survival?</i> <i>A Scientific Detective Story</i> – T. Colburn, D. Dumanoski, and J. P. Myers	The Food Quality Protection Act (FQPA)	International Convention on Liability and Compensation for Damage in Connection with the Carriage of Hazardous and Noxious Substances by Sea, London Comprehensive Nuclear-Test-Ban Treaty, New York
1997	The Special Session of the UN General Assembly to Review and Appraise the Implementation of Agenda 21 is held.	<i>Do We Consume Too Much?</i> – M. Sagoff <i>No Middle Way on the Environment</i> – P. R. Ehrlich, G. C. Daily, S. C. Daily, and J. Salzman	Convention on the Law of Non-Navigational Uses of International Watercourses, New York Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Wastes Management, Vienna Convention on Supplementary Compensation for Nuclear Damage, Vienna Protocol to Amend the Vienna Convention on Civil Liability for Nuclear Damage, Vienna Montreal Amendment to the Montreal Protocol on Substances That Deplete the Ozone Layer, Montreal Protocol of 1997 to Amend the International Convention for the Prevention of Pollution from Ships, 1973, as Amended by the Protocol of 1978 Relating Thereto, London Kyoto Protocol to the United Nations Framework Convention on Climate Change, Kyoto (not yet in force)	

(Continued)

Table 2.3 (Continued)

YEAR	EVENTS	PUBLICATIONS	U.S. LEGISLATION	MULTILATERAL ENVIRONMENTAL AGREEMENTS
1998	World population – 6 billion. The IMF activates General Arrangements to Borrow for the first time in twenty years.	<i>Cradle to Cradle: Remaking the Way We Make Things</i> – W. McDonough and M. Braungart		Protocol to the 1979 Convention on Long-Range Transboundary Air Pollution on Persistent Organic Pollutants (POPs), Århus Protocol to the 1979 Convention on Long-Range Transboundary Air Pollution on Heavy Metals, Århus Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade, Rotterdam Agreement for the Establishment of the Regional Commission for Fisheries, Rome Protocol to the 1979 Convention on Long-Range Transboundary Air Pollution to Abate Acidification, Eutrophication, and Ground Level Ozone, Gothenburg [Beijing] Amendment to the Montreal Protocol on Substances That Deplete the Ozone Layer, Beijing Basel Protocol on Liability and Compensation for Damage Resulting from Transboundary Movements of Hazardous Wastes and Their Disposal, Basel Cartagena Protocol on Biosafety to the Convention on Biological Diversity, Montreal
1999	The first Dow Jones global sustainability index is launched.	<i>Our Common Journey</i> – National Research Council <i>Natural Capitalism: Creating the Next Industrial Revolution</i> – P. Hawken, A. Lovins, and L. H. Lovins	The Chemical Safety Information, and Site Security, and Fuels Act	
2000	The Millennium Development Goals (MDGs) are established at the UN Millennium Summit held in New York The EU establishes the Lisbon Strategy to promote sustainable economic growth (via competitiveness) and employment while respecting the environment.			

2001	The IMF announces that it will establish the International Capital Markets Department to enhance its surveillance, crisis-prevention, and crisis-management activities.	Stockholm Convention on Persistent Organic Pollutants, Stockholm
2002	The UN World Summit on Sustainable Development (WSSD) is held in Johannesburg, South Africa.	International Treaty on Plant Genetic Resources for Food and Agriculture, Rome Convention on the Protection of the Underwater Cultural Heritage, Paris
2003		Protocol on Pollutant Release and Transfer Registers to the Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters Protocol on Strategic Environmental Assessment to the Convention on Environmental Impact Assessment in a Transboundary Context
2004		
2005		
2006		International Tropical Timber Agreement

(Continued)

Table 2.3 (Continued)

YEAR	EVENTS	PUBLICATIONS	U.S. LEGISLATION	MULTILATERAL ENVIRONMENTAL AGREEMENTS
2007	U.S. subprime mortgages begin to fail, initiating a global financial crisis.			
2008		<i>The Bridge at the Edge of the World: Capitalism, the Environment, and Crossing from Crisis to Sustainability</i> – J. G. Speth <i>Managing Without Growth: Slow by Design, Not Disaster</i> – P. A. Victor		
2009	Treaty of Lisbon is signed by the requisite number of EU member states.	<i>The Economic Growth Engine: How Energy and Work Drive Material Prosperity</i> – A. Ayres and B. Warr <i>Prosperity Without Growth – T. Jackson</i> <i>Agenda for a Sustainable America</i> – C. Dernback (ed.)		
2010	The European Commission establishes the Europe 2020 Strategy to promote sustainable growth and employment. The Preparatory Committee for the UN Conference on Sustainable Development holds its first meeting in preparation for the Rio + 20 Earth Summit in 2012. The BP Gulf oil spill occurs.	<i>Cents and Sustainability: Securing Our Common Future by Decoupling Economic Growth from Environmental Pressure</i> – M. H. Smith, K. C. Hargroves, and C. Desha <i>Accounting for Sustainability</i> – A. Hopwood, J. Uncerman, and J. Fries <i>Dynamic Sustainable: Technology, Environment, Social Justice</i> – M. Leach, I. Scoones, and A. Stirling <i>Freefall: America, Free Markets, and the Sinking of the World Economy</i> – J. Stiglitz	Dodd–Frank Wall Street Reform and Consumer Protection Act	
2011		<i>Technology, Globalization, and Sustainable Development: Transforming the Industrial state</i> – N. A. Ashford and R. P. Hall <i>Reinventing Fire: Bold Business Solutions for the New Energy Era</i> – A. Lovins and the Rocky Mountain Institute		

2012	The UN Conference on Sustainable Development is held in Rio de Janeiro, Brazil.	<i>Owning Our Future: The Emerging Ownership Revolution</i> – M. Kelly	
2013		<i>Flourishing: A Frank Conversation about Sustainability</i> – J. R. Ehrenfeld and A. J. Hoffman	
2014		<i>The Second Machine Age: Work, Progress, and Prosperity in a Time of Brilliant Technologies</i> – E. Brynjolfsson and A. McAfee <i>Capital in the Twenty-First Century</i> – T. Piketty <i>Degrowth: A Vocabulary for a New Era</i> – G. D'Alisa, F. Demaria, and G. Kallis (eds.) <i>The Bubble Economy: Is Sustainable Growth Possible?</i> – A. Ayres <i>Sustainability: A History</i> – J. L. Caradonna <i>Inequality: What Can Be Done?</i> – A. B. Atkinson	Paris Agreement under the United Nations Framework Convention on Climate Change
2015	The Sustainable Development Goals (SDGs) are established at the UN Sustainable Development Summit held in New York.		
2016	The United Nations Conference on Housing and Sustainable Urban Development (Habitat III) is held in Quito, Ecuador.	<i>Pursuing Sustainability: A Guide to the Science and Practice</i> – P. Matson, W. C. Clark, and K. Andersson <i>New Urban Agenda</i> – United Nations	

to reduce and eventually overcome the worst aspects of poverty by improving the lot of the hundreds of millions of people now living in abject poverty and despair.
(IUCN et al. 1980, p. 62)

To achieve this strategy, the WCS called for the liberalization of trade and the removal of all trade barriers to goods from developing countries. In addition, it recommended that economic and social growth be accelerated in developing nations.* Hence, the WCS did more than simply rename ecodevelopment as sustainable development; it connected local, regional, and national economic and social development with the conservation of living resources and the need for a stable, equitable, and more liberalized (that is, less regulated or subsidized) international economic system in which developing countries could participate on a more equal footing.

The WCS's notion of sustainable development – the idea that economic and social development can occur in unison with the conservation of living resources – presented a different perspective on global problems. Although the WCS did not fully integrate development and environmental considerations (Clapp and Dauvergne 2005), their use of the term “sustainable development” gave it greater recognition and increased its use in the international arena. The term became the central theme of the World Commission on Environment and Development's report *Our Common Future* and was the integrating theme of the 1992 UN Conference on Environment and Development (Caldwell and Weiland 1996).

2.4.1 *Our Common Future and the Earth Summit*

In light of the evidence that environmental conditions around the world were deteriorating (Brandt 1980; CEQ 1980; IUNC et al. 1980; UNEP 1982b) and population and economic growth – two critical factors affecting the environment – were continuing to increase (Strong 2003), the Governing Council of the UNEP called for the creation of a “global strategy for sustainable development.”† The following year, the UN General Assembly passed Resolution 38/161, approving the creation of a special independent commission on the environment to propose “long-term environmental strategies for achieving sustainable development to the year 2000 and beyond.”‡ As part of its terms of reference, the commission was required to consider the interrelationships between developed and developing nations and between people, resources, the environment, and development. In short, the commission was required to do nothing less than rethink and articulate a new vision of development.

Under the chairmanship of then–Prime Minister Gro Harlem Brundtland of Norway, the World Commission on Environment and Development (WCED, also known as the Brundtland Commission) was subsequently formed and held its first meeting in Geneva, Switzerland, in October 1984. The commission consisted of twenty-three members: four

* This recommendation can be traced back to the 1974 Declaration on the Establishment of a New International Economic Order (NIEO), which states that the purpose of the new international economic order is to “ensure steadily accelerating economic and social development.” *Declaration on the Establishment of a New International Economic Order*, Resolution 3201 (S-VI), May 1, 1974, www.un-documents.net/s6r3201.htm (accessed August 17, 2017). The declaration was released in 1974, the year the first oil crisis ended.

† United Nations Environment Programme (UNEP) (1982). Report of the Governing Council (session of a special character and 10th session, 1982), paragraph 49, page 13. Available at <http://repository.un.org/handle/11176/162474> (accessed May 29, 2018).

‡ UN General Assembly, *Resolution 38/161, Process of Preparation of the Environmental Perspective to the Year 2000 and Beyond*, December 19, 1983, sec. 8(a), www.un.org/documents/ga/res/38/a38r161.htm (accessed August 15, 2017).

from central European countries, seven from developed nations (including Maurice Strong, the chairman of the 1972 Stockholm Conference), and twelve from developing nations (WCED 1987).

Between 1984 and 1987, the Brundtland Commission received advice and support from thousands of individuals, institutions, and organizations from all over the world (WCED 1987, p. 359). The commission also visited each world region to obtain a first-hand view of environment and development issues and to hold deliberative meetings and open public hearings. On December 11, 1987, the commission's report, *Environmental Perspective to the Year 2000 and Beyond*, was submitted to, and adopted by, the UN General Assembly via Resolution 42/186 as a "broad framework to guide national action and international co-operation on policies and programmes aimed at achieving environmentally sound development."^{*} That same year, the commission's report was published as *Our Common Future*.

Benefiting from more than a decade of debate over the notion of ecodevelopment and then of sustainable development, the Brundtland Commission sought to effectively integrate social and economic development with the need for environmental protection. By combining these elements with the important notion of intergenerational equity, the commission created what has become the first widely accepted definition of sustainable development.

Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs. It contains within it two key concepts:

- the concept of "needs," in particular the essential needs of the world's poor, to which overriding priority should be given; and
- the idea of limitations imposed by the state of technology and social organization on the environment's ability to meet present and future needs.

Thus the goals of economic and social development must be defined in terms of sustainability in all countries – developed or developing, market-orientated or centrally planned. Interpretations will vary, but must share certain general features and must flow from a consensus on the basic concept of sustainable development and on a broad strategic framework for achieving it.

(WCED 1987, p. 43)

This definition highlights what has since become one of the major issues of contention about sustainable development: the *interpretation* of sustainable development by one nation might be seen as leading to "unsustainable" development by another. The ongoing debate between developed and developing nations reveals that the commission's objective to find middle ground between developed and developing nations' positions was largely unsuccessful (Cock 2002).

In keeping with the approach to development articulated by the 1974 Cocoyoc Declaration and influential publications such as *Small Is Beautiful* (Schumacher 1999)[†] and

* UN General Assembly, *Resolution 42/186, Environmental Perspective to the Year 2000 and Beyond*, December 11, 1987, p. 2, www.un.org/documents/ga/res/42/a42r186.htm (accessed August 15, 2017).

† Schumacher (1999, p. 139) rejected the idea that what "is best for the rich must be best for the poor" and redefined the conventional view of development toward human needs. "Development does not start with goods; it starts with people and their education, organization, and discipline. Without these three, all resources remain latent, untapped, potential" (ibid.). Schumacher's ideas are clearly reflected by the Cocoyoc Declaration, which establishes human needs as the focus of development efforts.

What Now: Another Development (Dag Hammarskjöld Foundation 1975),* *Our Common Future* defined the major objective of development as the “satisfaction of human needs and aspirations” (WCED 1987, p. 43). Further, it saw sustainable development not as an end state but rather as “a process of change in which the exploitation of resources, the direction of investments, the orientation of technological development, and institutional change are made consistent with future as well as present needs” (ibid., p. 9). The Brundtland Commission adopted a highly political agenda by viewing

sustainable development as a policy objective, rather than a methodology. It is an over-arching concept. [. . .] Such an approach is unapologetically normative, and places both the responsibility for problems, and the political will to overcome them, in the hands of human actors.

(ibid., p. 37)

The Brundtland Commission made a convincing argument that the environment and development are “inexorably linked” and cannot be treated as separate challenges (WCED 1987, p. 37). It concluded: “Development cannot subsist upon a deteriorating environmental resource base; the environment cannot be protected when growth leaves out of account the costs of environmental destruction” (ibid.). This recognition that the “costs of environmental destruction” need to be considered in the development equation provided the field of environmental economics with a strong endorsement. Further, the commission highlighted the role public policy could play in using “incentives and disincentives” to guide commercial organizations to develop environmentally sound technologies (ibid., p. 60). Redclift (1996, p. 18) argues that the endorsement of economic mechanisms as valid policy tools to protect the environment “effectively opened the door to environmental economics which sought to fill the policy vacuum.”

Our Common Future appeared at a time when the political climate was beginning to become more receptive to the issues raised by the report. Future prospects for economic growth in industrialized nations were beginning to look positive, while global ecosystems were beginning to show signs of distress (Engfeldt 2002). Hence, there was an international audience eager to learn how to embrace economic growth while reducing pressure on ecosystems. The commission’s insistence that science and technology could be used to meet human needs and solve environmental problems was the answer many were looking for. Toward the end of the 1980s, many governments were committed to market liberalization as a means of solving their economic problems. They saw trade as a way of stimulating ordinary (and unsustainable) economic growth. Therefore, by focusing on technological improvements that could support economic growth, conserve natural resources, and protect the environment, the commission gained the support of both developed and developing nations. As Dryzek (1997, p. 136) notes, “Sustainable development would surely lose unless it could be demonstrated that environmental conservation

* The Cocoyoc Declaration, *Small Is Beautiful*, and *What Now: Another Development* all present a consistent message of the need to redefine the whole purpose of development. They reject development that is focused on economic growth in favor of development that aims to satisfy the basic physiological and psychological needs of humankind. Although the primary focus is on meeting the basic needs of the poorest sections of each society, there is recognition that the needs of affluent sections of society are also not being satisfied. Free trade is rejected in favor of an international economic system that allows nation-states to enter and exit the economic system in concert with their own development strategies. Such an economic system is also seen to promote a more equitable distribution of economic gains and respond to concerns about environmental justice. In parallel, national sovereignty, the right to diversity, self-reliance, and endogenous development are all recognized as essential components of the satisfaction of human needs. Finally, there is a unanimous recognition that development must be in harmony with the environment.

[. . . was] obviously good for business profitability and economic growth everywhere, not just that these competing values can be reconciled.” Hence, unless science and technological innovation – two mainstays of economic growth in industrial societies – were a central theme of sustainable development, national governments (primarily of the North) would most likely have rejected the concept as another radical and politically unrealistic form of environmentalism.

By explicitly bringing science and technology into the development equation, the technologically optimistic Brundtland Commission sought to articulate a new era of economic growth where policies were designed to release human ingenuity to expand and increase the natural resource base. Hence, economic growth could continue, and the environment could be protected. The commission stipulated, however, that for this to be achieved, the protection of ecosystems “must be guaranteed,” and all “economic partners must be satisfied that the basis of exchange is equitable” (WCED 1987, p. 17).

Having articulated a bold new development agenda, the Brundtland Commission highlighted a major problem with the institutional frameworks that would implement the new era of economic and social development. It argued that most governmental environment agencies, especially those in developing nations, “tend to be independent, fragmented, [and] working to relatively narrow mandates with closed decision processes” (WCED 1987, p. 9). It stated that the same was true for many international agencies responsible for areas such as development lending, trade regulation, and agricultural development. The commission believed that the solution to these problems lay in ensuring that national and international institutions consider the ecological dimensions of policy together with economic, social, trade, energy, agricultural, and other dimensions. Such integration would close “institutional gaps” and bring environmental concerns into the center of decision-making. The idea was to develop a more proactive approach to environmental protection, rather than the more expensive “react-and-cure” approach that was typical of many government policies in the post-Stockholm era (Runnalls 2008). In parallel with this approach, the commission called for the strengthening of international law and conventions and for better implementation of these mechanisms for change.

Our Common Future was the first rigorous attempt to formulate the concept of sustainable development. A major part of its success was due to the commission’s efforts to base its recommendations on institutional and political realities and on what needed to be accomplished in the short term. The endorsement of an equitable and liberal international economy, fueled by scientific advance and technological progress that conserved resources and minimized environmental harm, resonated well with those who were struggling to reconcile development with the environment. Developed nations could continue along their development paths guided by economic incentives encouraging sustainable development. Simultaneously, developing nations could look forward to rapid economic growth by joining a more equitable international economic system.

However, even before the report’s publication, some commentators remained skeptical whether nation–states could implement the recommendations put forward (Redclift 1987). See also Runnalls (2008), who argues that the failure to dramatically reform domestic institutions and establish an international framework to address sustainability concerns is the core reason for the persistent worsening global threats.

In response mainly to the Brundtland Commission’s call for an international conference to “review progress made, and to promote follow-up arrangements [. . . to *Our Common Future*] to set benchmarks and to maintain human progress within the guidelines of human needs and natural laws” (WCED 1987, p. 343), the UN General Assembly decided to “convene the United Nations Conference on Environment and Development”*

* UN General Assembly, *Resolution 44/228, United Nations Conference on Environment and Development*, December 22, 1989, p. 1, www.un.org/documents/ga/res/44/a44r228.htm (accessed August 15, 2017).

(UNCED) in Brazil in 1992.* The decision to hold the conference in a developing nation – especially one that had made significant progress on environmental issues since the 1972 Stockholm Conference – “had enormous political relevance and symbolism” (McCormick 1995, p. 254). In addition, the importance of the UNCED was reinforced when it was decided that the conference should be held at the “summit level,” meaning that heads of state should be present. This decision had the effect of renaming the UNCED in the media as the Earth Summit (Strong 2003).

The UNCED was subsequently held in Rio de Janeiro June 3–14, 1992, and attracted some 178 nation-states, including 110 heads of state who attended the final two-day meeting (UN 1993b, 1993c, 1993d). The Earth Summit (also known as the Rio Summit) was much larger than the Stockholm Conference and was the first time in history that so many influential people had gathered in one place.

The main objectives of the UNCED were to review the progress that had been made since the Stockholm Conference and to identify strategies, programs, legal mechanisms, financial resources, and regional/national/global institutional frameworks that could protect and enhance the environment in the socioeconomic development process of all nation-states.† Its purpose was nothing less than to develop ways to protect the planet and ensure the welfare and future of humankind. Further, the UNCED planned to bridge the major conflicts between developed and developing nations in order to increase the likelihood that its outcomes would be implemented (Linner and Selin 2003). For this objective to be achieved, the impact that both poverty and affluence, individually and together, have on the environment needed to be addressed in the search for sustainable forms of economic development (South Centre 2002a).

The UNCED produced three official agreements: (1) the Rio Declaration on Environment and Development; (2) Agenda 21; and (3) the Statement on Forest Principles.‡ In keeping with the Stockholm format, the Rio Declaration provided a statement of principles that was supported by an action plan (Agenda 21) for its implementation. In addition, two conventions were opened for signature – the Convention on Biological Diversity and the Framework Convention on Climate Change. These conventions were a response to events of the late 1980s that raised concerns about the continuing extinction of species and depletion of biodiversity (the first environmental concern underlying sustainable

* Although the 1980s had witnessed a rise in the use of the term “sustainable development,” it was not used in the title of the conference because influential developing countries feared that doing so would reduce their freedom of action. Their position was that the title “Environment and Development” provided a level of ambiguity that strengthened their case that the environmental destruction witnessed during the latter part of the twentieth century was caused primarily by developed countries. Hence, developed nations should take the lead in rectifying the environmental destruction experienced around the world (Engfeldt 2002). In a similar context, Sachs (2001) argues that the word “development” in the title of the conference was a code word used by developing countries to express their desire for “recognition and justice” (ibid., p. 5). Following the aborted negotiations for a new international economic order in the 1970s and the international debt crisis of the 1980s, developing nations had a strong case for placing their “right to development” at the forefront of discussion (ibid.). Principle 3 of the Rio Declaration – “the right to development must be fulfilled so as to equitably meet developmental and environmental needs of present and future generations” – speaks directly to these concerns. Notwithstanding the politics behind the official title of the Earth Summit, Dernbach (1998) argues that the international community’s efforts to “synthesize and integrate environment and development issues” (ibid., p. 21) provided a strong endorsement to the notion of sustainable development.

† UN General Assembly, *Resolution 44/228, United Nations Conference on Environment and Development*, December 22, 1989, secs. 15(a)–15(w), www.un.org/documents/ga/res/44/a44r228.htm (accessed August 15, 2017).

‡ For an informative discussion of the UNCED agreements, see Grubb, Koch et al. (1993).

development in our framework) and about ozone depletion and global climate change* (the fourth environmental concern).

The UNCED agreements highlight a transition in the international community's conceptualization of development. The notion that prevailing economic policies were deepening economic divisions between developed and developing nations was widely understood by the Earth Summit delegates (UN 1993a). Therefore, the UNCED agreements sought to manage and protect ecosystems so as to establish a *prosperous* future for humankind. Further, it was widely accepted that no nation-state could achieve the objective of sustainable development on its own. As Caldwell and Weiland (1996, p. 107) note, the recognition that global international action would be required to address issues such as climate change meant that "Only One Earth" – the title of the Stockholm Conference – "became an operational reality at Rio."

Continuing the Brundtland Commission's conception of sustainable development, the Rio Declaration and Agenda 21 did not supplant prior approaches to development; rather, they revised (in fundamental ways) the *conventional development* approach. Before the 1990s, the conventional development model (promoted by the international community) incorporated four related concepts: (1) peace and security; (2) economic development; (3) social development; and (4) national governance that secures peace and development (Dernbach 1998, 2004, 2011). The Brundtland Commission and the UNCED agreements called for environmental concerns to be *integrated* into the conventional development model. Principles 3 and 4 of the Rio Declaration speak directly to this aim:†

Principle 3: The right to development must be fulfilled so as to equitably meet developmental and environmental needs of present and future generations.

Principle 4: In order to achieve sustainable development, environmental protection shall constitute an integral part of the development process and cannot be considered in isolation from it.

The recognition of the need to protect the environment – on which the development process depends – can be considered the "fifth element" of the international notion of development (Dernbach 1998, p. 21).

Whereas the Rio Declaration provided a vision of sustainable development, Agenda 21 provided a comprehensive plan of action that was created to guide and coordinate the work of the UN, governments, and other major groups in their efforts to transition society toward sustainable development. In this regard, Agenda 21 is often described as the first blueprint for sustainable development. The preamble to Agenda 21 states that national strategies, plans, policies, and processes are crucial to achieving its successful implementation, and the responsibility for sustainable development consequently lies with national governments. With the emergence of globalization and regional integration over the past two decades, the idea of making national governments responsible for achieving sustainable development is open to debate. For example, the formation of the European Union (EU) provides an alternative regional model for international engagement (see Chapter 10).

Although the UNCED is considered a watershed event in the formation of sustainable development, Box 2.1 provides a discussion of several important dissenting views.

* The decision to develop the Convention on Climate Change was made at the first meeting of the Intergovernmental Panel on Climate Change (IPCC), established by the World Meteorological Organization (WMO) and the UNEP, in 1988.

† *UNCED Declaration on Environment and Development*, www.un.org/documents/ga/conf151/aconf15126-lannex1.htm (accessed August 15, 2017).

Box 2.1 Critiques of the Earth Summit and the Rio Declaration

The 1992 United Nations Conference on Environment and Development (UNCED), commonly known as the Earth Summit, is seen as a seminal event, when the international community gathered to recognize and articulate the concept of sustainable development. Indeed, the summit was unprecedented in its scale and scope. Its mission was to revolutionize the way we think and live so as to protect the planet and ensure the welfare and future of humankind. A major part of this vision was to bridge the conflicts between developed and developing nations that had preoccupied many of the “development” discussions of the previous twenty years. However, although the Earth Summit was perceived by many to have addressed these issues successfully (given the challenge of achieving consensus among so many nation-states), there were those who argued that the summit had sidestepped vitally important and politically volatile questions.

In their review of the Rio Declaration, Grubb et al. (1993) argue that the principles reveal weaknesses in the compromises that were agreed on to make the declaration politically palatable. “Far from a timeless ethic, it was [. . .] a snapshot of history” (ibid., p. 85). A significant turning point in the negotiations of the declaration was the success of developing nations in placing their “right to development” at the forefront of considerations (Sachs 2001). The recognition that less developed nations needed to “develop” meant that the Rio Declaration effectively turned into a “declaration on development, rather than on environment” (ibid., p. 5). Further, because “development” can be defined in multiple ways, it can be argued that the Rio Declaration supports a business-as-usual approach to development where the environment is more of an afterthought.

On the eve of the UNCED, David Korten, founder and president of the People-Centered Development Forum, published a column that highlighted three questions that he argued had not been asked in the pre-summit discussions:

- “Is sustained economic growth possible within a finite ecosystem?”
- “Is the removal of barriers to the free international flow of trade and capital consistent with the essential need for community and environmental stewardship?”
- “Is official international assistance part of the solution or part of the problem?”^a

The first two questions addressed the conviction that economic growth would be sufficient to alleviate the world’s problems of poverty and environmental degradation. Korten argued that even a smarter (more environmentally sound) approach to sustained economic growth ignores data that indicates that the earth cannot support the scale of economic (that is, industrial) expansion envisioned by its proponents. Second, a reliance on free trade is likely to enable goods and capital to move freely across national borders, weakening the ability of governments to regulate their own economies and protect their citizens against fluctuations in the international economy.

Where corporate globalists tell of the spread of democracy and vibrant market economies, civil society tells of the power to govern shifting away from people and communities to financial speculators and global corporations dedicated to the blind pursuit of short-term profit in disregard of human and natural concerns.^b

Korten saw the UNCED process as being dominated by nation-states whose political power and social systems were grounded in market capitalism. Hence, there was no incentive for them to consider alternative forms of development that moved away from economic growth through industrialization.^c Those nations, groups, or individuals who questioned the economic belief that a “rising tide will raise all boats” faced ridicule for being insensitive to the needs of the poor.

Korten’s third question was based on the fact that although the amount of aid given to developing nations had increased over the previous four decades, environmental conditions in these nations had consistently worsened. Therefore, it seemed only logical to ask whether there were alternative international mechanisms through which developing nations could be assisted.

In response to Korten’s column, Herman Daly (1992) suggested that the first question was becoming impossible to ignore because of an increasing volume of data on the declining vitality of the earth’s ecosystems. He also suggested that Korten’s second and third questions were vitally important and would be the most challenging to address. Rather than attempting to tackle them at Rio, he recommended that they be resolved through further research after the summit and that the UNCED focus its attention on the first question. A look at both the Rio Declaration and Agenda 21 provides some evidence that the UNCED did attempt to address the first question directly. For example, Rio Principle 8 calls for nation-states to try to “reduce and eliminate unsustainable patterns of production and consumption.” In support of this principle, Agenda 21 dedicates an entire section to promoting “patterns of consumption and production that reduce environmental stress” (UN 1993a, p. 31).

One year after the Earth Summit, the *Ecologist* magazine published *Whose Common Future?* (1993), which addressed questions similar to those raised by Korten. However, its critique of the summit was rather more scathing. A main conclusion of *Whose Common Future?* is that communities should be reinstated as sources of social and political authority, and the idea that the modern CEO faces the same common future as the peasant in Bihar should be rejected. A critical question raised by the book is who will manage the environment for whose interest? It argues that how the environment should be managed is known through past experience and indigenous/local knowledge – both of which are becoming lost in the international economy. Further, the book’s arguments highlight the importance of balancing the role of national/local government with the role of the market, both of which must be held accountable to the people’s interests by the legal/institutional frameworks of civil society.

Finally, Michael Redclift (1996) provides a valuable retrospective on the Earth Summit. His main criticism is that its spectators might have been convinced that the principal environmental problems facing the world were “climate change, a loss of forests and, with them, biodiversity” (ibid., p. 19). Redclift argues that the UNCED neglected to address important questions relating to population, trade, poverty, the debt crisis (faced by many oil-importing developing nations), and distributional inequality more generally. In addition, he raises the important question whether the “development” of industrialized nations is what the developing world should be aspiring to achieve.

a D. Korten (1991), People-Centered Development Forum, “The UN Conference on Environment and Development: Unasked Questions,” Column no. 12, April 15, <http://livingeconomiesforum.org/1991/12KORTEN> (accessed January 13, 2011).

- b** D. Korten (2003), *Global Economics, Environmental Integrity, and Justice: Reflections of an "Economic Missionary,"* National Council of Churches, *Enough for All: Sustainable Living in a Global World*, Seattle University, June 20–23, www.pcdf.org/2003/NCC.htm (accessed May 13, 2010).
- c** In a speech to the World Business Council on Sustainable Development (WBCSD) on November 4, 1999, Gro Harlem Brundtland admitted that markets are not always right. To provide an example, she quoted a former prime minister of India who "saw no multinational companies willing to invest in educating the children of India, or immunising them and helping them to grow up" (Saha 2002, p. 23).

2.4.2 The Earth Summit II and III

In 1997, five years after the Earth Summit, the UN held a General Assembly Special Session (otherwise known as the Earth Summit II or Earth Summit+5) to review and appraise the implementation of Agenda 21. The evidence presented indicated that the condition of the global environment had continued to deteriorate and looked set to worsen (UNCSD 1997). Although some nations had been able to reduce pollution levels and the degradation of resources through institutional change and capacity-building efforts (involving both public participation and private-sector actions), these actions were not sufficient to counteract the sheer scale of human activity that fed negative environment and development trends (*ibid.*, p. 5).

In 2002, the Johannesburg Summit (or the Earth Summit III) was held to review progress since the UNCED. During the ten years since Rio, the world had experienced a new phase of economic growth that was largely based on patterns of development, consumption, and lifestyles that had the effect of widening the gap between affluent and poor nations (South Centre 2002b). Although many developed nations had experienced enhancements in their overall quality of life, the direct or indirect effects of globalization led to the gradual degradation of the social, economic, political, and natural environment in many developing nations (*ibid.*, pp. 6–7). Further, the international economic system was still far from being equitable. Differing levels of development and bargaining power throughout the world meant that the international economy tended to be dominated by those with excessive economic and political power.

Although there was a clear high-level commitment to make progress at Johannesburg, the intractable problems identified at the time of the 1997 Earth Summit II continued to be a problem during the Johannesburg plenary sessions. The final meeting of the Preparatory Committee for the Johannesburg Summit, held in Bali, Indonesia, from May 27 to June 7, 2002, failed to break the deadlock between developed and developing nations on how to reconcile the conflicting goals of economic development, poverty reduction, and environmental protection (New Scientist 2002a, 2002c).

An important development at the Johannesburg Summit was the recognition that the new era of economic globalization had changed the approaches considered necessary to transition the world toward sustainable development. The Johannesburg Declaration states that "the rapid integration of markets, mobility of capital and significant increases in investment flows around the world have opened new challenges and opportunities for the pursuit of sustainable development" (UN 2002). In addition to reaffirming a commitment to sustainable development, the declaration specifically urges developed nations to provide the internationally agreed-on levels of official development assistance (ODA) to developing nations. Further, and for the first time in such a declaration, the private sector is called on to recognize its role in achieving sustainable development. Finally, the

declaration states that the goals of sustainable development will be achieved through “effective, democratic and accountable international and multilateral institutions,” putting multilateralism at the center of sustainable development efforts (ibid.).

A significant outcome from the Johannesburg process was the international community’s commitment to market mechanisms and capacity building (or capacity development) as critical measures to achieve sustainable development. Developing nations, however, were concerned about the nature of this transition because it reduced the pressure on (and responsibility of) developed nations to provide their agreed-on share of overseas development assistance since “the market” would make up for any shortfall. The transition toward reliance on the market reflects a continuing ideological shift away from the role of the government as a policy driver.* In effect, the trend to greater trade liberalization allows industry (in theory) to escape or minimize the social costs of production by locating its operations in places where national laws of environmental protection are weak and good health and the environment are less valued. Alternatively, governments might be coerced into adjusting regulations to lower the financial risk of investing in their nation compared with other nation-states. If such regulatory adjustments have the effect of lowering environmental and worker health and safety standards, this outcome would clearly be a shift away from the objectives of sustainable development. The emphasis given to the international economy for development assistance further reinforced the international economy as the mechanism through which nation-states should follow their right to development.

The decisions by the United States to withdraw from many multilateral agreements and, instead, focus on voluntary partnerships, signaled to many environmental organizations that the United States was attempting to redefine sustainable development away from environment and development issues toward trade liberalization (James 2002). The fact that the Johannesburg delegates were able to reject a sentence from the summit’s final resolution that would have given the WTO a judicial role in trade and environment disputes indicates that the lines are drawn for a future battle on economic globalization (New Scientist 2002b).

Two other notable documents that contribute to an understanding of sustainable development are the Earth Charter (launched by the Earth Charter Commission in 2000) and the United Nations Millennium Declaration. Interestingly, the structures of both the Earth Charter† and the Millennium Declaration‡ align closely with the five components of sustainable development: peace and security; economic development; social development; national governance that ensures peace and development; and environmental protection. Because the two publications are produced by different sources (the UN and a nongovernmental organization [NGO]), it provides additional support for the notion that “sustainable” development can be broadly defined using these five critical elements.

* See the discussion of the so-called Washington Consensus in Section 3.4.1 of Chapter 3.

† The Earth Charter Initiative, *The Earth Charter*, <http://earthcharter.org/discover/the-earth-charter/> (accessed August 15, 2017).

‡ The major headings of the United Nations Millennium Declaration are the following: (1) values and principles (specifically: freedom; equality; solidarity; tolerance; respect for nature; and shared responsibility); (2) peace, security, and disarmament; (3) development and poverty eradication; (4) protecting our common environment; (5) human rights, democracy, and good governance; (6) protecting the vulnerable; (7) meeting the special needs of Africa; and (8) strengthening the United Nations. United Nations, *United Nations Millennium Declaration*, www.un.org/millennium/declaration/ares552e.htm (accessed August 15, 2017).

2.4.3 *Rio+20 and the green economy*

In June 2012, twenty years after the 1992 Rio conference, the United Nations Conference on Sustainable Development (known as Rio+20) was held in Rio de Janeiro, Brazil. The conference was attended by some 50,000 policymakers, environmentalists, and business leaders, who were charged with reinvigorating the international community's efforts to promote sustainable development. The two themes of the conference were (1) the green economy in the context of sustainable development and poverty eradication, and (2) creating an institutional framework for sustainable development. Further, the preparatory meetings to Rio+20 revealed seven critical issues that needed priority attention. These issues covered jobs, energy, cities, food, water, oceans, and natural disasters.

The principle outcome from the conference was the endorsement of the "green economy" as a flexible mechanism for advancing sustainability. Given its emergence in the sustainable development lexicon, the mechanism is explored in more detail below.

With regards to creating an institutional framework for sustainable development, the outcome from the conference can best be described as one that enhances/strengthens/clarifies existing frameworks, rather than establishes new frameworks. For example, conference attendees committed to strengthening UNEP so it can fulfill its role as a leading authority on the global environmental agenda. One important step in this regard was the call to stabilize UNEP's funding from the UN and from voluntary contributions. The conference report also calls for the parties to multilateral environmental agreements to work together to reduce any unnecessary overlap that exists between agreements (see Section 10.3 in Chapter 10 for a discussion of international environmental law). However, beyond the general recognition of the need for an "inclusive, transparent, reformed, strengthened and effective multilateral system" (UN 2012, p. 14), Rio+20 failed to establish a comprehensive framework with commitments and targets for long-term action. These commitments would later emerge in the form of the Sustainable Development Goals (SDGs).

The 2010 UN report on the "Objective and themes of the United Nations Conference on Sustainable Development" provides a useful commentary on the prevailing international view of sustainable development (UN 2010). The report reaffirms the need for an integrated and "balanced consideration of social, economic and environmental goals and objectives in both public and private decision-making" (*ibid.*, p. 3), and recognizes that the focus on a green economy lies firmly within the environment and economic dimensions. The Rio+20 conference provided decision-makers with an opportunity to revisit the message from the 1992 Rio conference – that economic development (*i.e.*, growth) must be decoupled from environmental harm. The green economy was the conceptual framework the UN system promoted to achieve this objective. However, it should be noted that the green economy "does not 'supplant' or substitute for sustainable development but rather is best understood as a means to achieving the end of sustainable development" (*ibid.*, p. 5).

The Rio+20 conference report, entitled *The Future We Want*, provides the following commentary on the green economy in the context of sustainable development and poverty eradication:

We affirm that there are different approaches, visions, models and tools available to each country, in accordance with its national circumstances and priorities, to achieve sustainable development in its three dimensions which is our overarching goal. In this regard, we consider green economy in the context of sustainable development and poverty eradication as one of the important tools available for achieving sustainable development and that it could provide options for policymaking but should not be a rigid set of rules. We emphasize that it should contribute to eradicating poverty as well as sustained economic growth, enhancing social inclusion, improving human welfare

and creating opportunities for employment and decent work for all, while maintaining the healthy functioning of the Earth's ecosystems.

(UN 2012, p. 9)

The concept of the green economy builds on the modernist development stance established in the Brundtland report and at the 1992 Rio conference. This approach is reflected in the conference report, which recognizes "the critical role of technology as well as the importance of promoting innovation" to make progress towards sustainable development and reduce poverty (UN 2012, p. 13). The report also emphasizes the importance of technology transfer to developing countries as a key part of this strategy.

The transition to a green global economy is likely to require significant investment in new technology combined with more stringent national and international regulations/standards to curb undesired levels of pollution and stimulate innovation (Ashford and Hall 2011). These types of actions have revived the concerns of developing countries, who argue they could face green protectionism, conditionality, and subsidies that protect the domestic economies of developed regions (UNCSD and UNCTAD 2011). Thus, the tension between competitiveness and environmental standards, and the impact that transition strategies might have on trade, are likely to become important areas of debate in the coming decade. There is also a concern that the green economy may create a growing "technology gap" between advanced and emerging economies, where countries with the financial and innovative capacity can sustain and expand their leading position, leaving others behind (UN 2010). This concern has increased the focus on mechanisms to transfer or share technologies with emerging economies, which raises important questions in areas such as intellectual property. Many of the challenges that will accompany a transition to a green economy are clearly articulated in several reports prepared for Rio+20 (UN 2010; Ocampo et al. 2011; UNCSD and UNCTAD 2011; UNEP 2011).

The question of whether economic growth can be decoupled from environmental pressures is the subject of Smith et al.'s (2010) book entitled *Cents and Sustainability*. Following in the footsteps of *Our Common Future*, *Cents and Sustainability* provides an in-depth look at potential decoupling pathways. The book's focus on sustained economic growth is defended by the argument that since "there is no sign of any government committing to 'slow' economic growth [...] efforts to decouple are the only realistic option and need to be better informed and accelerated" (Smith et al. 2010, p. xliii).

Cents and Sustainability argues that since wealth (and hence consumption) and population are unlikely to decline in the medium term, significant technological changes present the only practical way to make progress towards the goal of absolute decoupling and, hence, environmental sustainability. One challenge, however, is that the promotion of green technology may only have a marginal impact on the total number of jobs – see Getzner (2002, 2004), Walz (2010), and Lorek and Spangenberg (2014). The reason for this is that while green technologies do create new jobs, they also destroy jobs in industries that become technologically inferior. These industries tend to be the traditional energy industries. An additional problem is that as new innovations are created, the form in which they are originally introduced tends to be the most labor intensive. As new process innovations take place, labor can – or is likely to – be replaced by capital, and jobs are lost in the process. Furthermore, when opportunities for additional technological modernization are seized, more labor can be shed. Thus, for the decoupling approach and the green economy to be successful, there needs to be an explicit consideration of how meaningful and well-paid jobs and earning capacity can be enhanced and become a part of the creation and delivery of new, highly efficient products, processes, and services (Ashford et al. 2012).

The principal argument of *Cents and Sustainability* and reports such as UNEP's *Towards a Green Economy* is that economic growth can coexist with environmental

protection – reinforcing the message from the 1992 Rio conference that economic growth and environmental protection can advance in unison while reducing poverty. The publications are based on a premise that a decoupling agenda or green economy presents the most viable pathway towards sustainable development. A critical question though, is whether the policies and mechanisms that promote a green economy or decoupling lead to evolutionary or revolutionary change.

As currently envisioned, the green economy rests heavily on the notion that green growth will drive progress towards sustainability. The question not addressed at Rio+20 is how this green growth agenda will lead to the necessary fundamental and equitable reconfiguration of the global economy in time to address challenges such climate change. For example, Hoffmann (2011) provides an array of arguments that cast doubt on the ability for green growth to significantly reduce greenhouse gas emissions in an absolute and permanent way on a global scale. He remarks:

“Green growth” naively postulates that technological progress and structural change would be sufficient to uncouple economic from GHG and resources/material consumption growth, without questioning the existing asymmetrical market structures, related supply-chain governance, and economic driving forces (dematerialized growth will remain an illusion under the prevailing capitalist accumulation imperative). . . .

Without democratization of economies and changes in income-distribution and culture related to consumption behaviour, the required fundamental transformation will remain illusory.

(Hoffmann 2011, pp. 14–15)

If the answer to sustainable development is not found in technology-enabled green growth, the question becomes what other options exist? The dominance of growth (in general) as an overarching goal is perhaps the most significant barrier confronting sustainable development. Daly’s (1996) notion of the steady-state economy is one example of an alternative development model, whereby the economy operates within ecosystem limits. Another approach would be to focus on human-centered development, where, for example, the production and consumption of products is replaced by activities that would enable people to do things for people. Thus, the focus on economic growth would be replaced by a focus on growing opportunities for people to serve people, rather than engaging in the making of material- and energy-intensive products. The agenda endorsed at Rio+20 has ensured that *growth* will remain the objective of development for the foreseeable future. Put another way, Rio+20 failed to establish an alternative agenda to growth.

2.4.4 The 2015 Sustainable Development Goals (SDGs)

Three years after Rio+20, the United Nations Sustainable Development Summit was held in New York to adopt the post-2015 development agenda. The creation of the post-2015 agenda emerged from an unprecedented global dialogue that included thematic discussions, national consultations in 88 countries, and the development of numerous reports. This process led to the creation of three notable sets of Sustainable Development Goals by the UN’s intergovernmental Open Working Group on Sustainable Development Goals (OWG) (17 goals) (UN 2014), the High-Level Panel on the Post-2015 Development Agenda (12 goals) (UN 2013), and the Sustainable Development Solutions Network (10 goals) (SDSN 2014).

The final set of 17 SDGs (drafted by the OWG) was adopted by the UN General Assembly on September 25, 2015 (see Figure 2.1). The new SDGs – shown in Table 2.4 alongside the previous eight MDGs – and targets are described as “integrated and indivisible, global in nature and universally applicable, taking into account different national realities,

SUSTAINABLE DEVELOPMENT GOALS



Figure 2.1 The Sustainable Development Goals

Source: United Nations

Table 2.4 The MDGs and SDGs

<i>2000 – Millennium Development Goals (MDGs)</i>	<i>2015 – Sustainable Development Goals (SDGs)</i>
Goal 1: Eradicate extreme poverty and hunger	Goal 1: End poverty in all its forms everywhere Goal 2: End hunger, achieve food security and improved nutrition, and promote sustainable agriculture Goal 10: Reduce inequality within and among countries
Goal 2: Achieve universal primary education	Goal 4: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all
Goal 3: Promote gender equality and empower women	Goal 5: Achieve gender equality and empower all women and girls
Goal 4: Reduce child mortality	Goal 3: Ensure healthy lives and promote well-being for all at all ages
Goal 5: Improve maternal health	
Goal 6: Combat HIV/AIDS, malaria, and other diseases	
Goal 7: Ensure environmental sustainability	Goal 14: Conserve and sustainably use the oceans, seas, and marine resources for sustainable development Goal 15: Protect, restore, and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss
Goal 8: Develop a global partnership for development	Goal 16: Promote peaceful and inclusive societies for sustainable development, provide access to justice for all, and build effective, accountable, and inclusive institutions at all levels Goal 17: Strengthen the means of implementation and revitalize the global partnership for sustainable development
–	Goal 6: Ensure availability and sustainable management of water and sanitation for all
–	Goal 8: Promote sustained, inclusive, and sustainable economic growth, full and productive employment, and decent work for all
–	Goal 9: Build resilient infrastructure, promote inclusive and sustainable industrialization, and foster innovation
–	Goal 11: Make cities and human settlements inclusive, safe, resilient, and sustainable
–	Goal 12: Ensure sustainable consumption and production patterns
–	Goal 13: Take urgent action to combat climate change and its impacts

capacities and levels of development and respecting national policies and priorities” (UN 2015b, p. 13). The challenge now facing nations is how to operationalize the 17 goals and 169 targets. The interconnectedness of the goals and targets will require the multipurpose and co-optimized design of policies that can impact both the human and natural realms.

In this regard, the SDGs make an important step forward by recognizing that the static and linear approaches to decision-making need to be replaced by “more dynamic, integrated, natural and human system models that incorporate the dynamics of stocks, flows, trade-offs, and synergies” (Costanza et al. 2016, p. 59). Work has already begun on how to map the influence of one SDG or target on another, recognizing that these relationships are likely to vary by geographic location, governance structures, and available technology (Nilsson et al. 2016). However, some have argued that it will be impossible to achieve all 17 SDGs based on previous development trajectories (Spaiser et al. 2016) or inherent contradictions among the goals (Spangenberg 2016), highlighting the critical importance of disruptive innovation/change – a central theme of this book.

The post-2015 agenda is the latest evolution in the concept of sustainable development, which looks set to continue to evolve in relation to new knowledge and world events. While six of the SDGs do not easily map onto the previous eight MDGs (see Table 2.4), with the exception of the emerging interest in resilient cities/infrastructure, the new goals reflect ideas that have long been addressed or discussed by the international community. Thus, the SDGs can be considered as providing a more comprehensive statement of the ideas embodied within the concept of sustainable development. They also continue to advance a technologically optimistic and growth-oriented approach to development that has its roots in the Brundtland formulation of sustainable development. For example, SDG 9 calls for “inclusive and sustainable industrialization” supported by “innovation,” and SDG 8 for “sustained, inclusive, and sustainable economic growth, full and productive employment, and decent work for all.” This book combines these two goals and explores how innovation-fueled “green” growth can create meaningful and well-paid employment and capital ownership opportunities for all in a global economy.

2.5 The critical importance of employment

What is perhaps most striking about the current conceptualization of sustainable development is the inadequate treatment of employment. For example, McEntire (2005) provides a succinct review of many of the publications and events that are commonly associated with environmental sustainability; however, like many commentators on the subject, he does not identify employment as an important aspect. The reason for this is the strong emphasis given to environmental challenges at the 1972 Stockholm and 1992 Rio conferences, which effectively locked sustainability thinking into an environment and development (that is, economic) framework.

Early expressions of sustainability in terms of working conditions and economic welfare do exist – for example, in the 1944 Declaration of Philadelphia developed at the creation of the International Labour Organization (ILO) – but these have yet to be formally integrated into the environmental sustainability perspective. The separation and isolation of these approaches to development must obviously be bridged for a successful modern approach to sustainable development. One step toward this objective is to highlight several connections between the 1972 Stockholm Declaration and the 1944 Declaration of Philadelphia.

The Stockholm Declaration focuses on the preservation and improvement of the human living environment. Several of the key principles of the declaration are shown in Table 2.5, which organizes them according to Dernbach’s (1998, 2004) five components of sustainable development: peace and security; economic development; social development; national governance that ensures peace and development; and environmental protection measures. In contrast, the Declaration of Philadelphia, developed by the ILO more than twenty years earlier, was adopted to enhance the condition of the human working

Table 2.5 Dermbach's (1998) five components of sustainable development and the principles of the Stockholm and Rio Declarations

<i>Component of sustainable development</i>		<i>Principles of the Stockholm Declaration^a</i>	<i>Principles of the Rio Declaration^b</i>
Peace and security	Principle 26 – Man and his environment must be spared the effects of nuclear weapons and all other means of mass destruction. States must strive to reach prompt agreement, in the relevant international organs, on the elimination and complete destruction of such weapons.		Principle 24 – Warfare is inherently destructive of sustainable development. States shall therefore respect international law providing protection for the environment in times of armed conflict and cooperate in its further development, as necessary. Principle 25 – Peace, development, and environmental protection are interdependent and indivisible. Principle 26 – States shall resolve all their environmental disputes peacefully and by appropriate means in accordance with the Charter of the United Nations.
	Principle 8 – Economic and social development is essential for ensuring a favorable living and working environment for man and for creating conditions on earth that are necessary for the improvement of the quality of life. Principle 18 – Science and technology, as part of their contribution to economic and social development, must be applied to the identification, avoidance, and control of environmental risks and the solution of environmental problems and for the common good of mankind.		Principle 5 – All States and all people shall cooperate in the essential task of eradicating poverty as an indispensable requirement for sustainable development, in order to decrease the disparities in standards of living and better meet the needs of the majority of the people of the world. Principle 12 – States should cooperate to promote a supportive and open international economic system that would lead to economic growth and sustainable development in all countries, to better address the problems of environmental degradation. Trade policy measures for environmental purposes should not constitute a means of arbitrary or unjustifiable discrimination or a disguised restriction on international trade [...]
Social development	Principle 1 – Man has the fundamental right to freedom, equality, and adequate conditions of life, in an environment of a quality that permits a life of dignity and well-being, and he bears a solemn responsibility to protect and improve the environment for present and future generations. In this respect, policies promoting or perpetuating apartheid, racial segregation, discrimination, colonial and other forms of oppression, and foreign domination stand condemned and must be eliminated.		Principle 25 – <i>see above</i> . Principle 1 – Human beings are at the center of concerns for sustainable development. They are entitled to a healthy and productive life in harmony with nature. Principle 8 – To achieve sustainable development and a higher quality of life for all people, States should reduce and eliminate unsustainable patterns of production and consumption and promote appropriate demographic policies.
			Principle 20 – Women have a vital role in environmental management and development. Their full participation is therefore essential to achieve sustainable development.

Principle 16 – Demographic policies which are without prejudice to basic human rights and which are deemed appropriate by Governments concerned should be applied in those regions where the rate of population growth or excessive population concentrations are likely to have adverse effects on [...] the human environment and impede development.

Principles 8 and 18 – *see above*.

Principle 13 – In order to achieve a more rational management of resources and thus to improve the environment, States should adopt an integrated and coordinated approach to their development planning so as to ensure that development is compatible with the need to protect and improve [the] environment for the benefit of their population.

Principle 14 – Rational planning constitutes an essential tool for reconciling any conflict between the needs of development and the need to protect and improve the environment.

Principle 15 – Planning must be applied to human settlements and urbanization with a view to avoiding adverse effects on the environment and obtaining maximum social, economic, and environmental benefits for all. In this respect projects which are designed for colonialist and racist domination must be abandoned.

Principle 17 – Appropriate national institutions must be entrusted with the task of planning, managing, or controlling the environmental resources of States with a view to enhancing environmental quality.

Principles 16 and 26 – *see above. The preamble to the declaration also reinforces the importance of national governance.*

National governance that ensures peace and development

Principle 21 – The creativity, ideals, and courage of the youth of the world should be mobilized to forge a global partnership in order to achieve sustainable development and ensure a better future for all.

Principle 25 – *see above*.

Principle 3 – The right to development must be fulfilled so as to equitably meet developmental and environmental needs of present and future generations.

Principle 10 – Environmental issues are best handled with participation of all concerned citizens, at the relevant level. At the national level, each individual shall have appropriate access to information concerning the environment that is held by public authorities, including information on hazardous materials and activities in their communities, and the opportunity to participate in decision-making processes. States shall facilitate and encourage public awareness and participation by making information widely available. Effective access to judicial and administrative proceedings, including redress and remedy, shall be provided.

Principle 11 – States shall enact effective environmental legislation. Environmental standards, management objectives, and priorities should reflect the environmental and development context to which they apply. Standards applied by some countries may be inappropriate and of unwarranted economic and social cost to other countries, in particular developing countries.

Principle 13 – States shall develop national law regarding liability and compensation for the victims of pollution and other environmental damage. States shall also cooperate in an expeditious and more determined manner to develop further international law regarding liability and compensation for adverse effects of environmental damage caused by activities within their jurisdiction or control to areas beyond their jurisdiction.

(Continued)

Table 2.5 (Continued)

<i>Component of sustainable development</i>	<i>Principles of the Stockholm Declaration^a</i>	<i>Principles of the Rio Declaration^b</i>
Environmental protection measures	Principle 2 – The natural resources of the earth, including the air, water, land, flora, and fauna and especially representative samples of natural ecosystems, must be safeguarded for the benefit of present and future generations through careful planning or management, as appropriate. Principle 3 – The capacity of the earth to produce vital renewable resources must be maintained and, wherever practicable, restored, or improved. Principle 4 – Man has a special responsibility to safeguard and wisely manage the heritage of wildlife and its habitat, which are now gravely imperilled by a combination of adverse factors. Nature conservation, including wildlife, must therefore receive importance in planning for economic development. Principle 5 – The non-renewable resources of the earth must be employed in such a way as to guard against the danger of their future exhaustion and to ensure that benefits from such employment are shared by all mankind.	Principle 22 – Indigenous people and their communities and other local communities have a vital role in environmental management and development because of their knowledge and traditional practices. States should recognize and duly support their identity, culture, and interests and enable their effective participation in the achievement of sustainable development. Principle 4 – In order to achieve sustainable development, environmental protection shall constitute an integral part of the development process and cannot be considered in isolation from it. Principle 7 – States shall cooperate in a spirit of global partnership to conserve, protect, and restore the health and integrity of the Earth's ecosystem. In view of the different contributions to global environmental degradation, States have common but differentiated responsibilities. The developed countries acknowledge the responsibility that they bear in the international pursuit of sustainable development in view of the pressures their societies place on the global environment and of the technologies and financial resources they command. Principles 8, 11, and 13 – <i>see above.</i> Principle 14 – States should effectively cooperate to discourage or prevent the relocation and transfer to other States of any activities and substances that cause severe environmental degradation or are found to be harmful to human health.

Principle 6 – The discharge of toxic substances or of other substances and the release of heat, in such quantities or concentrations as to exceed the capacity of the environment to render them harmless, must be halted in order to ensure that serious or irreversible damage is not inflicted upon ecosystems. The just struggle of the peoples of ill[-affected] countries against pollution should be supported.

Principle 7 – States shall take all possible steps to prevent pollution of the seas by substances that are liable to create hazards to human health, to harm living resources and marine life, to damage amenities, or to interfere with other legitimate uses of the sea.

Principle 15 – In order to protect the environment, the precautionary approach shall be widely applied by States according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation.

Principle 16 – National authorities should endeavor to promote the internalization of environmental costs and the use of economic instruments, taking into account the approach that the polluter should, in principle, bear the cost of pollution, with due regard to the public interest and without distorting international trade and investment.

Principle 17 – Environmental impact assessment, as a national instrument, shall be undertaken for proposed activities that are likely to have a significant adverse impact on the environment and are subject to a decision of a competent national authority.

Principle 18 – States shall immediately notify other States of any natural disasters or other emergencies that are likely to produce sudden harmful effects on the environment of those States. Every effort shall be made by the international community to help States so afflicted.

Principle 19 – States shall provide prior and timely notification and relevant information to potentially affected States on activities that may have a significant adverse transboundary environmental effect and shall consult with those States at an early stage and in good faith.

Principle 23 – The environment and natural resources of people under oppression, domination, and occupation shall be protected.

Principles 25 and 26 – *see above.*

a Principles 9, 10, 11, 12, 19, 20, 21, 22, 23, 24, and 25 of the Stockholm Declaration are not included in the table because they do not fit within any of the categories listed.

b Principles 2, 6, 9, and 27 of the Rio Declaration are not included in the table because they do not fit within any of the categories listed.

environment. These two declarations provide the major intellectual underpinnings of the concept of sustainable development.

The Declaration of Philadelphia expands the aims and purposes of the ILO “based on the relationship between labor and social, and economic and financial problems” and outlines the principles that should guide the national policies of its members (Bartolomei de la Cruz et al. 1996, p. 5).^{*} A core belief behind the Declaration of Philadelphia is that peace can be achieved only if it is based on “social justice,” a concept that is much broader than “human rights” and focuses on human aspirations as a struggle between the individual and the state (Bartolomei de la Cruz et al. 1996). Social justice is defined in terms of human values and aspirations: “All human beings, irrespective of race, creed or sex, have the right to pursue both their material well-being and their spiritual development in conditions of freedom and dignity, of economic security and equal opportunity.”[†] In addition, achieving these conditions “must constitute the central aim of national and international policy,” and these “policies and measures, in particular those of an economic and financial character,” should be assessed against the fundamental objective of social justice.[‡]

The notion of social justice supports the fundamental principles on which the ILO was based, namely, that:

- labor is not a commodity;
- freedom of expression and of association are essential to sustained progress;
- poverty anywhere constitutes a danger to prosperity everywhere;
- the war against want requires to be carried on with unrelenting vigor within each nation, and by continuous and concerted international effort in which the representatives of workers and employers, enjoying equal status with those of governments, join with them in free discussion and democratic decision with a view to the promotion of the common welfare.[§]

In concert with the Stockholm Declaration, the Declaration of Philadelphia supports economic and social development and the creation of a stable international market. In particular, it calls for international and national

measures to expand production and consumption, to avoid severe economic fluctuations to promote the economic and social advancement of the less developed regions of the world [see Principle 8 from the Stockholm Declaration], to assure greater stability in world prices of primary products [see Principle 10 from the Stockholm Declaration], and to promote a high and steady volume of international trade.[¶]

However, whereas the Declaration of Philadelphia explicitly links development concerns to human welfare, including the protection of workers in all occupations, the Stockholm Declaration links such concerns to the protection and improvement of the natural

^{*} On November 1, 1945, all members of the UN automatically became members of the International Labour Organization (ILO). In addition, any nation–state that subsequently joined the UN could also become a member of the ILO if it accepted the obligations under the ILO’s Constitution. States that were not members of the UN could join the ILO by a majority vote of the ILO Conference (Bartolomei de la Cruz et al. 1996).

[†] Source: The International Labour Organisation. *The Declaration of Philadelphia*, Section II, (a), http://blue.lim.ilo.org/cariblex/pdfs/ILO_dec_philadelphia.pdf (accessed August 15, 2017).

[‡] *Ibid.*, Section II, (b) and (c).

[§] *Ibid.*, Section I.

[¶] *Ibid.*, Section IV.

environment. Hence, taken together, the declarations protect both aspects of the human environment – that in which we live and that in which we work.

There is also a positive tension between the two declarations with regard to economic growth. The Declaration of Philadelphia calls for the expansion of the international economy to improve human welfare and to create more jobs,* but the Stockholm Declaration qualifies this by stating that economic development should occur in such a way that the environment is protected. In many ways, it is surprising that it took the international community so long to connect these two different strains of human welfare – employment and a healthy environment – with economic development.

The 1992 Rio Declaration reaffirmed and built on the 1972 Stockholm Declaration. Although some of the principles included in these two declarations cover the same subject matter – compare the principles in Table 2.5 – the Rio Declaration effectively broadened the notion of “conventional development” or “ecodevelopment” to “sustainable development” by integrating environmental protection into the development process. Principles 3 and 4 of the declaration speak directly to this end.

If one considers the 1972 Stockholm and 1992 Rio declarations alongside the 1944 Declaration of Philadelphia and other relevant documents such as Agenda 21, the positive tensions generated between these instruments begin to provide a more robust and comprehensive formulation of the notion of sustainable development. It is this formulation of sustainable development that is considered throughout this book. As a result of the recent great recession, fair employment with adequate purchasing power is arguably emerging as an essential third pillar of the concept of sustainable development, alongside the environment and economy.

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* This position was reaffirmed in a report by the ILO, which suggests that globalization’s “potential for good is immense. [...] Wisely managed, [the global market economy] can deliver unprecedented material progress, generate more productive and better jobs for all, and contribute significantly to reducing world poverty” (WCSDG 2004, p. x). For a discussion of how globalization affects employment, see Section 5.2 in Chapter 5.

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Part II

Economic development, globalization, and sustainability

In Part I of this work, we discussed the nature (Chapter 1) and evolution (Chapter 2) of the multidimensional concepts of sustainability and sustainable development. In Part II: Economic Development, Globalization, and Sustainability, we discuss economic development within the context of (*domestic* supply and demand) forces operating more-or-less within the nation-state (Chapter 3), how the nation-state develops in an environment increasingly influenced by external forces (for example, globalized trade, information, and finance) operating in the global economy (Chapter 4), and the effects that both technological change and globalization have, or are expected to have, on the three pillars of sustainability (Chapter 5).

As we shall see, technological change is both a vehicle for the improvement of the workings of the industrial state and a cause of unsustainability. Therefore, understanding the technological change process (Chapter 6), the important roles of the private sector (Chapter 7), and the government (Chapter 8) in promoting economic development and economic welfare is essential to the design of industrial policy, which is the focus of Part III.



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Part one: current theory

3.1 The meaning of economic development

3.1.1 Growth and development distinguished

In Chapter 1, we discussed fundamental concepts of economic growth and the metrics that might be used to measure that growth in terms of increased GNP and GDP. We also argued that not all increases in these metrics were necessarily good. For example, the GDP of a region might go up as a result of activities related to digging out of a blizzard or rescuing people in a flood, but no one would argue that more of this kind of increase in GDP was good, even if some firms and people benefited or profited from the activity. Similarly, increased GDP due to increases in expenditures for treatment of diseases related to malnutrition or exposure to toxic chemicals is not to be considered preferable to prevention, even though financial flows might be greater. Increased economic activity (involving expenditures for goods and services) necessitated by natural or human-made disasters are not part of any deliberate growth strategy of government in its trusteeship role for its people. Thus, there is “good GDP” and “bad GDP.”*

Given the problems with GDP, other indexes of human development† have been created that attempt to account for the positive attributes of development not captured by GNP and GDP (see Section 1.1.1 in Chapter 1). Many, many contributions to GNP and GDP growth are desirable and concern a government’s economic or industrial policy. **In Part One of this chapter, we first focus on understanding the historical patterns and determinants of economic growth in the positive sense, ignoring for the moment the undesirable externalities that might flow from that growth. We then summarize critiques of what has come to be called “the Northern model” of development. In Part Two of the chapter, we explore the underpinnings of the limitations of the current understanding of the determinants of growth in this time of economic upheaval, the emergence of “degrowth” as a viable alternative, and new approaches for achieving economic sustainability.**

Long-run economic growth has been at the heart of economic analysis since the first founding documents of economic theory. Economic growth was, in essence, the topic of Adam Smith’s treatise *The Wealth of Nations*. Growth, however, should not be considered as an end in itself. Economists have focused their efforts on analyzing the causes of growth for centuries because it has the potential to decrease poverty, increase the standard of living, support goals such as education and health care, and substantially affect the quality of life of the citizenry.

It is essential to note that in the study of national economies, *development* is generally distinguished from *economic growth*. Economic growth is measured in “economic” terms – for example, GNP, GDP, and other economic metrics – and does not account for nontraded goods, unpaid services, and cultural attributes. Development is not a purely economic phenomenon. According to Todaro and Smith (2015, p. 18),

development must be conceived of as a multidimensional process involving major changes in social structures, popular attitudes, and national institutions, as well as the acceleration of economic growth, the reduction of inequality, and the eradication of poverty. Development, in its essence, must represent the whole gamut of change by which an entire social system, tuned to the diverse basic needs and evolving aspirations

* See Section 3.3.1.2 for a deeper discussion of problems of measurement in a postindustrial society.

† See Daly (1994) for a discussion of the distinction between growth and development that applies to developed as well as developing countries.

of individuals and social groups within that system, moves away from a condition of life widely perceived as unsatisfactory toward a situation or condition of life regarded as materially and spiritually better.

Economic and social development in all societies must have at least the following three objectives (Todaro and Smith 2015, p. 24):*

- To increase the availability and widen the distribution of basic life-sustaining goods such as food, shelter, health, and protection (as well as essential services);
- To raise levels of living, including, in addition to higher incomes, the provision of more jobs, better education, and greater attention to cultural and human values, all of which will serve not only to enhance material well-being but also to generate greater individual and national self-esteem; and
- To expand the range of economic and social choices available to individuals and nations by freeing them from servitude and dependence, not only in relation to other people and nation-states but also to the forces of ignorance and human misery.

The role of national governments in the context of economic development is essential.

Contrary to the view of many neoclassical economists, we argue that this role should not be limited to ensuring the proper functioning of markets and the correction of market failures.

Traditional (both classical and neoclassical) economics focuses on the efficient, least-cost allocation of scarce productive resources and the optimal growth of these resources over time in order to produce an ever-expanding range of goods and services (Todaro and Smith 2015, p. 9). Markets, in that context, are considered to be “perfect,” while the consumer is perceived as a rational utility maximizer.

In contrast, development economics has a more extensive scope. Apart from being concerned with the optimal allocation of existing scarce productive resources and with their sustained growth over time, development economics also deals with the economic, social, political, and institutional mechanisms necessary to bring about rapid, large-scale improvements in levels of living for developing countries (Todaro and Smith 2015, p. 10). In this context, imperfect markets and asymmetric information are the rule rather than the exception, and rational economic calculations at the individual and social level can be heavily influenced by tribal, ethnic, clan, or religious considerations, while disequilibrium situations often prevail in the economy.

Formal economic thinking remains essentially confined to static equilibrium instead of examining the dynamics of the economy (Niehans 1990). This key distinction will be discussed later. The historical perspective and the empirical observations of the first classical economists (Adam Smith, David Ricardo, and Karl Marx, among others) led to some key intuitions about the growth process, but not to coherent theories of economic growth (Niehans 1990). However, this was something that was destined to change in the era of model-building, through the contributions of a series of scholars who dramatically shifted the way their contemporaries ended up viewing the process of economic growth.

3.1.2 Factor endowments and the classification of capital

Economic historians speak in terms of “factor endowments” that nations might possess to explain their economic growth. Early lists included land, material resources, energy, and a physically strong labor force. When nations were essentially agricultural, land was the

* See Section 3.4.1 for the contributions of Seers (1997) and Sen (1999) to the discussion of development.

most highly valued factor – and thus the driving force behind colonialism – and only after the Industrial Revolution did material resources, energy, and more skilled labor take on importance.

Advanced nations are often described now as being in the postindustrial era, in which services, rather than manufacturing, become increasingly important and “knowledge-based” work replaces physical work. Today, an expanded list of factor endowments (in addition to financial capital) might include the following:

- Land
- Material resources (natural and physical capital)
- Energy*
- Labor capable of performing physical work
- Know-how (intellectual human capital)
- [Innovation systems][†]
- Built capital (that is, infrastructure, such as railways, bridges, roads, ports, airports, and dams)
- Information and communication technology (ICT)[‡]
- (Health and the environment)[§]
- Structural capital (knowledge and productive routines held by organizations)
- Networks and outsiders (linking organizations, people, and entrepreneurs)
- Social capital (knowledge held by consumers and citizens)

Although these factors are not listed in order of importance nor in strictly chronological order of their emergence as important for growth, this list does describe an unfolding of factor endowments and characteristics that more or less parallels the phases of successive industrial development that have occurred and are discussed in this chapter.

The way in which these various factors are used in the production process and the provision of services depends on different characteristics:

- The cost of each factor of production will influence its desirability. Production processes will tend to use more intensively those factors of production whose relative prices are lower.

* See the later discussion on the importance of inexpensive and easily accessible sources of energy in explaining high rates of economic growth in industrial and industrializing countries. Also see the discussion of energy in Chapter 12.

† Innovation systems are discussed in Chapter 6 in the context of the institutions that foster technological innovation. We place this asset in square brackets to serve as a reminder that, unlike other factors that can be easily acquired, this describes a complex *system* of interacting determinants that reflect different political, social, and economic development cultures and traditions. In general, industrialized nations have highly developed innovation systems, while developing countries differ markedly in their infrastructure, legal institutions, and political systems that could enhance more optimal use of the other factor endowments that they possess. See Rodrik (2007), who argues for more “self-discovery,” coordination of government policies, and government–private-sector communication in developing nations to foster economic growth.

‡ See the later discussion on *The Second Machine Age* (Brynjolfsson and McAfee 2014) and the next industrial transformation driven by ICT.

§ Good human health (both physical and mental) and an unpolluted and preserved environment (what could be called “environmental capital”) are increasingly regarded as essential for maintaining the *productiveness* of human and natural/physical capital, even if they are not factors of production per se. For this reason, we place them in parentheses.

- The volatility of costs and prices also determines how intensively a factor of production is used. Production factors with less volatile prices tend to be used more intensively. (The volatility of prices may be beyond the control of the producer, i.e., they may be exogenous.)
- The mobility of factors of production will have an impact on how intensively these factors of production are used. This element is particularly important for human capital and physical capital. Production processes will tend to privilege the more highly mobile/movable factors of production. (The mobility of these factors may be somewhat under the control of the producer, i.e., they are more endogenous.)
- Finally, a key determinant is how easy or difficult it is for the producer to leave idle a specific factor during a period of reduced production. Those factors that can be temporarily retired more easily (e.g., physical capital such as equipment) would tend to be used more intensively.

These different elements determine how intensively each factor of production is used, which in turn determines the mix of factors used in production of goods or the provision of services. Two remarks must be made regarding these determinants. First, they are interdependent. For example, different relative prices are a driver of factor mobility, which in turn affects price volatility. Second, these determinants may function differently in an international context. Finally, it is important to note that government policies and institutions, both domestic and trade-focused, can influence the specific mix of these factor endowments. These issues are explored in Section 4.4 in Chapter 4.

3.2 Theories and perspectives on economic growth

The relationship between different factor endowments or types of capital and economic growth has been the subject of volumes of analysis, predictions, and reinterpretations. It is beyond the scope of this book to provide a comprehensive review of that literature. What we do provide is the salient evolution of major thinking that has guided economic and industrial policy since the middle of the twentieth century, from Robert Solow to current innovation-based perspectives, including the emergence of the so-called knowledge-based economy.

The classic economic literature on economic development after World War II comprises a number of theories of economic growth that do not rely on technological change as an important factor. Among these strands of thought, the most prominent are the linear-stages theories (including Rostow's stages of growth and the Harrod–Domar growth model), the structural change models, and the international-dependence models (see Ashford and Hall 2011, Chapter 3, for a fuller discussion of these theories).

The linear stages theories looked at the historical evolution of the now developed countries (once undeveloped agrarian societies) and at the positive experience of the Marshall Plan to conclude that the process of development was a series of successive stages of economic growth through which all countries must pass, emphasizing the key role of accelerated capital accumulation. The most influential representative of this line of thought was Walt W. Rostow. Rostow's Stages-of-Growth Model suggested that the underdeveloped world had to follow a particular set of prescriptive policies before moving to the stage of takeoff into self-sustaining growth. This model placed a particular emphasis on accelerated capital accumulation rooted in the mobilization of domestic and foreign savings, which would then generate sufficient investment to increase economic growth.

The Harrod–Domar growth model describes the economic mechanism by which increases in savings and investing would lead to accelerated growth. It uses a linear production function where the output is expressed as the capital stock times a constant, and

it was one of the first models to suggest that the economy could grow in perpetuity. One of the limitations of the Harrod–Domar model is that more saving and investment is a necessary, but not a sufficient, condition for accelerated rates of economic growth. Apart from savings and investment, labor-force growth and technological progress are two other components of economic growth that are not considered in the Harrod–Domar production function. Specifically, the constant capital/output ratio does not allow for technological progress.

The structural change models focus on the mechanisms by which poor countries transform their domestic economic structures from agrarian to modern manufacturing and service economies. The best-known example of this approach is the “two-sector surplus labor” model of W. Arthur Lewis, in which a process of labor transfer takes place from an over-populated, subsistence rural sector with zero marginal labor productivity to a high-productivity, modern urban industrial sector; the process continues until all surplus rural labor is absorbed. The focal point of the model is on both the process of labor transfer and the growth of output and employment in the modern sector, determined by the rate of industrial investment in the modern sector on the assumption that capitalists reinvest all their profits. One criticism to this model is that **even if capitalist profits are reinvested in the local economy and not sent abroad, they could nevertheless be reinvested in labor-saving equipment and then, even if output did increase, wages and employment rates would remain unchanged, or even lowered.**

The international-dependence models gained increasing support during the 1970s, and versions of them have been recently emphasized by proponents of the anti-globalization movement. These models assert that developing countries are caught up in a dependence and domination relationship with developed countries. The thesis of the neocolonial-dependence model is that underdevelopment is the result of the very structure of the international capitalist system and its unequal power relationships between the center (the developed countries) and the periphery (the developing countries). The false-paradigm model attributes underdevelopment to faulty and misleading advice from well-meaning but biased and ethnocentric developed-country assistance agencies and multinational donor organizations. Finally, the dualistic-development thesis underlines the coexistence of different sets of conditions (rich and poor nations, modern and traditional methods of production, educated elites, and illiterate masses). This coexistence would be chronic in underdeveloped societies instead of merely transitional and would be characterized by increasing differences between superior and inferior conditions.

See Ashford and Hall (2011, Chap. 3) and Gupta (2015) for a detailed history of these early theories of economic growth* that do not rely on technological change as an important factor, as opposed to more modern theories, which have recognized this factor to be essential in understanding growth.

3.2.1 Neoclassical growth theory: the Solow model

The Solow neoclassical growth model, for which Robert Solow received the Nobel Prize in economics in 1987, encapsulates the main features of the neoclassical growth theory and is probably the most famous model of economic growth to date.† Solow’s basic innovation

* See also Ayres (2014), Ayres and Warr (2009), Drucker (1994, 1999), Niehans (1990), Schumpeter (1939), and Todaro and Smith (2015).

† The equation $\Delta k = sf(k) - (\delta + n)k$ is the fundamental equation of the Solow model. The intuition behind this equation is that the change in the capital/labor ratio k (or growth in capital intensity in the course of time) depends on aggregate savings $sf(k)$ (savings rate s times $f(k)$, which is the output of the economy) after allowing for the amount of capital required to service depreciation, δk , and after providing the

was to construct his model of production in a way that allowed for the substitution of labor for capital in the production process.* This substitution process had significant advantages. First, it allowed the producer to switch from capital to labor when capital became too expensive, and vice versa (Warsh 2006). Furthermore, the model also allowed for an exogenous parameter that described the rate of technical change. Because the rate of technological progress is given exogenously, the Solow neoclassical model is sometimes called an exogenous growth model. Thus, the model has no explanatory power with respect to the source of technical change.

A key point in Solow's analysis was the estimated contribution of technical change to the rate of U.S. GDP growth over the period 1909–1949. Through the use of a modified production function $Y = f(K, L, t)$, where K is capital, L is labor, and t represents technical change over time, **Solow found (really assumed) that technical change accounted for approximately 50 percent of the increase in output per capita**, which corresponded to a contribution to GNP growth of the nonfarm sector of about 1.5 percent a year (Solow 1957). Solow's finding underlined the importance of, and provided a means to include, technological change explicitly in the mathematical modeling of economic growth through what is commonly referred to as Solow's residual: the proportion of long-term economic growth not explained by growth in labor or capital and therefore assigned primarily to exogenous technological change (Todaro and Smith 2015, p. 159).

3.2.2 New growth theory: Romer's model

New or endogenous growth theory was developed during the late 1980s by Paul Romer, but many of its basic elements and intuitions were already present in the work of Joseph Schumpeter. The motivation behind the introduction of this new theory originated from the limitations of the neoclassical theories in illuminating the sources of long-term economic growth (Todaro and Smith 2015, p. 159). In these models, technological change is treated as mostly exogenous. In contrast, Romer's (1990) model treats technological change as endogenous.

Endogenous growth simply means technological change generated from within a system, as opposed to technological change that is treated as a "black box" in exogenous growth models. In the 1990s, output was much higher than it was in the 1890s. Economics needed some economic theory to account for that level of growth. In 1990, output per hour worked in the United States was calculated as ten times as valuable as output per hour worked one hundred years before (Romer 1990). Technological progress provided a good-quality explanation for that level of growth, along with the growth in human capital, or the development of an effective labor force. In other words, the most important fact assumed by the new endogenous growth theory is the expectation of increasing returns on capital because of technological change (Warsh 2006) (rather than on increases in

existing amount of capital per worker to new workers joining the labor force, nk (Todaro and Smith 2015, p. 156). If $sf(k^*) = (\delta + n)k^*$, then the capital intensity remains unchanged, and the economy grows without any change in its structure. This, according to the model, is the path of balanced growth (Niehans 1990).

The notation k^* denotes the level of capital per worker when the economy is in steady state. Solow deemed this equilibrium level of capital to be stable. If $k < k^*$, then $(n + \delta)k < sf(k)$. But from the equation we see that when $(n + \delta)k < sf(k)$, $\Delta k > 0$. As a result, k in the economy will grow toward the equilibrium level k^* (Todaro and Smith 2015, pp. 156–157). Similar reasoning applies when $k > k^*$.

* The labor/capital ratio was fixed in earlier growth models, and steady growth occurred only under certain specific conditions. Solow substituted the fixed labor/capital ratio for a production function in which both capital and labor could vary.

competition and division of labor, as was the case in Adam Smith's theory (1776); see Box 3.1).

The new growth model also fills other gaps of the neoclassical theory, which (1) considers technological progress as independent from decisions of economic agents, and (2) fails to explain big differences in growth among countries with similar technologies. Furthermore, at the core of endogenous growth theory lies a criticism of globalized trade.

In traditional neoclassical models, growth also emanates from trade. Neoliberal economists have interpreted the association between higher growth rates and a larger volume of trade as one where causality flows from the second to the first rather than the other way around (Gill and Law 1988). However, as the criticisms of Ricardo's theory of comparative

Box 3.1 Adam Smith (1723–1790)

Adam Smith is regarded as the patriarch of classical economic growth theory. In his magnum opus, *An Inquiry into the Nature and Causes of the Wealth of Nations*, which is considered the founding document of the science of economics, Smith linked the division of labor and the pursuit of self-interest to the general welfare of society and outlined the guiding principles behind the allocation of resources in a growing economy.

Perhaps the most famous phrase that emerges from his book is Smith's "invisible hand," a term that describes a process that advances the interests of a society through the individual's search of self-interest and self-advantage. Thus, what Smith essentially argued was that greed will drive actors to socially beneficial behavior. This is nothing different from the process of "competition," working though the interdependent system of prices and quantities that is known today as the price system.

Smith's central message with respect to growth was that the division of labor increases labor productivity. In his analysis, Smith used the examples of workers in several different disciplines to make the case that under an optimal division of labor, they would end up producing more output than they would produce if they worked independently to satisfy their various needs. In Smith's view, this was the locomotive behind increasing productivity and improving standards of living.

At its core, Smith's growth model is an optimistic one. In Smith's viewpoint, an increased division of labor will lead to increases in productivity, incomes, and consequent increases in demand that will increase the size of markets and, through this virtuous spiral, cause further increases in the division of labor, productivity, and so on. However, this process was neither automatic nor inevitable. "Good government" was necessary in order to maintain a competitive environment and avoid the emergence of monopolies, which would restrict output in order to increase prices and, consequently, their profits. Even though the role of the government was not needed for the functioning of the market for Smith, except to maintain a competitive economy and avoid monopoly, it played a central role in other areas such as defense, administration of justice, and the consolidation of public institutions. He also made a forceful case for the mutual benefits of free trade among nations, introducing the principle of absolute advantage. For him, it was better to buy a cheaper commodity from another country and pay for it with the resources obtained from a local industry with some advantage in comparison to other countries. The concept of comparative advantage was later further developed by David Ricardo.

advantage (see Box 3.2) suggest, an increasing volume of trade does not necessarily lead to sustainable growth. What endogenous growth theory did was to show how countries can work in the context of a globalizing economy to **focus on complementary activities**, such as education and retraining, and coherent regulatory frameworks, which can facilitate their economic development.

In his 1986 article “Increasing Returns and Long-Run Growth,” Paul Romer essentially laid the foundations of endogenous growth theory. He proposed a model where **economic growth is driven by the accumulation of knowledge**, which is the really important form of capital (Romer 1986). Romer essentially tried to discard the neoclassical hypothesis of diminishing marginal returns in capital investments, permitting increasing returns in aggregate production and focusing on the role of externalities (specifically, knowledge spillover effects) in determining the rate of return on capital investments (Todaro and

Box 3.2 David Ricardo (1772–1823)

David Ricardo’s most famous contribution to economics is the theory of comparative advantage, developed in his book *On the Principles of Political Economy and Taxation* (1817). Ricardo’s theory argues that a nation is economically best off if it does whatever it is comparatively best at, even if others are better at it. According to that perspective, if two countries specialize in the production of those goods for which they have a comparative advantage, and trade ensues, there is an absolute gain in welfare for both economies (Gill and Law 1988).

This theory, however, appears to have significant limitations. In globalization, foreign direct investment is the rule rather than the exception. Hence, the export sector of one nation can be owned by capitalists from another, and nothing prevents these foreign owners from repatriating most of their profits (Gill and Law 1988). This was exactly the case for countries like India, most of whose resources were depleted by England. In general, relying on trade for economic growth can be problematic, especially in the case of developing countries. This does not mean that growth cannot be achieved in that scenario. However, it can be achieved only at the cost of escalating international, North–South, and internal inequalities, along with increasing dependence on transnational firms (Gill and Law 1988).

Unlike Smith, Ricardo did not offer a new model of economic growth. While Smith had tried to explain the growth of wealth, Ricardo deemed that the proper task of an economist was to study the distribution of wealth among the three major classes of society: the workers, the landowners, and the capitalists (Warsh 2006). However, Ricardo did modify Smith’s existing model of economic growth to include diminishing returns to land.

According to his analysis, unlike labor, the output of which could be increased through increases in productivity, Ricardo deemed land to be “variable in quality and fixed in supply” (Ilegbinosa 2013, p. 196). Hence, as growth increases, more land is necessary, but land cannot just be created, because it already exists in limited supply. This significantly affects growth. First, the limited supply of land will lead to increases in rents and consequently decrease entrepreneurial profits. Furthermore, the prices of agricultural goods will increase over time, and this will lead to workers requiring wage increases. This leads to a quicker barrier to growth than Smith allowed for, but Ricardo also claimed that this decline can be happily checked by technological improvements in machinery and the specialization brought by trade.

Smith 2015, p. 160). According to Romer, investment in knowledge leads to *increasing* returns in marginal products because technological innovation can lead to the deployment of new technologies, which can reduce the cost of production and put one company ahead of its competition. Romer's last point in his 1986 article was that knowledge has what he described as a "natural externality" because it cannot be perfectly patented or kept secret. Hence, new knowledge has a positive spillover effect on the production possibilities of other firms as well.

In his 1990 article "Endogenous Technological Change," Romer (1990) set out the preconditions for the deployment of endogenous growth. His model has four basic inputs: capital, labor, human capital (education, training), and an index of the level of technology. **Romer's key intuition is that the most important precondition of growth lies not in population dynamics but in human capital dynamics. Hence, it is investments in new research, education, and human capital rather than investments in physical capital accumulation* that should be fostered.**

In general, endogenous growth theory, by focusing on knowledge and externalities, provides a way for countries to enter the new knowledge economy by making the best use of their available resources. The main weakness of this model, however, is that it overlooks inefficiencies that arise in developing countries (poor infrastructure and poor capital and goods markets) that can significantly affect a country's growth prospects.

3.2.3 *The Ayres–Warr analysis*

Although new growth theory has been widely considered to complement the fundamental weakness of the Solow model – that is, that Solow merely assumes growth rather than explains it – a series of scholars believe that Romer's analysis still displays significant weaknesses.

As elaborated earlier, Solow's model assumes that capital displays diminishing returns. Fundamentally, this implies that developing economies will grow faster than developed economies, and that economic convergence will be the realistic result. Nonetheless, this fact is widely disputed because most scholars believe that convergence has not been observed in reality (Clark 2007; R. Ayres and Warr 2009). Romer's model essentially tried to build on Solow's model while endogenizing the standard theory – without, however, making fundamentally drastic alterations.

Romer puts forward a trade-off between current consumption and investment in knowledge. He further makes the assumption that knowledge can be monopolized long enough to be profitable to the discoverer, but it is also possible that the knowledge becomes available as a free good (R. Ayres and Warr 2009). The central point of Romer's analysis lies in the fact that positive returns to scale constitute the main explanation behind economic growth. Romer, however, puts forward an additional point. He postulates that economic growth essentially takes place when people take resources and rearrange them in ways that are more valuable, thus creating new economic "recipes." From his analysis, as R. Ayres and Warr (2009) underline, Romer seems to believe that the magnitude of knowledge capital and the rate of growth depend on the number of new "recipes" discovered instead of the quality or sector of application. **However, knowledge capital does not constitute a homogeneous entity, because some ideas and some sectors are fundamentally more productive than others** (R. Ayres and Warr 2009).

* Contrast this idea with the suggestion that it is cheap sources of energy, facilitated by investments and innovations in energy sources, extraction, and use that are the important drivers of growth (cf. the Ayres–Warr analysis (2009) in the next section).

R. Ayres and Warr (2009) opine that growth without energy (or with less of it) is not possible. They argue that past growth was driven not by globalization or consumer spending but by the ever-declining price of energy or energy services (performing useful work) since the start of the Industrial Revolution. **They also argue that it is the technology of energy conversion and utilization, rather than technology in general, that drives growth.** In contrast, neoclassical economists argue that energy is not an important factor of growth because its cost share is so small, but this is based on the questionable assumption that there are no real constraints on substitution between capital, labor, and energy (see Mankiw et al. 1992). The output elasticity of energy, or of useful work, can be – and eventually is – much larger than the cost share.

Thus, R. Ayres and Warr (2009) have put forward an alternative model of economic growth that manages to account for **useful work** or **exergy** (energy accounting for efficiency) as a factor of production. As they note (R. Ayres and Warr 2009, p. 218, emphasis added):

A strong implication of our main results is that future economic growth depends either on continued declines in the cost of primary exergy or on an accelerated increase in the output of useful work from a decreasing exergy input, that is, increasing exergy-to-work conversion efficiency. Energy prices have increased significantly in the last few years and are almost certain to increase further, both because of increased demand and because of the need to cut greenhouse gas emissions. **If the rate of technological progress in conversion efficiency slows down, we believe that economic growth will necessarily slow down as well.** Hence, it can no longer be assumed, without question or doubt, that growth along the “trend” will continue indefinitely and that “our grandchildren will be much richer than we are” as some economists have asserted.

It is interesting to note that their perspective is consistent with the effect of energy price spikes on economic growth and with job losses through process innovations of big firms, which manage to sustain output with fewer employees. (See a discussion of the recent work of Autor et al. (2017) in Section 3.5.2 on structural changes of the economy in the U.S. and Europe resulting in four to six “superstar” firms with economic dominance having significantly lower shares of productivity advances going to wages.)

The above analysis has been expanded in a series of recent writings, including *Bringing Energy Back into the Economy* (Alam 2008), part five of *The Perfect Storm* (Morgan 2013), and *The Bubble Economy* (R. Ayres 2014). All three pieces consider (useful) energy as the “real currency” or currency of the “real economy,” and view the economy as consisting “of streams of energy-producing and energy-using activities” (Alam 2008, p. 21). From this perspective, **growth in cheap energy supplies is a prerequisite for (present and future) economic growth,*** which is needed to relieve debt (R. Ayres 2014; Morgan 2013), create employment (Byrnjolfsson and McAfee 2014), and promote global prosperity. Indeed, growing supplies of energy – or access to new forms of energy – would stimulate innovations to take advantage of this more abundant energy or the new forms in which it becomes available. Yet, this is not the direction we seem to be headed. On the contrary, the cost of oil to the economy looks set to rise in coming decades, despite fracking, due to increasing demands from developing countries† and declining average energy return on

* The two essential considerations of “growth of what?” and “growth for whom?” are omnipresent in these texts and will be detailed in Section 3.7 and subsequent chapters.

† According to IMF research by Benes et al. (2012), oil prices are likely to double by 2020, due mainly to increasing demand from China and other developing countries, regardless of what happens with shale oil.

energy invested (EROEI) (R. Ayres 2014; Morgan 2013).^{*} As a result, R. Ayres advocates for large-scale investing in renewables in order to achieve a triple-win: (1) cut greenhouse gas emissions; (2) stimulate innovation-based economic growth and employment; and (3) offer long-term investment opportunities for insurance companies and pension funds.

Morgan (2013) is less optimistic than R. Ayres. While R. Ayres argues that renewables will become increasingly profitable and attractive (versus increasingly costly-to-extract fossil fuels), Morgan points out that renewables will still be more expensive (i.e., have a lower EROEI ratio) than fossil fuels ever were during the First and Second Industrial Revolutions and up until the beginning of our century. The tension here is that increasingly relying on alternative sources of energy with lower EROEI ratios will mean that “an ever-higher share of total output [GDP] will be absorbed by the cost of energy, [. . . and] that less value [. . . will remain] for other [development] purposes” (Morgan 2013, p. 78). Morgan (2013, p. 3) concludes that “the economy as we have known it for more than two centuries is beginning to unravel,” and may cease to be viable within the next decade unless the trends are reversed.

3.2.4 Implicit assumptions about technological innovation in neoclassical, environmental, and ecological economics

Environmental and ecological economics implicitly adopt or assume contrasting views on the ability of technology to overcome social and environmental problems stemming from economic (or human) activity. **Whereas neoclassical economics leans toward technological optimism, ecological economics is more pessimistic about the ability of new technology to address negative externalities (or spillovers) without extensive government intervention.**

In neoclassical economics, technology is treated as an exogenous factor in the economy (Huber 2004), and the price of resources is determined using static rather than dynamic efficiency (see Section 9.8 in Chapter 9). As resources become scarce, prices will rise until they reach a level (an *upper limit*) that will enable a substitute to enter the market – this idea follows Solow’s (1993) notion of resource *fungibility*. If technological innovation (either in the realm of resource-extraction technology or product/material development) is not able to provide a substitute – and the incumbent resource is essential – then the resource is likely to be used until an ecological limit is reached, after which the environment will be seriously damaged. This point highlights the major difference between neoclassical and ecological economics. **Neoclassical economics is not directly concerned about ecological limits per se, whereas identifying these limits and living within them are primary foci of ecological economics.**

^{*} The decrease in oil prices by 75 percent between June 2014 and January 2016 (*The Economist* 2016) does not contradict the hypothesis that the cost of oil will dramatically rise in the long term. On the contrary, the fall in the oil price seems to be due to (1) a temporary excess of production owing to punctual supply and demand circumstances (Krauss 2016); (2) OPEC’s refusal to intervene to stabilize prices of the major producers such as Saudi Arabia and United Arab Emirates in the hope of driving inefficient producers out of the market even if this represents a much lower reward to themselves; (3) the temporary increase in U.S. domestic production by means of fracking, even though shale wells cost about twice as much as ordinary ones (Morgan 2013); and (4) the slow recovery in world demand after the financial crisis. However, the key determinant of prices in the long term is production cost, and oil has not suddenly become cheaper to find and exploit. Quite the opposite: the EROEI (energy returned on energy invested) has risen from 2 percent in the 1970s to almost 10 percent today (Newland 2014). Oil prices are likely to rise in the long term also because the current fall in oil prices may also inhibit both changes in citizens’ behavior toward low carbon consumption and the development of safe and cheap alternative sources.

Like neoclassical economics, ecological economics does not explicitly address the process of technological (or system) innovation. It assumes that if it is possible to set ecological limits, then technology will somehow adjust (using pricing or other economic or legal instruments) to operate within these limits. One approach that ecological economists might use to address the problem of global warming is capping global CO₂ emissions and establishing a mechanism to trade emission rights. However, there is evidence to suggest that emission-trading schemes do not encourage technological innovation but rather the diffusion of existing technology (Kemp 2000; N. A. Ashford and Caldart 2008; Driesen 2004). If improvement in efficiency by a factor of ten or more is what is required to transition toward sustainable development, then simply diffusing existing technology is not likely to be sufficient (see Section 1.3.3 in Chapter 1 for a discussion of the “factor X” debate).

A tenuous argument against the idea of living within ecological limits is that given the societal benefit received from a particular sociotechnical system (such as the transportation or energy system), societies around the world might be willing to tolerate a certain amount of environmental degradation (for example, global climate change) to continue receiving an important service (such as mobility or electricity).^{*} **One way to avoid the debate over whether we should stress ecological limits is to ask how much we can make technology into a driver for sustainable development.** Focusing on technology as a driver raises several important questions. Do we need incremental, revolutionary, or disrupting forms of change? Are marginal changes to large-scale sociotechnical systems adequate? For the most part, disrupting technology was originally discussed in the realm of products displacing other products (Christensen 1997). An important question is how can disrupting technology lead to a process change or further to a system innovation. The answers to such questions are explored in Chapters 6, 7, and 8.

3.2.5 Peak oil and economic growth

Despite the fact that most models of economic growth omit energy from their analysis, some analysts describe growth as being increasingly energy-dependent (R. Ayres and Warr 2009). An interesting empirical observation is the fact that significant recessions have taken place following past oil crises. Even in the context of the 2008 financial crisis, many experts have argued that the spike in energy prices, and especially that of oil, contributed significantly to the recession, augmenting the effects of the burst of the housing bubble.

How long will oil last? This fairly simple question has generated an extremely heated debate for decades. Nonetheless, Smil (2008) notes that most of the debate does not occur because of this question as such, since some commercial production of crude oil will persist throughout the twenty-first century. The central issue lies in what is widely known as “peak oil theory.” Peak oil is the point when the maximum rate of global petroleum extraction is reached. After this point, according to the theory, the rate of production will enter a phase of terminal long-term decline. The basic assumption of the proponents of the peak oil theory states that when we compare the total volume of the estimated ultimate recovery (EUR) of oil with the worldwide cumulative production, half of the EUR has already been extracted or will be in a matter of years (Smil 2008).

The decline in oil production has been treated by many theorists as extremely important – some have gone so far as to describe it as the “doomsday” of modern civilization – while others have merely treated it as a relatively minor issue, given the rate of technological innovation. The peak oil alarmists, as they are called, have their detractors. Among them, Vaclav Smil paints a more optimistic picture, referring to similar

^{*} In fact, this position was taken by developing countries during the 1970s (see Section 2.3.1 in Chapter 2).

false alarms levied at coal. His critique is rooted in the following observations (Smil 2008, p. 165):

- The values of EUR are anything but certain and tend to rise with better understanding of petroleum geology, with frontier exploration, and with enhanced recovery techniques.
- The proponents of an imminent peak of global oil extraction disregard the role of prices, ignore historical perspectives, and presuppose the end of human inventiveness and adaptability.
- Recent peak oil worries are only the latest installment in a long history of failed peak forecasts. The proponents claim that this time the circumstances are not the same and their forecasts will not miss the mark, which “mixes correct observations with untenable assumptions.”
- Finally, when one contemplates a world with little or no oil, a gradual decline of global oil production does not have to translate into economic and social catastrophes.

Thus, Smil’s (2008) principal arguments are that estimates of EUR are just that – estimates – and they have been systematically revised upward historically. No one really knows what the real EUR is. In addition, there is no fundamental reason that the recovery curve should be bell-shaped over time. It may very well decline to a plateau – rather than experiencing a steep decline – as technology advances, energy-relevant efficiency increases, and the demand for oil decreases. Although Smil (2008, pp. 176–177) admits that the occurrence of an oil peak, along with major energy transitions, would wreak havoc on current energy producers and could lead to severe socioeconomic dislocations, he still does not believe that serious concern is justified. Smil (2008, p. 182) offers that “with the exception of flying and long-distance land and maritime transport [...] everything that is done with liquid fuels can be done with gases.” He argues, “the combination of non-conventional oil, natural gas, and gas-to-liquid conversions means that hydrocarbons should be with us as major sources of global energy supply far beyond the middle of the century” (2008, p. 186).

Should peak oil simply be dismissed as a nonissue, raised by alarmists? Not quite. **The increasing use of cheap energy and particularly fossil fuels was the catalyst of the Industrial Revolution and historically has been one of the most important factors behind economic growth and prosperity. The impact of peak oil on economic growth will generally depend on the exact rate of decline and on the development and speed of adoption of viable alternatives (or backstop technologies).**

In 2005, the U.S. Department of Energy published a report titled *Peaking of World Oil Production*. This report, known as the Hirsch report (Hirsch et al. 2005, p. 4, emphasis added), noted that

the peaking of world oil production presents the U.S. and the world with an unprecedented risk management problem. As peaking is approached, liquid fuel **prices** and **price volatility** will increase dramatically, and, without timely mitigation, the economic, social, and political costs will be unprecedented. Viable mitigation options exist on both the supply and demand sides, but to have substantial impact, they must be initiated more than a decade in advance of peaking.

In general, **the economic growth of the past decades has been fueled by cheap energy prices. In that context, peak oil, when met with increased energy demand from industrializing countries, will quite possibly create a situation that, depending on the speed of deployment of viable alternatives, will create significant limits to growth.** As the Hirsch

report underlines, oil is going to peak at some point (or already has). Thus, the main issue lies in the mitigation effort that will need to take place in order for the world to experience the least possible impact.

Another perspective that is worth developing here is the one already mentioned in Section 3.2.3 and according to which “the critical issue with peak oil does **not** hinge around remaining reserves. Rather, the critical issues are **energy returns on energy invested** (EROEI) and **deliverability**” (Morgan 2013, p. 69, emphasis added). The concern is that while difficult-to-access (fossil) energy sources may still exist, it will not be energetically and thus economically viable to extract and use them, because ER (energy returns) will be lower than EI (energy invested). Left only with sources of energy with lower EROEI ratios (than the fossil fuels of the eighteenth, nineteenth, and twentieth centuries), the energy bill will increase dramatically, leaving society with less money available for all other purposes.

Readers may want to study Alam (2008), Ayres (2014), Ayres and Warr (2009), Hirsch et al. (2005), Morgan (2013), and Smil (2008) in order to have a firmer base for judging. Technological optimism clearly underlies Smil’s analysis. Whether R. Ayres and Warr and Morgan are unnecessarily pessimistic remains to be seen. **As with other potential impending crises, the precautionary principle* needs to be brought into the policy choices in this area of substantial future uncertainty.**

The Paris Climate Agreement of December 12, 2015, is a historic milestone that will contribute to shaping these policy choices. The Agreement was approved by almost all the countries in the world (195 states)[†] and acknowledged that global warming is a worldwide phenomenon and, as such, it needs to be addressed “all together.” The aim of the Agreement is to set a limit to the global average temperature increase for this century at well below the 2°C threshold compared to the pre-industrial era, in pursuit of the 1.5°C target, and the strategy of the Agreement for the implementation of polluting emissions reduction is mainly based on National Plans (Intended Nationally Determined Contribution, or INDCs), which have been requested from all the parties (Palea 2016). In other words, under the new system each country puts forward its own nationally determined plan based on what it believes it can achieve over the next 10–15 years. Plans typically include policy proposals in the electricity, transportation, industrial, and forestry sectors. Some of these plans are quite ambitious and, in general, signal a fundamental shift in how countries produce and consume energy (Patron 2015).

The Climate Agreement does not provide for any sanctions or penalties for countries that do not comply with the agreements signed, but it does lay out a flexible framework requiring parties to regularly submit an inventory report on the progress made in achieving the goals set (Palea 2016). This would enable the public to track the status of each country’s progress and prompt governments to tighten existing and future targets, which would in turn boost confidence in implementation despite the absence of penalties for underperformance (Patron 2015).

The impact on oil prices will depend on the pace at which governments ratchet up policies to constrain oil demand. There will be long-term effects with policies that directly target the transportation sector, which consumes half the world’s oil. Paris’s strong political

* See Section 9.5.2 in Chapter 9 for a discussion of the precautionary principle.

† In 2017, President Trump announced his intent to withdraw from the agreement, a process that would take four years. Even if the U.S. had remained in the Paris Agreement, the Trump administration’s cuts to the EPA and actions to reverse the Obama administration’s clean energy regulations would have essentially resulted in the same outcome. In response to the federal government’s withdrawal from the Paris Agreement, over 300 mayors have joined the Climate Mayors Agreement to uphold the commitments made in Paris.

signal can boost public and private investment in alternative transportation fuels and vehicle efficiency, and the removal of fossil fuel subsidies can moderately reduce demand and subsequently prices, with the impact growing over time as the vehicle fleet changes. The Paris Agreement can also inject momentum into global negotiations underway on aviation and marine fuel controls. On the other hand, there are also supply-side impacts: regulations that tighten controls on methane may increase production costs, and growing pressure by environmentalists for companies to abandon risky environmental investments – such as oil sands, deep water, and Arctic drilling – can limit supply options and force companies back to onshore assets in politically unstable countries (Patron 2015), increasing prices. The bottom line is that global climate action will most likely widen the volatility of prices in the oil sector.

3.3 Technological development and growth theory

3.3.1 Technological change

For almost three centuries, societies have experienced the transformative power of technological innovation. **This section looks at why technological innovation has been and is such an important driver of progress, especially during the last one hundred years, which has been an era of unprecedented technological change.**

Technology – defined here as the application of science for the achievement of practical purposes (Dorf 2001) – is considered in the context of society, the economy, employment, the environment, and national governance.

The work of Nobel Laureate Robert Solow (1957), followed by the contributions of Paul Romer (1986), demonstrated, through empirical work, that technological innovation was a key factor (driver) in explaining different rates of economic growth in various countries. Indeed, the oft-recited phrase “innovation is the engine of economic growth” has its origin in that work and continues to be the centerpiece of traditional industrial policy in both the United States and Europe (Ashford and Renda 2016; European Commission 2017). Through laws, economic incentives embodied in those laws, and supporting institutions, the profits and investments of private industrial and financial sectors are closely linked to R&D and its resulting innovation. However, the future does not promise a continuation of a virtuous relationship among production, employment, consumption, and economic growth.

The characteristics and capabilities of modern technology far surpass any forms of technology that supported earlier societies. **One major point of distinction between the technologies of the Industrial Revolution and those used by hunter–gatherer and agricultural societies concerns the energy sources on which technologies depend.** Modern technology is predominantly dependent on fossil fuels and other sources of nonrenewable energy (oil, coal, gas, and nuclear), whereas the more primitive technologies were powered by the three Ws – wind, water, and wood (Wetlesen 1999).^{*} In this regard, the First Industrial Revolution was primarily an *energy* revolution. Perhaps a future industrial transformation will be characterized by a shift to renewable energy sources and away from a reliance on nonrenewable supplies (Jänicke and Jacob 2009).

Today, many national economies are in crisis and turmoil, characterized by stagnation and unemployment, following the economic meltdown in 2008 (Ashford and Hall 2011;

* The muscle power of humans and domestic animals also played an important role in helping these societies achieve their objectives (Wetlesen 1999).

Moravcsik 2016). Stiglitz (2015), Atkinson (2015), and Varoufakis (2013; 2016), among others, offer various explanations:

- technological displacement and deskilling of labor;
- significant shifts in the concentration of wealth and income;
- globalization and the changing centers of commerce and flows of financial capital;
- short-termism of economic investment; and
- the failure of government financial regulation and serious faults in the financial architecture.

Brynjolfsson and McAfee (2014, p. 202) have written insightfully on the decoupling of technological innovation and employment of unskilled and semi-skilled workers (reflecting skill-based technical change), which is resulting in the polarization of the labor market as “the middle class continues to hollow out,” while highly skilled workers in ICT and artificial intelligence continue to contribute to high rates of economic growth in the economy. At the same time, global climate disruption and environmental degradation are increasingly linked to the failure of products and services to internalize those effects in their cost and prices, resulting in a growing critique of excessive consumption and challenging the wisdom of economic growth itself.

In critiquing the “degrowth movement,” Ashford (2016) has identified the need to decouple profit from economic growth in order to provide the appropriate incentives for sustainable development. But, in any case, an additional reality seems to be emerging, one that challenges the basic assumption that technological innovation can continue to improve standards of living and quality of life. The notion that Schumpeterian thinking based on the “winds of creative destruction” is giving rise to yet another Kondratieff wave of economic progress is now being challenged.

Robert Gordon (2012, 2016), as well as Robert Ayres (2006, 2014), questions the assumption, widely accepted since Solow’s contribution in the 1950s, that economic growth is a continuous process that will persist forever. He argues instead that the progress and growth achieved between 1870 and 1970 are unique and impossible to repeat, since innovations during that “special century” (electricity, gas, telephone, water, sewer, processed foods, house appliances, anesthetics, antibiotics, working conditions) were more important than innovations today and brought about an overarching transition from an agrarian society of loosely linked small towns to an increasingly urban and diverse society. In other words, the implication is that we have reached plateaus in economic growth – especially those related to manufactured goods and appliances.

Krugman (2016), in his review of Robert Gordon’s (2016) book, opines that Gordon may well be correct that innovation in products and services may have peaked and technological advances may result in slow economic growth. R. Ayres (2016) is not yet ready to jettison important advances in replacing the internal combustion engine, electrification of transportation, energy storage, and health care that may not change consumption patterns very much, but could well increase our standard of living. R. Ayres (2016) further argues that the importance of environmental and social forms of welfare are growing fast in relation to strictly marketable goods and services, and these benefits are very real even if not reflected in GDP. What all these authors can agree upon is that the old assumptions are unlikely to hold and new strategies are required.

3.3.1.1 *The long waves*

The first person to identify the occurrence of major technological transitions during the nineteenth and twentieth centuries was the Russian economist Nikolai Kondratieff

(Kondratieff 1935). Kondratieff's notion of a long-wave cycle (known as a Kondratieff wave, or K-wave) was originally used to describe long-wave economic cycles or structural changes in the world economy.* By observing the behavior of prices and interest rates in the United Kingdom and the United States between 1789 and 1925, Kondratieff identified long-wave cycles of S-shaped growth (that is, initial slow growth that is followed by a period of rapid growth toward saturation) that occurred over a period of fifty to sixty years. His ideas were later adopted and further elaborated by the Austrian economist Joseph Schumpeter (1939), who argued that **K-waves were caused by the clustering of innovations that led to rapid technology-based economic growth, which either opened up new markets or disrupted existing ones** (see the discussion in Section 3.3.2).†

Within the modern era of technological development, there have been four distinct sixty- to seventy-year K-waves (or periods) of technology-driven economic development (Grübler and Nowotny 1990). **Each of these waves can be characterized by growth sectors, emerging technologies, and new concepts of management and industrial organization** (Table 3.1). In each case, the emergence of new technologies resulted in a technological transition that tended to follow a sigmoid curve (S-curve) (Figure 3.1). Although **the fifth technological cycle of development (1985–2050) is in the process of being defined**, the items/characteristics identified are those emerging in many industrial societies today, with the possible exception of the nuclear sector being a growth sector.‡ (See the later discussion of the work of Carlota Perez on what might be expected from the fifth Schumpeterian wave.)

A potential growth sector that has been added to Table 3.1 is the *NBIC convergence* (that is, the convergence of nanotechnology, biotechnology, information and communication technology, and cognitive sciences into major new areas of research and development). Important emerging technologies that have been added to the list in Table 3.1 are nanotechnology and ubiquitous computing – that is, computers/technologies that are embedded and networked into all aspects of our lives to such an extent that we are not fully aware of their existence or simply take them for granted. Brynjolfsson and McAfee, authors of

* G. Modelski, *Globalization as an Evolutionary Process: Yesterday and Today, Kondratieff Waves, Evolution and Globalization*, www.sociostudies.org/almanac/articles/kondratieff_waves_evolution_and_globalization/ (accessed 14 October 2017).

† Schumpeter (1934 [1912]) was the first person to distinguish diffusion from invention and innovation by describing technological innovation as the linear process of *invention–innovation–diffusion*. His theory was that entrepreneurs innovate not only by taking an invention to market, but also by creating new manufacturing processes (for example, Eli Whitney's "American system" of manufacture of interchangeable parts), identifying products for new consumer markets, and developing new forms of industrial organization. However, a limitation of Schumpeter's theories is that he was preoccupied "with the individual entrepreneur and the individual innovation" and was reluctant to "conceptualize invention, innovation, and technology accumulation as a social process" (Freeman 1990, p. 24). Schumpeter (1934 [1912], p. 228) explained clustering by stating that "the appearance of one or a few entrepreneurs facilitates the appearance of others," and he provided no real explanation of what caused clustering or why Kondratieff's long-wave cycles occurred in non-uniform but necessarily periodic intervals (Ruttan 1959). Today it is widely recognized that the institutional or legislative framework within which businesses operate (what might be called "institutional capital") plays an influential role in the formation of innovation clusters (Freeman 1990; Kingston 2004). See Chapter 6 for a related discussion of national innovation systems.

‡ Public unease about the safety of nuclear technology, nuclear proliferation, long-term waste-management requirements, and life cycle costs are four important factors limiting the growth of the nuclear sector. However, if greater emphasis is placed on electricity production that does not produce CO₂ and these four factors are adequately addressed, the nuclear sector might experience a resurgence (Deutch et al. 2003; Nuttall 2004). In any event, nuclear power is likely to remain a highly controversial energy option.

the recent *The Second Machine Age* (2014, p. 90), would likely agree with our addition as they emphasize that

the exponential, digital, and recombinant powers of the second machine age have made it possible for humanity to create two of the most important one-time events in our history: the emergence of real, useful artificial intelligence (AI) and the connection of most of the people on the planet via a common digital network,

and go on to categorize ICTs as general-purpose technologies (GPT). In line with their observation, we add, to Table 3.1, robotics and automation as potential fundamental phenomena of the fifth wave.

Perhaps what is most striking about the waves of economic development (represented by the pace of innovation) is how the scientific and technological breakthroughs that fueled them have also shaped the modern era by improving public health and changing the fabric of modern society (Langford 2004). From the steam engine to the combustion engine and from the telegraph to satellite and laser communications, each transition has provided new opportunities to improve our quality of life. These transitions in technology have been paralleled by major scientific advances in such areas as medicine and genetic engineering, which have improved the health of those societies with access to the new medicines or knowledge.

With each transition, the complexity of new technological systems is increasing and is placing greater demands on our ability to understand how these new systems interact and behave. The task of defining and understanding the dynamic and evolving nature of technological systems will be a major undertaking of the twenty-first century. One might argue that our inability to understand or predict, and then to counteract or respond to, the behavior of these systems is the main reason that there exists so much concern about the future prospects of developed societies on the part of those analysts concerned with safety. We need not look far to see numerous events that have devastated communities and the natural world as a result of technological and scientific advances.* Nonetheless, the idea that technology has played, and will continue to play, an influential role in shaping modern industrial societies predominates. This idea of *technological determinism* – a *technology-led* theory of social change – can be traced back to the early stages of the Industrial Revolution.† The most recent addition to discussions about the next major phase

* A few salient examples include the 1969 oil spill and subsequent fire on the Cuyahoga River in Ohio and oil spill off the coast of Santa Barbara, California; the 1979 Three Mile Island nuclear accident in Pennsylvania; the 1984 incident where a leak of deadly methyl isocyanate at a Union Carbide pesticide plant in Bhopal, India, killed some 3,800 people; the 1986 nuclear reactor meltdown at the Chernobyl power station that released radioactive material throughout the Northern Hemisphere; the 1989 *Exxon Valdez* oil spill that released 11 million gallons of oil into Alaska's Prince William Sound; the 2010 *Deepwater Horizon* oil spill into the Gulf of Mexico that released 210 million gallons of oil, and the 2011 nuclear accident at Fukushima. Although preventing such disasters is a primary objective of systems engineering, some argue that no matter how many warnings and safeguards are designed into our modern large-scale technological systems (such as a nuclear power or petrochemical plant), growing systems complexity means that failures are inevitable (Perrow 1999). Of course, what are missing from the preceding list are incidents that occurred through the intentional use of nuclear, chemical, biological, and conventional weapons.

† M. R. Smith (1994) provides an insightful discussion of how technological determinism, initially conceived in Europe, found a fertile ground in the newly independent United States as a result of its desire for progress. He argues that Benjamin Franklin and Thomas Jefferson were the "nation's prophets of progress" who sought new mechanical technologies as a means to realize the vision of a "virtuous and prosperous republican society" (ibid., p. 3). Smith suggests that to Franklin and Jefferson, "progress

Table 3.1 Characteristics of major technological complexes

	1770–1830	1820–1890	1880–1945	1935–1995	1985–2050
Growth sectors	Water power Ships Canals	Coal Railroads Steam power Mechanical equipment	Cars Trucks Trolleys Chemical industry Metallurgical processes	Electric power Oil Airplanes Radio and television Instruments and controls	Gas Nuclear Information Telecommunications Satellite and laser communications [NBIC]
Emerging technologies	Mechanical equipment Coal Stationary steam power	Electricity Internal combustion Telegraph Steam shipping	Electronics Jet engines Air transport	Nuclear Computers Gas Telecommunications	Biotechnology Artificial intelligence Space communication and transport [Nanotechnology Ubiquitous computing]
Management		Economy of scale Interchangeable parts	Administrative management	Professional management	Participatory and interconnected systems management
Industrial organization	Concept of the industrial firm Division of labor	Concept of mass production Interchangeable parts	Concept of management structure and delegation	Concept of decentralization	Concept of systems structure

Source: Grübler and Nowotny (1990), reproduced in NRC (2002, p. 73).

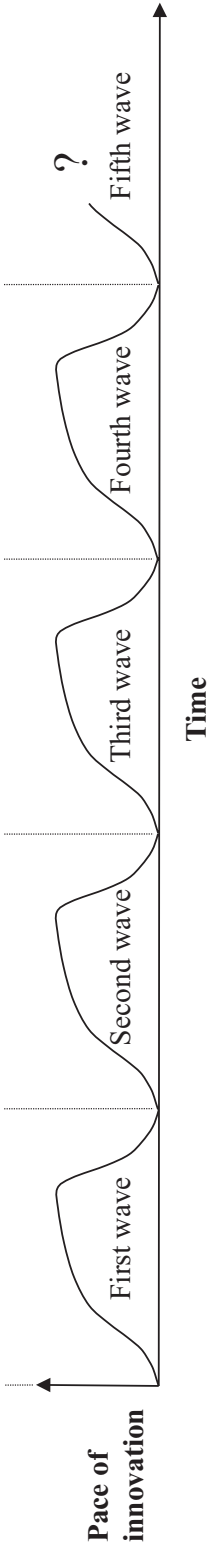


Figure 3.1 Stylized graph of Schumpeter's waves of technology-based economic development

Note: This figure is based on a similar diagram presented in Jowitt (2004, p. 81). However, an important difference is that Jowitt's graph depicts a reduction in the duration of each subsequent wave of innovation (i.e., the first wave is 60 years in length, the second wave is 55 years in length, and so on until the fifth wave, which is predicted to be 30 years in length). If we look at specific technologies, there is evidence to suggest that the rate at which society adopts new technology is increasing. See, for example, Christensen's book *The Innovator's Dilemma* (1997), in which he charts the rapid advance of disk-drive technology that occurred over a contracted time period. Source: Adapted from Jowitt (2004, p. 81).

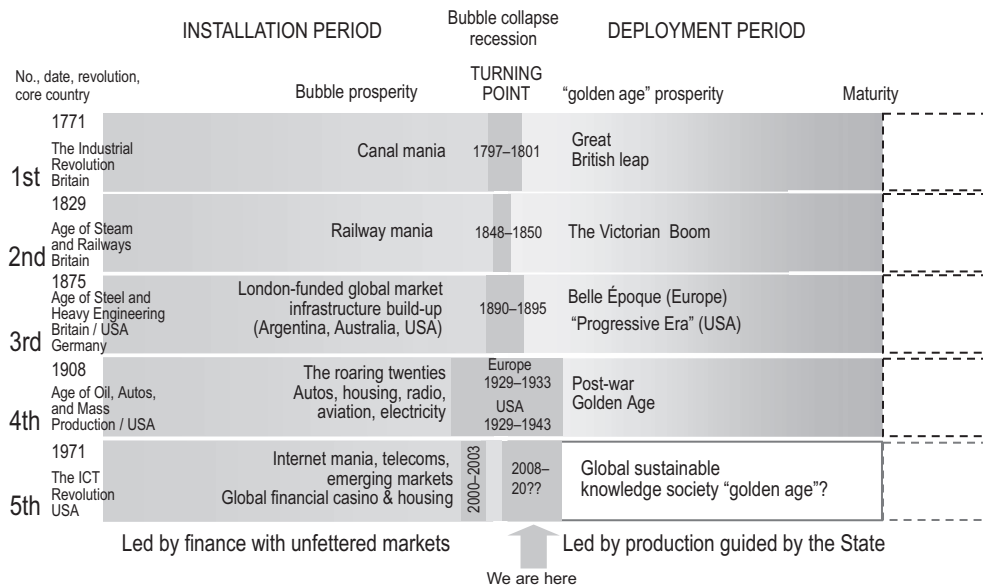
in industrial advance is found in *The Second Machine Age* (Brynjolfsson and McAfee 2014) described in Section 3.5. It goes beyond the idea of a postindustrial society discussed in the next section.

Robert Gordon (2016) has a different view of major technological transitions in the nineteenth and twentieth century and argues instead that a single hundred-year period, the “special century” from 1870 to 1970, was significantly more important to progress than have been all other periods before or after. He talks about “one big wave” – as opposed to Kondratieff’s idea of successive waves – that was made possible by a unique and impossible to repeat clustering of what he calls the “Great Inventions” that would change life in cities and towns, at home and at work, lengthen life expectancy and conquer infant mortality, and achieve the transition from an agrarian society to an urban and industrial society.

Carlota Perez (2016), an economics professor at the London School of Economics, also bases her hypothesis on a thorough historical understanding of innovation, but her views are significantly more optimistic than Gordon’s. Perez confirms the view of Kondratieff and Schumpeter that there have been five distinct “technological revolutions” since around 1770, and points to certain features that recur each time. Specifically, according to Perez, each great surge of development driven by each revolution has taken half a century or more to spread unevenly across the economy, and each has occurred in two distinct periods – installation and deployment – with a transitional phase in the middle marked by a bubble collapse and a shorter or longer recession (Figure 3.2). The first period, installation, is characterized by Schumpeterian “creative destruction” with ferocious competition, an increase in the concentration of wealth at the top 10 percent, laissez-faire ideology, destruction of mature industries, and also social disruption and adaptation, including massive displacement of old skills and polarization between old and new industries, regions, and incomes. In the past, as now, argues Perez, every installation period has culminated in a major bubble followed by a major crash. And the major collapses have historically set the political conditions for the state to step in and play an active role in favor of investment and growth. These state actions unleash a second period: that of deployment, where investment and innovation are used in a convergent way across the economy, resulting in wealth gains for the bottom 90 percent.

On these premises, Perez argues that the present moment is the equivalent to the 1930s and 1940s. We have already seen the initial impact of creative destruction of ICTs, and the

meant the pursuit of technology and science in the interest of human betterment (intellectual, moral, spiritual) and material prosperity” (ibid., p. 3). However, Smith (1994) describes how, at the turn of the nineteenth century, Franklin and Jefferson’s views failed to prevail because of the emergence of a more technocratic vision of progress espoused by Alexander Hamilton and Tench Coxe. This technocratic view grew from the belief that America’s political independence rested on economic independence. The early success of machine-based manufacturing convinced Hamilton and Coxe that technology would be the means by which economic independence could be achieved. In addition, with the nation’s abundant resources and a limited populace to exploit them, if America was to surpass Britain and Europe in technological prowess, then new technology and machines would be required (Pursell 1996). During the following century and a half, America’s decision to focus on technological advance laid the groundwork for major advances in manufacturing that had a significant influence on American culture (Pursell 1996; Smith and Marx 1994). An example of two influential innovations produced during this period were Eli Whitney’s “American system” of manufacture of interchangeable parts (Smith 1994) and Henry Ford’s triumph of the automobile (Flink 1988). See Pursell (1996) for an insightful discussion of influential technologies from America.



The equivalent historical period for the diffusion of the ICT revolution is the 1930s

Figure 3.2 The historical record: bubble prosperities, recessions, and golden ages

Source: Adapted from Perez (2016).

next few decades may be equivalent to the golden age of the 1950s and 1960s, but this requires from politicians and policy-makers *the choice of a direction*; in other words, an orientation for innovation is necessary, and this orientation can be a conscious socio-political choice. In Perez's views, this should be a "green direction." Indeed, the ICT revolution has the capacity to facilitate sustainable innovations to radically reduce materials and energy consumption while stimulating the economy. Thus, "green" as a direction is not about sustainability versus growth; instead, it turns the environmental crisis from an economic problem into an economic opportunity, provided that policy makers have the vision to guide this fifth wave in this direction.

Finally, a word is in order concerning the continued importance of non-energy-related technological advances. They may contribute considerably to improving the quality of life without being reflected in economic growth metrics. For example, better pharmaceuticals may replace less effective ones with little direct economic impact, although true indirect impacts of a population living longer and healthier may result in a cascade of effects that are complicated to assess.

In a revealing analysis of job churn (defined as new occupations being created while older occupations are destroyed), Atkinson and Wu (2017, p. 1) conclude that levels of occupational churn in the United States are now at historic lows and that what is needed is more innovation-led productivity gains. They observe "in no decade has technology created more jobs than it has eliminated" (ibid., p. 2) and "most new jobs [...] will be created across the economy from the new demand that higher productivity enables" (ibid., p. 20). They conclude that productivity gains (enjoyed by firms) will result in lower prices or higher wages and not profit-taking, a crucial assumption unlikely

to manifest. Along with the observations of Perez, they describe the fifth Schumpeterian technology long-wave revolution as in a period of stagnation, which they opine may last as long as 20–25 years before beginning to recover. They call for eliminating regulatory barriers, ensuring a reasonable business tax system, worker retraining, and temporary income support for displaced workers, but reject the idea of a universal basic income.

3.3.1.2 The information or postindustrial revolution

At the turn of the twenty-first century, developed economies were perceived to be transitioning toward a postindustrial, or information-based, society (Castells 1999). Bell (1999) describes a postindustrial society as one that relies on the economics of information (or intellectual capital) as opposed to the economics of goods (from manufacturing) or reliance on the services sector rather than the manufacturing sector of production. Where the steam engine was argued to be the catalyst for the Industrial Revolution, global information technology is argued to be the catalyst for the Information Revolution. Therefore, the signs of an emerging postindustrial society are a growing services sector and an increasing reliance on information technology. However, the postindustrial society was not envisioned to displace the older one; instead, it was expected to overlies some of the previous layers, just as the industrial society did not eliminate the agricultural sectors of society (Bell 1999). People would still rely on agriculture and manufacturing to survive. The development of new technological forms for the postindustrial society would need to respond to this new era of human development, where information and products and services become intertwined.

In the insightful article “The Age of Social Transformations,” Drucker (1994) charts the major changes that have occurred in the structure of society from the early agricultural to the new knowledge-based societies. **In particular, Drucker describes how two technology-based shifts in the nature of employment have occurred.**

It is evident that before World War I, the single largest group in every country consisted of traditional farmers, followed in developed nations by live-in domestic servants (Drucker 1994, p. 54). By the 1950s, the Industrial Revolution – triggered by emerging technologies such as the steam engine – had gathered full momentum, and industrial workers now formed the single largest group in developed nations (ibid., p. 56). The core tasks of these workers were manufacturing and serving the products of manufacturing (such as car and appliance repair). Interestingly, the skills that agricultural workers and domestic servants brought to their new “industrial” positions meant that they were often overskilled for their jobs. At the turn of the millennium, the traditional industrial worker began to be replaced by the technologist – “someone who works both with hands and with theoretical knowledge” (ibid., p. 56). Good examples of technologists are dentists and computer and X-ray technicians. More generally, Drucker (ibid., p. 62) refers to the newly emerging dominant group as “knowledge workers.” He argues that although the foundation of the knowledge worker is a formal education, this is only the beginning. If the new comparative advantage lies in the application of knowledge, this means that the knowledge worker must be able to learn continuously to bring value to his or her firm or business (ibid., pp. 62–63). Modern-day knowledge-based workers form what is now termed the “service industry,” which includes (1) health care services (such as dentistry and medicine), (2) knowledge-based services (such as banking and information management), and (3) food and retail services. However, it should be recognized that the first two job categories are likely to require higher levels of educational achievement than the third category.

Drucker (1994) argues that the problem with this latest transition is that **displaced industrial workers cannot simply move into knowledge-based or service employment because they lack the education necessary to do such tasks**. Hence, if industrial workers are to succeed in knowledge-based employment, they must “change their basic attitudes, values, and beliefs” (ibid., p. 62). The transition also means that good education and a capacity for lifelong learning become paramount.

What Drucker fails to acknowledge, though, is that displaced industrial workers may have no choice but to accept low-wage employment in the service sector (Berger 2005; see Section 1.1.3). Although working in a fast-food establishment, for instance, will bring in some income, it is debatable whether such employment is fulfilling to the worker, given his training and preferences (see Section 1.1.3). Hence, the future does not look particularly promising for those industrial workers caught in the transition between the industrial economy and the service economy, although the economy as a whole showed great promise at the time. As a matter of fact, Guy Standing, in his book *The Precariat – The New Dangerous Class* (2011), made an alarming account of a new “class-in-the-making” of people suffering from the consequences of liberalized globalization and technological displacement. See also Brynjolfsson and McAfee (2014), who discuss the hollowing out of the middle class. As Paul Krugman (2016) puts it, “the future is not what it used to be.”

Other articles and reports analyzing the current state of employment, production, skills, and wages, both globally and in the U.S. (Autor 2014; Wolf 2014; Beblavy and Maselli 2014; National Academy of Engineering 2015), echo Drucker’s previous observations. That is, the end of the twentieth century has marked the beginning of a wave of labor and jobs polarization with increasing demand for both high-skilled and low-skilled jobs and a severe reduction in middle-skilled ones (Autor 2014; Autor et. al. 2017; Brynjolfsson and McAfee 2014). Some of the main concerns associated with this widening gap in skills demand include (1) **increasing inequality**, not only between the top 1 percent and the rest of the population, but among the “other 99 percent,” as indeed “the rungs of the economic ladder have pulled further apart [and] the chance of ascending the ladder has not improved” (Autor 2014, p. 849); and, more importantly, (2) the **decrease in the real earnings** of middle- and lower-skilled workers. This last trend can be traced to four main causes: the substitution by computer-intensive machinery; the globalization of labor markets; the decline in penetration and bargaining power of labor unions in the U.S.; and, perhaps most alarmingly, faltering public policy (Autor 2014).

The U.S. National Academy of Engineering (2015) and Beblavy and Maselli (2014) generally agree with Autor’s (2014, p. 6) conclusion that “the ongoing rise of skills differentials is not inevitable.” And while

popular accounts frequently assert that the U.S. is in the midst of a “college bubble,” abundant economic evidence strongly suggests otherwise [. . . The] cost of college should not obscure the fact that the real lifetime earnings premium to college education has likely never been higher.

(Autor 2014, p. 6)

Thus, enabling a larger proportion of adults to attain higher education and acquire more skills is seen as a solution (albeit not the only one) to raise the total supply of skills available to the economy and flatten the education premium, thereby reducing the spread in real-earnings amongst workers. The Center for European Policy Studies report (Beblavy and Maselli 2014), however, fears that

the increase in firms' demand for high-skilled tasks is not high enough to absorb the overall inflow of educated workers. This results in over-qualification and possibly rising high-skilled unemployment. The improvement of skill levels on the supply side must be coupled with stimulation on the demand side to avoid these mismatches. Indeed, some policies enhancing R&D would help to increase the outlet for high-skilled labor supply in addition to improving the competitiveness of Europe.

(Beblavy et al. 2014, p. 53)

Wolf (2014) adopts a similar point of view.* He explains that the 2014–2015 INWORK–ILO *Global Wage Report*

clearly exposes the immense costs of a globalizing capitalism for the wage-earning majorities in Western Europe, North America and Japan [. . .] Capitalism no longer delivers a rising standard of living in the regions where it began and developed first.

(ibid., p. 69)

He sheds light on another important fact, however, which is that “in the developed countries, while real wages stagnated throughout the crisis since 2007, the **productivity** of workers continued to rise” (ibid., emphasis added). In his words, “there is a growing gap between what workers give capitalists (productivity) and what capitalists give workers (wages). That gap measures profits. They have grown the fastest of all” (ibid.). This is one reason why approaches such as binary economics (see Section 3.6.1) that broadly distribute the ownership of *future* growth (i.e., capital) deserve close attention.

Productivity† growth in the United States in the second half of the 1990s was attributed to the information revolution, and Europe adopted its famous Lisbon Strategy in 2000 to emulate the ICT-driven knowledge-based economy as explaining the apparent cause of the U.S. economic success (Hagemann 2008). This is the main position adopted by van Ark et al. (2008, p. 25), who argue that “the European productivity slowdown is attributable to the slower emergence of the knowledge economy in Europe compared to the United States.” However, there have been many disappointments associated with the performance of the information revolution. The tech bubble burst in 2001, and the ICT productivity “miracle” may have imploded at the same time. Solow (1987, p. 36) famously said, “You can see the computer age everywhere but in the productivity statistics,” giving rise to **the productivity or Solow paradox**. In 1997 in the *Financial Times*, Stephen Roach, chief economist for Morgan Stanley, opined: “The productivity gains of the Information Age are just a myth” (Griffith 1997). Acknowledging the greater productivity growth in the United States than in Europe, Roach attributed greater output to longer working hours in the United States. Today, we could add to longer working hours the higher rate of labor

* However, he arrives at a slightly different conclusion, emphasizing, beyond education, the need for greater cooperation and organization of the working class to counterbalance the decline underway and revive economic democracy.

† Productivity should not be confused with productiveness. *Productivity* is found by dividing (total) output by a factor of input (e.g., capital, labor, or energy) – that is, it is the amount of output per unit of input. *Productiveness* is a measure of the quality of being productive or the capacity for producing. See more details in the later discussion.

participation in the U.S. Isbell (2001, p. 258) offered another explanation to the Solow paradox:

The story is one of input substitution, not technological change. The relatively swift declines in computer prices have led to huge investments in information technology equipment, and this equipment has been substituted for other inputs. The changes in output from this substitution have nearly cancelled out, resulting in very little economic growth.

And he invited us to recall that “if technological changes have not improved our productive performance, they have changed our lives” (*ibid.*, p. 263).

In examining the relationship between ICT and trends in labor productivity and employment in the 1990s in Europe and the United States, van Ark et al. (2003, p. 86) found

The inverse relationship between employment and productivity growth has been much more prominent in manufacturing industries than in service industries. Secondly, during the 1990’s [sic], the relationship [. . .] turned positive in many industries, in particular ICT-using industries in the service sector. Finally, the employment-reducing effects of productivity growth have remained considerably stronger in Europe than in the US.

Commenting on the sources of economic growth in the 1990s, in 2003 the OECD (2003, p. 14) nonetheless voiced optimism about the new economy, saying, “The use of ICT may be increasing the efficiency of innovation, further contributing to long-term growth potential.” The OECD’s optimism has not waned, even in the light of the 2008 financial crisis OECD (2010a, 2010b).

In line with the Solow paradox, some have expressed skepticism regarding the potential economic significance of ICT in the twenty-first century. Greenspan (1996) and Shiller (2000) viewed the contribution of ICT economic growth largely as expressions of “irrational exuberance” in the markets. And Gordon (2012) and Cowen (2011), while recognizing the gains of the Internet, considered that they had all mostly been captured by the beginning of the century, leaving most new innovations to focus on not so economically significant “cheap fun.”

Specifically, Gordon (2016) calculates average annual growth rates of output per hour in three different intervals (1890–1920, 1920–1970, and 1970–2014). After deducting the contributions of education and capital deepening, what remains is the growth of total factor productivity (TFP) or Solow’s residual, the best proxy available for the underlying effect of innovation and technological change on economic growth. And, as Gordon observes, the growth of total factor productivity between 1970 and 2014 is about one-third of the growth rate registered during the previous period (1920–1970). Gordon recalls that when in 1987 Robert Solow famously quipped “we can see the computer age everywhere but in the productivity statistics,” Paul David responded, “Just wait,” implying that a long gestation period could intervene between a major invention and its payoff in productivity growth.* David was in fact trying to draw an analogy between ICT and electricity. Indeed, almost four decades had to elapse between Edison’s opening in 1882 of a power plant in Lower Manhattan and the upsurge in productivity growth in 1920s associated with the

* See the shared optimism of Perez discussed earlier.

electrification of manufacturing. According to David, the delay between an invention and its effect on productivity statistics corresponds to the time needed to perfect the machinery and see its price decrease, and for this reason the productivity surges linked to ICTs would still take some time to show. David's analogy turned out to be prophetic but, as Gordon points out, just for eight years: U.S. productivity soared in 1996–2004 only to return in 2004 to the slow levels of 1972–1996. In Gordon's opinion, this lack of ICT's influence on productivity statistics (Solow's paradox) is simply due to the fact that the computer revolution is not as important as the electricity revolution was, and changes in the spheres of entertainment, communication, and information technologies are not as transformative as changes in food, clothing, and other aspects of life were until 1970, bringing about improvements in working conditions for adult males on the job, adult women in the home, and gradually in the labor market, and facilitating the transition from child labor to schooling.

Others, like Hagemann (2008) and Brynjolfsson and McAfee (2014), have expressed a different view, identifying ICTs as a general-purpose technology (GPT) that may take a long time to become manifest in macroeconomic growth and productivity data. Besides, as Brynjolfsson and McAfee (2014) put it, because many of the services provided by ICTs have zero price, they are virtually invisible in the official statistics. They add value to the economy but not dollars to GDP and, because our productivity data are based on GDP metrics, the availability of free goods does not move the productivity dial, even if there is little doubt that they have real value. Indeed, not all quality improvements and innovations are reflected in cost or price increases or decreases.

Hagemann (2008, p. 61) offers three possible explanations for the Solow paradox:

- 1 Some of the benefits of ICT may not be picked up by the productivity statistics, such as improvements in the quality and diversity of services;
- 2 The benefits of ICT, such as organizational change and the upskilling of workers, may be slow to emerge; and
- 3 The creation and expansion of networks take time to occur and may not show up in the statistics.

More recently, Acemoglu et al. (2014) agreed not to discard the Solow paradox as they found mixed evidence for faster productivity growth in more IT-intensive industries (and little evidence of such phenomenon post-1990s). They also concluded that “to the extent that there is more rapid growth of labor productivity in IT-intensive industries, this is associated with declining output and even more rapidly declining employment” (ibid., p. 394). However, they caution us not to read this as evidence of the “workerless-workplace narrative,” pointing out that “relative employment declines in technology-intensive industries halted or modestly reversed from 2000 onward, which is inconsistent with the premise that [technological change] contributed to the slackening of labor demand in the new millennium” (ibid., p. 399).

Liagouras (2005), on the other hand, raises more fundamental questions about the usefulness of metrics of progress that had been developed for industrial societies in “postindustrial capitalism”:

Perhaps the most serious difficulty is to find convenient indicators in order to measure what is intangible or invisible. [. . .] This is a more general problem, which concerns not only investment but also all basic concepts, such as product, productivity, growth, etc., which we inherited from the industrial era.

(ibid., p. 24)

The notion of productivity no longer makes sense in an economic context where quality and variety take precedence over quantity. Investment in intangible capital (R&D, training, software, and long-term marketing positioning) becomes more important than the mechanization of labour processes. Last, but not least, the secular tendencies towards specialization and de-qualification of labour – and the vertical–horizontal expansion of the firm – are clearly reversed.

(*ibid.*, p. 23)

In commenting on the currency of the need to resolve the Solow paradox, in which large investments in ICT have not shown up in the productivity statistics, Liagouras (2005) asks:

If the inventions in ICTs and in biotechnologies are so revolutionary as it is said, why after two decades of unprecedented technical progress is this not reflected in output and productivity statistics?

(*ibid.*, p. 29)

The first explanation concerns the incapacity of national account systems, constructed within and for industrial capitalism, to measure the economic performance of post-industrial societies. In industrial societies, the wealth of individuals and nations takes the form of an accumulation of standardized commodity goods. The production of the latter is achieved through the use of other goods like machines and materials. In this schema of “production of commodities by means of commodities,” even work is reduced to unqualified (simple) labor and then to the goods required for its reproduction. Thus, increases in the wealth of individuals and nations are identified with increases in the quantities of goods that they produce and sell. However, given that the value of the total product also depends on the evolution of prices of different goods, the elaboration of cost-of-living indexes – like the Consumer Price Index (CPI) – permits the isolation of the quantity-effect from the price-effect, and thus the measurement of the real growth of output. Still, the above framework becomes problematic when (a) there are important and/or continuous changes in the quality, variety, and convenience of the goods, (b) new goods are introduced very often, (c) investment in different forms of intangible capital becomes important, and (d) service relationships become dominant in the whole economy (and not only in the service sector). This means that what exactly characterizes postindustrial capitalism cannot be easily measured, and by consequence, contemporary national accounts overstate inflation and understate growth in output and in productivity.

(*ibid.*, p. 29)

In activities like healthcare, education, culture, insurance, knowledge-intensive business services and environmental services, the objective is not to accumulate commodities, but to maintain and ameliorate the state of a human or a natural system in the long run. This implies first of all that long-run outcomes cannot be reduced to a measurable immediate output – as is the case with manufacturing and agricultural goods.

(*ibid.*, p. 30)

In conclusion, many analysts have argued that the more we move towards [a] post-industrial society, the more the notions of growth, output, and productivity that we inherited from industrial capitalism will become obsolete. This means also that, with time, it will be necessary to invent a new national accounts system, and not simply improve on the existing one. Note however that the elaboration of new conventions for post-industrial economic performance go far beyond measurement issues. **The**

ultimate question is what kind of (post-materialist) development do we want, and in what kind of (post-industrial) society do we want to live?

(ibid., p. 30, emphasis added)

These observations bring into question whether all the attempts to develop sustainability metrics may, in the end, be inadequate to track failures and successes in transformational initiatives. (See Boxes 3.4 and 3.5 in Section 3.4.2 for a related discussion of the measures used to track development in Kerala, India, and in Costa Rica.)

An important metric relevant to employment is *inherent lower cost*,* which measures the cost savings that can be attributed to enhanced capital, labor, and labor–capital-interface† productiveness. Here **productiveness should not be confused with productivity. Productivity is found by dividing total output by a factor of input – that is, it is the amount of output per unit of input. Productiveness is a measure of the quality of being productive or the capacity for producing.** Examples are a more productive machine that is capable of faster output and a more productive worker who is capable of more creative or faster work and higher-quality outputs if his or her skills have been enhanced. Therefore, labor productivity can be enhanced by the use of more productive capital (such as a smarter machine) or more productive workers, or both. As a result, it is important to measure the productiveness of labor, capital, and the labor–capital interface because this provides a more accurate measure of where a company’s/nation’s competitiveness lies – in its capital, its labor, the interface between the two, or a mixture of two or more of these elements.‡ The problem with conventional measures of labor productivity – such as that included in the 2006 United Nations Commission on Sustainable Development (UNCSD) framework (Ekins and Medhurst 2006) (which divides output by a labor factor input, such as number of hours worked or wages paid) – is that it fails to identify who or what is responsible for the production/competitiveness.§

Another interesting indicator or metric is the *cost savings derived from environmental and social factors* that can be attributed not to production efficiencies, but rather to improvements in environmental, social, and/or employment factors that yield positive financial benefits in terms of reduced costs or even positive social benefits such as more satisfied workers. Using the current situation as a baseline, new initiatives/programs can be assessed by how much future expenditure they *save*. A “lower-cost” analysis takes a broad view of the problem being addressed. For example, the use of a new process/initiative that reduces accidents and lowers pollution levels is likely to avoid health costs associated with injured or ill workers/bystanders and lower any potential environmental cleanup/remediation costs.

Finally, it would be valuable to measure how the *performance* – which is similar to the quality and variety of outputs discussed by Liagouras – of an industry sector or products has improved over time. This indicator may reflect changes in the rate of innovation, which is a central determinant of competitiveness.

The meaning, sources, and measurement of competitiveness continue to draw the attention of those scholars, organizations, and institutions concerned mainly with economic

* In addition to the magnitude of the costs of the factors that contribute to the productiveness of an enterprise, the volatility and mobility of these various factors influences their relative use by the firm in making decisions about what factors to employ in the production of goods or delivery of services.

† The labor–capital interface is the match between a particular technology and a person for a given production scenario. For example, ergonomically designed workstations are a better match than poorly designed ones.

‡ Energy might well be added as an important input.

§ This problem is directly addressed by the theory of binary economics discussed in Section 3.6.1.

growth. The Washington-based European–American Business Council* addressed this issue in a 2009 report (Atkinson and Andes 2009) and revised the results again in the aftermath of the Great Recession (Atkinson and Andes 2011). Noting that capital accumulation and economies of scale were the important drivers in the old economy and asserting in 2009 that “in the United States [. . .] virtually all the increase in productivity after 1995 has been due to the use of IT by organizations” and that better use of IT explains faster growth in the U.S. than in Europe, the report argued that: “many nations no longer compete principally on low costs, but instead compete on the basis of innovation and knowledge as they seek to create, grow and attract high value-added firms. This report assesses nations’ innovation-based, global competitiveness” (Atkinson and Andes 2009, abstract).

The results both in 2009 and 2011 were striking and called for urgent measures to promote competitiveness and innovation in both the U.S. and Europe. The 2011 report claims that (Atkinson and Andes 2011, pp. 1–2)

the [2009] report relied on sixteen indicators from these broad categories: (1) human capital; (2) innovation capacity; (3) entrepreneurship; (4) IT infrastructure; (5) economic policy; and (6) economic performance.

The results were a surprise to most and a wakeup call to many. The United States did not rank number one as many assumed. In fact, it ranked fourth out of thirty-eight nations or regions. And the EU-15 ranked even lower, 16 percent below the United States. [. . .]

Now over two years later, we have an opportunity to revisit this question of who is leading and who is lagging [. . .]. And we find that the United States’ and EU-15’s ranks remain unchanged, fourth and eighteenth respectively [. . .]. But in terms of progress and rate of change the picture is troubling to say the least. Of 44 countries and regions, the United States ranks second to last in terms of progress over the last decade, ahead of only Italy. This is slightly better than in 2009 when the United States ranked dead last. And the EU-15 ranks thirty-sixth in the rate of change behind twenty non-EU-15 nations. [. . .]

These findings continue to have significant implications for Europe and the United States. Both continue to lose ground in the race for global innovation advantage. We see that the two regions of the globe making the fastest progress are Eastern Europe and Southeast Asia. [. . .]

So where does that leave the United States and Europe? The simple answer is that unless they change course, the path they are in is a downward one, at least in relative terms. Regaining global innovation-based competitiveness means moving aggressively into next-generation industries, including advanced IT, robotics, nanotechnology, biotechnology, and high-level business services, while at the same time maintaining output in highly efficient and competitive traditional industries [. . .].

There are two key steps Europe and the United States must take to increase the chances of this successful outcome. First, [. . .] the United States and Europe must engage in a strategic partnership to push back against innovation mercantilism. A key step should be the establishment of a Trans-Atlantic Partnership. [. . .] Both Europe and the United States also need to ensure that their domestic policies do a much better job of supporting innovation, productivity and competitiveness, through both

* The European–American Business Council merged in 2013 with the Transatlantic Business Dialogue to create the Transatlantic Business Council, an advocacy group representing business on trade and investment issues.

increased government investment in innovation and lower taxes on corporate investment in innovation.

But each region has special challenges. For Europe, it's to fully embrace innovation. As much as European leaders proclaim their support of innovation [. . .], [t]hey want the benefits of a knowledge-based technology economy without the creative destruction that not only accompanies it but is required to achieve it. Unless Europe can accept that innovation entails plant closures and job losses, new technologies with uncertain social or environmental impacts, and new kinds of business models and organizations that may challenge traditional assumptions about matters like privacy, it is unlikely that it will be able to keep up in the race for global innovation advantage.

America's challenge is different. For too many in America believe that [. . .] any strategy in the United States should be to ensure that market forces are allowed to work (e.g., support free trade, restrict market power, simplify the tax code and deregulate market entry) rather than enact a proactive innovation competitiveness strategy. This ties into to America's other big challenge, overthrowing the stale straightjacket of neoclassical economics that holds that countries do not compete, that innovation is manna from heaven, and that government action to spur innovation only makes things worse. Instead, it needs to embrace a new "innovation economics" that puts advancing innovation at the forefront of economic policy.

In this context, the recommendations made in the 2009 report to promote innovation and competitiveness are worth noting.

[. . .] Nations or regions should:

- 1 **Put in place incentives for firms to innovate within their borders.** These should include robust R&D tax incentives; incentives, such as accelerated depreciation, to invest in new equipment, particularly IT; and other policies that spur investment in the building blocks of growth, such as workforce development tax credits.
- 2 **Be open to high-skill immigration.** High skill immigrants are the source of many new ideas and innovations. Countries that are open to high skill immigration will be able to better succeed.
- 3 **Foster a digital economy.** Nations should not only expand public investments in IT in areas such as health care, energy systems, transportation, government, and education, but also put in place the right regulatory frameworks to spur, not limit, digital investment. Nations need to also consider how existing regulatory and public procurement policies can be redesigned to intentionally spur digital transformation.
- 4 **Support the kinds of institutions that are critical to innovation.** Nations need to expand funding not just for university research, but for the kinds of mechanisms and institutions that help foster commercialization of research. In addition, they need to boost support for a host of efforts such as local economic development, entrepreneurship development, and workforce training.
- 5 **Ensure that regulations and other related government policies support, not retard, innovation.** Too often, powerful interest groups (business, civic, and labor) fight against change and innovation, often under the guise of the public interest, but all too often the result is that progressive and positive innovation is slowed. Nations should ensure that their regulations, procurement, and other related policies tilt toward innovation.

(Atkinson and Andes 2009, pp. 26–27)

While the last recommendation is not surprising from an international pro-business coalition, it is contradicted by the evidence that regulation has generally stimulated innovation (see the discussion in Section 8.3.5 in Chapter 8).

In the context of evaluating EU policies to achieve deep decarbonization to address global climate disruption, Ashford and Renda (2016) have challenged the myths that we suffer from an “innovation deficit” and that “regulation harms innovation.”

The Transatlantic Business Council issued its 2017 Transatlantic Economy Report (Hamilton and Quinlan 2017) from a more optimistic perspective, affirming that the U.S. hyper-competitive economy (ranked third worldwide, according to the World Economic Forum’s latest Global Competitiveness Report) is driven by a strong innovative, risk-taking corporate culture and is underpinned by world-class universities and a dense web of university–industry collaboration in R&D. The report further claims that statistics underscore the importance of the digital economy to healthy transatlantic commerce and to the globally competitive position of the United States and the European Union: individuals tap global networks to learn, work, play, create, or build personal or professional connections; consumers benefit from easier, faster, and cheaper access to products and services; and small and medium-sized business and entrepreneurs stand to be major beneficiaries from increased productivity and efficiency, better market intelligence, and greater reach at lower cost.

Another expression of the importance of innovation in stimulating economic growth is found in a report for the EU Commission (EU Commission 2017). Unfortunately, as with other initiatives focusing on supply-side interventions, the report fails to focus sufficiently on the necessary demand-side policies affecting the purchasing power of citizens and workers which must complement innovation-driven growth.

3.3.2 *Joseph Schumpeter’s “creative destruction”*

The now-famous term “creative destruction” was coined by Austrian economist Joseph A. Schumpeter to describe how innovative products and processes displace old ones in the context of a dynamic market economy (McCraw 2007). Contrary to the Smithian/Marshallian description of the economy as being in a state of equilibrium, Schumpeter described capitalism as being “by nature a form or method of economic change [. . . that] not only never is but never can be stationary” (Schumpeter 1962 [1942], p. 82).

Schumpeter’s description of the process of creative destruction challenged the fundamental premise of neoclassical economics with respect to the notion of price competition at the epicenter of the capitalist process. In *Capitalism, Socialism, and Democracy*, Schumpeter argued that the new products and processes that result from technological competition and product and process innovation are more important in understanding the essence of capitalism than the standard model of price competition that places emphasis on decentralized markets as the means to lowering prices for a given set of goods and technologies (Diamond 2006). Capitalism, according to Schumpeter, could be better understood as an evolutionary rather than a static process, whose basic drivers of change were not social and natural transformations but the introduction of new goods, new methods of production and processes, new markets, and new forms of industrial organization inherent in the capitalist process.

Schumpeter considered the forces of creative destruction to be the locomotive of the capitalist process and the driving force behind economic growth. An increasing number of economists are arguing that it is conceivable that policies that would make a national economy more open to creative destruction would promote a higher rate of economic growth (Diamond 2006).

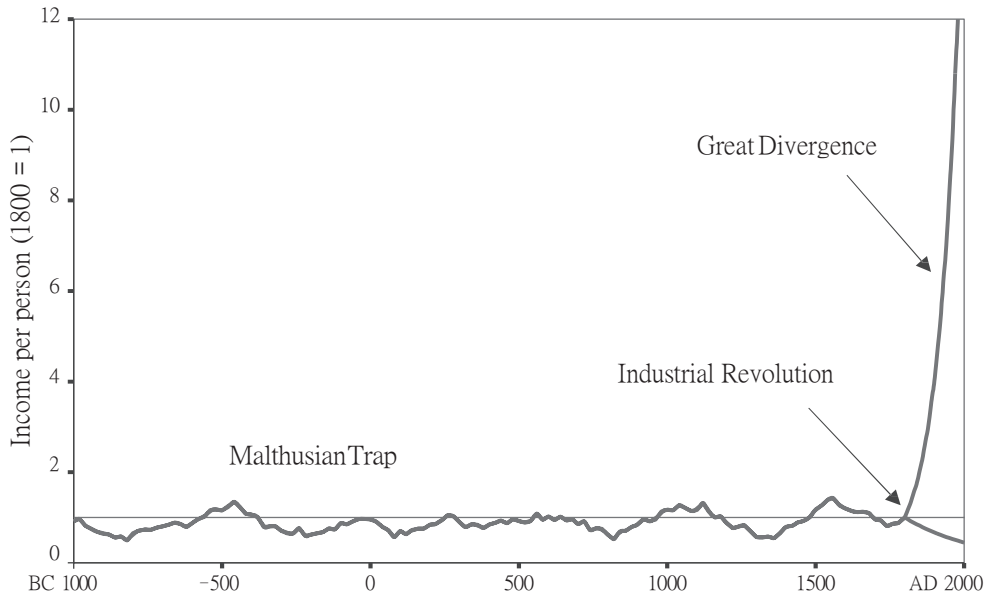


Figure 3.3 World economic history in one picture

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Figure 3.3 provides supportive evidence of Schumpeter's conceptual framework of the economy. As Clark (2007, p. 1) notes:

Before 1800, income per person – the food, clothing, heat, light, and housing available per head – varied across societies and epochs. But there was no upward trend. A simple but powerful mechanism, [...] the *Malthusian Trap*, ensured that short-term gains in income through technological advances were inevitably lost in population growth.

Clark (2007) argues that the average person of 1800 was essentially as well-off as the average person of 100,000 B.C. Although this assumption might initially seem to be mistaken, it is corroborated by the facts. In essence, the median citizen of the 1800 world was actually worse off than her remote ancestors. Life expectancy in the 1800s was as high as it was for hunter-gatherers (30 to 35 years), while average stature, a measure of health, was actually higher in the Stone Age (Clark 2007).

Clark (2007) notes that this lack of progress was due to a mechanism he calls "the Malthusian Trap," named after the person who first described this economic logic, the Reverend Thomas Robert Malthus (see Box 3.3). The Malthusian model had three main assumptions about the economy (Clark 2007, p. 20):

- 1 Each society has a *birth rate*, determined by customs regulating fertility, but increasing with material living standards.
- 2 The *death rate* in each society declines as living standards increase.
- 3 *Material living standards* decline as population increases.

Hence, the main intuition of the model is that any benefits from technological increases before the 1800s were absorbed by population increases and were thus not reflected in the per capita standard-of-living analytics. However, at some point between 1770 and 1860, something different occurred. The English population tripled; however, real incomes, instead of collapsing, increased (Clark 2007). There exist many competing explanations of why the Industrial Revolution occurred, why it took place in the given time frame, or why it began in England. However, most explanations contain a central element of technological innovation (with the notable exception of R. Ayres and Warr (2009), who attribute access to cheap energy as the most important driver of economic growth) and lend credence to Schumpeter's perspective that technology and innovation lie at the epicenter of economic growth.

Box 3.3 Thomas Robert Malthus (1766–1834)

Malthus's central contribution to the early discussions of the causes and effects of economic growth was his much-debated 1798 work *An Essay on the Principle of Population, as It Affects the Future Improvement of Society, with Remarks on the Speculations of Mr. Goodwin, M. Condorcet, and Other Writers*. The historical context sheds significant light on Malthus's insights. In the 1800s, the population of London had increased from 200,000 to 900,000 people, and most of the new residents were underprivileged (Warsh 2006).

Both Malthus and Ricardo focused on the principle of diminishing returns. The central argument of Malthus's analysis, however, relied on a single comparison between arithmetic and geometric growth rates. Malthus argued that population increases could be stopped only by misery and vice in the long run. He based his arguments on two variables: *population* and *food*. The central claim of his theory, however, was that these two variables had two fundamentally different potential growth rates: geometric and arithmetic.

Malthus declared that there was empirical evidence that populations grew with a fixed amount of time to double. He noted, especially, the resource-rich United States, where he claimed that the population doubled every twenty-five years. This fixed doubling time is called geometric growth. In contrast to population growth, he asserted that food resources could, at best, exhibit arithmetic growth, which means food increasing by a fixed absolute amount in a fixed amount of time.

In general, Malthus's analysis made the case that the actual population has the propensity to push above the food supply. Because of this propensity, any effort to improve the quality of life of the lower classes by increasing their incomes or improving agricultural productivity would be futile, because the extra resources would be entirely absorbed by an induced increase in population.

Malthus later proposed a series of practical policies commensurate with his analysis of demographics. His goal was to instill middle-class virtues in the lower classes, which were responsible for boosting the birth rate. His proposed policies included the introduction of universal voting rights, state-run education for the poor, the abolition of the Poor Laws, and the creation of a free nationwide labor market. In his view, once the poor developed a taste for comfort, they would require a better standard of living for themselves before starting a family. Hence, Malthus suggested that sufficiently high incomes might be enough by themselves to reduce the average national birth rate.

3.3.3 Market structure and innovation

In *Capitalism, Socialism, and Democracy* (1962 [1942]), Schumpeter outlined that large firms operating in concentrated markets, often enjoying monopoly power, are the main engine of technological progress and innovation. An important element of the Schumpeterian paradigm was the monopolist's ability to bear risks, attract the best workforce, and enjoy a superior financial position (Scherer et al. 1992). Schumpeter argued that giant firms could afford to gamble on new techniques and were willing to absorb losses in some of their new ventures because they could be confident of profits in others (McCraw 2007). This position contrasted with the one that he had previously outlined in his *Theory of Economic Development* (1934 [1912]), in which he insisted that innovations emanate from new and characteristically small firms.* These firms would eventually grow large; however, they would start as "outsiders" in Schumpeter's analysis.

Schumpeter, partially influenced by the German historical school's approach to economics, which consisted of detailed histories of various industries and institutions, was not trying to devise elaborate mathematical theories on paper, but rather to observe his surroundings in order to derive tangible conclusions. He cited the United States as his most favored example. Indeed, at the beginning of the twentieth century, firms such as General Electric, Eastman Kodak, and DuPont founded research departments explicitly for the purpose of developing new technologies and products. In that way, innovation was made part of their normal business routine, which constituted a profound change in business structures. However, at the same time, new companies continued to bud and innovate alongside the large-scale establishments, which lent support to what Schumpeter had predicted in 1912 but contradicted his stated thesis in *Capitalism, Socialism, and Democracy*, published in 1942.

This latter view was particularly radical given the mainstream economic thought of the era, which was encapsulated in Adam Smith's treatise on the merits of competitive markets and of the invisible hand as heralds of affluence and prosperity. The Schumpeterian hypothesis was making exactly the opposite assumption: that innovation, which was the cornerstone of economic progress and prosperity, directly relied on the expectation of a monopoly position or the possession of it.

Economists appear to be split on the issue. Kenneth Arrow and William Fellner have argued that the incentives to innovate are greater in a framework of competitive market pricing (Scherer et al. 1992). On the other hand, John Kenneth Galbraith suggested that it is in a strategic interactions environment among few oligopolists that innovation is optimally fostered (ibid.). Further, some found evidence for the original Schumpeterian assumption of a linear relationship between firm size and R&D, while others, such as F. M. Scherer, Morton Kamien, and Nancy Schwartz (1982), found an inverted-U relationship, with diseconomies of scale after a certain point (Scherer et al. 1992).

On the whole, there is little empirical support for the view that large firm size or concentration is directly associated with a higher degree of innovative activity. Even when such a correlation is present, we are not in a position to be sure about the direction of causality. In specific industries that are research intensive, such as pharmaceuticals, a high degree of concentration or monopoly power† may be unavoidable because of the significant fixed costs and indivisibility of research that are associated with the characteristics of the specific industries in question. In the pharmaceutical industry's case, monopoly power

* See the discussion in Chapters 6 and 7 of whether radical (i.e., disruptive) innovation is more likely to arise in small firms.

† This raises the question of whether large firms use not only their resource base, but also their relative influence on the political system to advance their innovations.

is provided through comprehensive patent rights on specific drugs. Alternatively, Rodrik (2007) argues the results may be context-specific, reflecting differences in the entirety of governmental policies in different countries. See also the work of van Ark et al. (2003), where the growth experience in the “new economy” vis-à-vis large versus small firms is different in the United States from that in the EU.

It is useful to note that although Schumpeter wrote about innovation in general, **not all innovations are qualitatively the same. Christensen (1997) distinguishes between two types of innovative activities in the product context: (1) sustaining innovations and (2) disruptive innovations** (see the discussion in Chapter 6). Sustaining innovations are innovations that will be generally valued by the incumbent firm’s customer base (Diamond 2006). These are the sort of innovations that the incumbent firm is expected to pursue generally by engaging in evolutionary transformations. On the other hand, disruptive innovations are generally discontinuous and possibly involve the displacement of dominant firms and institutions, with new firms catering to a different customer base (Moors 2000; Luiten 2001; N. A. Ashford et al. 2002; Partidario 2003).

Another body of literature has focused on modeling the desire of firms to innovate. Aghion and Howitt (2005) studied the relation between innovation and competition, trying to address the question whether increased competition stimulates innovation. Their analysis concludes that **the effect of competition on innovation decisively depends on where firms are situated relative to the technological frontier**. For instance, in sectors where competition is significant for firms that are close to the technological frontier, an increase in competition will induce firms with additional incentives to innovate in order to move ahead and reap some monopoly profits. However, if firms are far from the technological frontier, competition discourages innovation because there is little profit to be made from catching up with the front-runners.

In summary, empirical evidence on the correlation between market size and innovative activity has provided us with mixed results so far, and thus the validity of the Schumpeterian hypothesis will need to be examined more closely empirically.

3.4 Critiques of, and alternatives to, the Northern growth model

3.4.1 *Growth in developing economies and the Washington Consensus*

Challenging economic orthodoxy, Seers (1997) questions some of its fundamental precepts in single-mindedly promoting economic growth in developing countries:

We can, after all, fall back on the supposition that increases in national income, if they are faster than population growth, sooner or later lead to the solution of social and political problems. [...] **Economic growth may not merely fail to solve social and political difficulties; certain types of growth can actually cause them.**

(Seers 1997, p. 39, emphasis added) [Seers argues that increases in per capita income may occur with adverse distributional inequities.]

Inequality cannot really be reduced so long as property ownership is concentrated.

In a highly unequal society, personal savings often flow abroad or go into luxury housing and other investment projects of low or zero priority for development.

(Seers 1997, p. 41, emphasis added)

Further, he notes that “national income measures published for most developing countries have very little meaning” (Seers 1997, p. 40). Seers (1997) **argues that the purpose of economic development is the reduction of poverty, inequality, and unemployment.**

Table 3.2 Rules of good behavior for promoting economic growth

<i>Original Washington Consensus</i>	<i>Augmented Washington Consensus</i>
1 Fiscal discipline	11 Corporate governance
2 Reorientation of public expenditures	12 Anti-corruption
3 Tax reform	13 Flexible labor markets
4 Interest-rate liberalization	14 Adherence to WTO disciplines
5 Unified and competitive exchange rates	15 Adherence to international financial codes and standards
6 Trade liberalization	16 "Prudent" capital account opening
7 Openness to foreign direct investment	17 Non-intermediate exchange-rate regimes
8 Privatization	18 Independent central banks and inflation targeting
9 Deregulation	19 Social safety nets
10 Secure property rights	20 Targeted poverty reduction

Source: Rodrik (2007, p. 17).

Interestingly, Seers's observations are expressed more than fifteen years before Piketty (2014) discussed these ideas in his work on the concentration of wealth and income.

According to Nafziger (2006), Amartya Sen (1999) adopts a different definition, stating that **freedom of choice to determine one's future and pathways to that future, instead of development, is the ultimate goal of economic life and the most efficient means of realizing general welfare** (see the related discussion in Section 1.2.2 in Chapter 1). Actually, Seers (1997) is close to Sen when he states: "What are the necessary conditions for a universally acceptable aim [of development]? The realization of the human personality" (Seers 1997, p. 40).

Sen's definition of freedom differs greatly from that of neoclassical economics. For Sen, "unfreedoms" include hunger, famine, ignorance, unsustainable economic life, unemployment and underemployment,* barriers to economic fulfillment by women of minority communities, premature death, violation of political freedom and basic liberty, threats to the environment, and little access to health, sanitation, or clean water (Nafziger 2006). According to this analysis, freedom of exchange, labor contract, social opportunities, and protective security are not just ends of development but also the means to it. In general, economic development constitutes the most powerful instrument for reducing poverty. Although this issue is highly important for every society, it is, of course, more relevant for the developing world.

The characteristics of development policy have changed drastically in the past decades. During the 1950s and 1960s, "big-push, planning and import-substitution" policies dominated the development agenda of reformers in poor nations (Rodrik 2007, p. 16). These ideas started losing prominence in the 1970s, when more market-oriented approaches started being adopted. By the late 1980s, views had converged around a set of policies that John Williamson dubbed "the Washington Consensus."† As Rodrik notes, these policies (see Table 3.2) remain at the heart of the conventional understanding of a desirable policy framework (possibly now rejected), even though they have been augmented and expanded in recent years.

Williamson's original list was augmented by a series of second-generation reform policies of a more institutional nature than those targeted on good governance. As Rodrik notes,

* Again, Seers's (1997, p. 41) views are complementary: "To reduce unemployment is to remove one of the main causes of poverty and inequality."

† See *A Guide to John Williamson's Writing*, www.piie.com/staff/jwguide.cfm (accessed April 5, 2016).

these second-generation reforms arose from the **growing recognition that market-oriented policies might be inadequate without a more fundamental institutional transformation.**

Nevertheless, contemporary growth experiences do not corroborate the widespread adoption of the Washington Consensus as the orthodox growth paradigm. The region that made the most determined attempt to remake itself through the adoption of the Washington Consensus was none other than Latin America, which reaped minimal growth benefits from these policy choices. In fact, countries such as Mexico, Brazil, and Argentina did more liberalization, deregulation, and privatization in a few years than the East Asian countries did in four decades (Rodrik 2007). A similar case could be made for Africa, where decline persists even though Washington Consensus policies have been adopted in different states. South Korea's and Taiwan's growth policies were significantly different from the Washington paradigm. Instead of privatizations, both countries invested in public enterprises. It is interesting to note that South Korea also did not permit foreign direct investment (FDI) inflows (Rodrik 2007).

China and India, the two locomotives of Asian growth, also constitute interesting cases in that respect. It is true, of course, that both countries during their growth path departed from previous policy choices and decided to adopt policy frameworks based on markets and private enterprise. However, China never adopted a private-property-rights regime and "merely appended a market system to the scaffolding of a planned economy" (Rodrik 2007, p. 20). At the same time, India deregulated at a particularly slow pace, had significant trade restrictions until recently, and undertook minimal privatization (Rodrik 2007).

The picture that emerges from this analysis is quite clear. **Although some key elements of success are the same in all growth strategies (sustainable government finances and sound money, a healthy institutional environment, some degree of market orientation), different regions require a different set of policies.** For Seers (1997), the greatest error of neoclassical economics was the universalization of the West's development experience.* The Washington Consensus, in particular, has been catastrophic for the developing world. It is not accidental that those countries that decided to embark on different growth strategies were the ones that showed the highest growth rates and the most significant poverty reduction.

We are now in the aftermath of the 2008 financial crisis and the unraveling of the global financial system. In a provocative essay in the *Guardian* titled "The Death of the Washington Consensus? Paul Krugman's Nobel Prize for Economics Signals the Intellectual Tide Is Turning against Unrestricted Free Trade," Kevin Gallagher (2008) recites Krugman's and others' argument that "tariffs and subsidies to domestic industries can divert profits away from foreign firms and increase a nation's income," challenging the orthodoxy of market fundamentalism in the context of the benefits of trade to developing countries. This is only one view in the debate, but it illustrates the fact that the 2008 financial crisis has compelled a deep reexamination of neoliberal doctrine. Many works across disciplines, including Cohen, et al. (2010), Sachs (Feffer 2015), Krugman (2012), Piketty (2014), Ayres (2014), Galbraith (2014), Stiglitz (2015), and Varoufakis (2016), just to name a few,† have emerged since 2008, calling into question the neoliberal fundamentals on which our present economic and political systems are based.

Taking on a multidisciplinary perspective, Éloi Laurent's *Inequality as Pollution, Pollution as Inequality* (2013) explores in both developed and developing countries the nexus between income inequality and environmental crisis and degradations, and the reciprocal causality between both. According to his analysis, inequality creates environmental

* See also Mehmet's (1995) critique of the "Eurocentricity of economic development theories."

† See more details on these works and others in Section 3.7.

degradation because an increasingly uneven distribution of wealth increases the total growth necessary to meet the needs of the vast majority of the population. Income and power inequalities can also improve the ability of rich consumers and producers to transfer the environmental costs associated with their consumption and production patterns to socially deprived areas, either within or outside the country's borders. Inequality further acts as a multiplier of the vulnerability of populations and increases the social damage caused by environmental shocks, and at the political level inequality is often associated with partisan polarization, which prevents the broad consensus and bipartisan cooperation necessary for environmental policy-making from actually happening.

It is thus clear that there is a causal link between economic inequalities and progressive environmental deterioration. However, as Laurent (2013) points out, causality also works in the opposite direction and environmental inequalities can easily morph into social inequalities. For example, children from poor families in underprivileged and polluted areas are more likely to be born in poor health, resulting in poor school attainment and eventually lower income, hence perpetuating injustice. **The conclusion of this analysis is that the design and implementation of social–ecological policies, integrating both dimensions, should be a political priority in developed, emerging, and developing countries. In this work, we argue that expanding the scope of factors to be integrated or co-optimized in the decision-making/policy-making process is critical to advancing sustainable development.**

3.4.2 Sustainability in practice: the cases of Kerala and Costa Rica

Although the two models presented here (see Boxes 3.4 and 3.5) have significant differences, both have important characteristics of sustainability in the policies that they have chosen to pursue. The Kerala model focuses on a series of parameters other than GDP growth, such as literacy rates, education, and health. At the same time, the Costa Rican model places any growth considerations inside the context of environmental protection and preservation. In general, could a growth model that would combine the positive aspects of Kerala and Costa Rica, without the increased unemployment of Kerala, and that would be applicable to states with less biodiversity than Costa Rica, be realistic? Whatever the case might be, both Kerala and Costa Rica deserve to be studied and monitored closely.

Box 3.4 Kerala's development model

Kerala is an Indian state stretching along the southwest shore of the subcontinent. With a size slightly smaller than Switzerland's, Kerala has a population equivalent to Canada's and, according to the India Census (2011), its 33 million inhabitants make Kerala three times as densely settled as the rest of the country.

Kerala is best known for having achieved since India's independence in 1947 some of the highest indicators of social development in the industrializing world, with near first-world levels in literacy, health care, life expectancy, and infant mortality, and it has been one of the most widely cited cases of successfully practicing sustainable development (Franke and Chasin 1990; Parayil 1996; Drèze and Sen 2013; El Khoury 2015).

A particularly interesting facet of Kerala's development is that, during the first decades, it was completely hidden from the GDP per capita statistics. And actually, states with per capita incomes higher than that of Kerala have been faring much

worse than Kerala in social indicators of development (Parayil 1996). For instance, in 1991–1992, it had a Physical Quality of Life Index (PQLI) 33 points higher than Punjab, which had double its GDP per capita (Parayil 1996). And in 2007, Kerala scored higher than the national average in terms of average life expectancy (74 years versus 63 years) and literacy rate (91 percent versus 65 percent) (Deparle 2007). In 2011–2012, Kerala's life expectancy at birth was 77 years (11 years more than India's national average and only two years less than in the United States); the adult literacy rate was 93 percent (versus 62 percent in India); voter turn-out (74.4 percent) was higher than India's and the United States' (both 58 percent); and the HDI (0.79) was well above India's (0.554) and closer to the United States' (0.937) (El Khoury 2015). Kerala's infant mortality rate was roughly one-quarter of that of India in general (13 versus 61), and its rate of female literacy (92 percent) was 27 points higher than the national average (Drèze and Sen 2013; Rosow and George 2015). Comparisons with fast-growing Indian states less committed to social policies are revealing. For example, the yearly growth of per capita state domestic product between 2001 and 2011 was one point higher in Gujarat than in Kerala (8.2 percent versus 7 percent); however, poverty estimates in Kerala in 2010 were less than half of Gujarat's (12.0 versus 23.0) and the proportion of the population who were multidimensionally poor* in Kerala in 2006 was less than one third (12.7 versus 41.0) (Drèze and Sen 2013).

There is no evidence that the cultivation of sustainable development in Kerala has been at the cost of conventional economic success. Quite the opposite: while showing still some limitations (e.g., elevated rates of unemployment and dependence of remittances), Kerala has today one of the highest per capita incomes and lowest poverty rates among all Indian states.

The Kerala in comparative perspective table (below) provides a comparison between selected Asian countries, three Indian states with favorable social indicators (Kerala, Himachal Pradesh, and Tamil Nadu), and three states comparatively deprived (Bihar, Madhya Pradesh, and Uttar Pradesh) and illustrates how in spite of regular warnings since the 1980s that Kerala's development achievements were unsustainable, its lead over other states shows no sign of diminishing over time (Drèze and Sen 2013).

None of these outcomes occurred by chance. On the contrary, they were the direct result of a set of policy choices by Kerala's liberal administrations, which had a policy priority of investing in a welfare state. Kerala spent 46 percent more on health and 36 percent more on education than the average Indian state (Deparle 2007). Hence, the Kerala model constitutes a clear example of how the quality of life of the citizenry can be improved through government intervention in the economy, without a primary focus on encouraging economic growth. Specifically, at least four major public-policy principles have been integral to Kerala's society since the 1960s: a commitment to land reform, which redistributed landownership to the benefit of millions of peasant families; a continuing policy commitment to education and spreading literacy to all, including women and the lowest castes; a strong government-funded health care program; and a vigorous support for decentralized and participatory democracy programs, which were introduced in the mid-1990s to give people at the local-government and village-council (panchayat) level the opportunity to make the decisions about their everyday social reality while providing resources, training, and infrastructural support for this purpose. This resulted, *inter alia*, in a flourishing social economy with a focus on volunteerism, cooperatives, and neighborhood self-help groups (Rosow and George 2015; El Khoury 2015).

Table: Kerala in comparative perspective, 2011

Country or state	Population (millions)	Growth rate of per capita or GDP ^a (% per year)		Youth literacy rate, aged 15–24 2010 ^b (%)		Estimated life expectancy at birth ^c (years)		Under-5 mortality rate (per 1,000 live births)	Total fertility rate ^d	Prevalence of undernutrition, children aged under 5 ^e years (%)	
		1980–1981 to	1990–1991 to	Female	Male	Female	Male			Height- for-age	Weight- for-age
		1990–1991 to	2000–2001 to	2000–2001 to	2010–2011	2000–2001 to	2010–2011				
China	1,344	8.3	9.0	99	99	75	72	15	1.6	10	4
South Korea	50	7.5	4.7	–	–	84	77	5	1.2	–	–
Thailand	70	5.4	3.1	98	98	78	71	12	1.6	16	7
Tamil Nadu	72	3.7	5.1	93	97	71	67	25	1.7	31	30
INDIA	1,241	3.1	3.9	74	88	67	64	61	2.6	48	43
Himchal Pradesh	7	2.9	4.5	95	99	72	68	46	1.8	39	37
Uttar Pradesh	200	2.5	1.3	65	85	64	62	73	3.4	57	42
Bihar	104	2.5	0.4	52	81	66	66	59	3.6	56	56
Sri Lanka	21	2.4	3.9	99	98	78	72	12	2.3	17	21
Nepal	30	2.1	2.3	78	88	70	68	48	2.7	49	39
Kerala	33	1.7	4.6	99	99	77	72	13	1.8	25	23
Madhya Pradesh	73	1.7	2.9	68	88	64	61	77	3.1	50	60
Bangladesh	150	0.9	2.6	78	75	70	68	46	2.2	43	41

a Gross domestic product (GDP) for countries; state domestic product (SDP) for Indian states; estimates are based on semi-log regression.

b 2005 for Thailand; 2005–2006 for India and Indian states.

c 2010 for China, South Korea, and Sri Lanka; 2006–2010 for Indian states.

d 2010 for China and South Korea.

e 2006–2010 for countries; 2005–2006 for India and Indian states.

Source: Drèze and Sen (2013).

The principles discussed above are not independent from each other: education, health, a more egalitarian society, and democratic participation have been mutually reinforcing, illustrating the idea that when it comes to development, everything is related to everything else. The educational advance in Kerala has been a major factor in the increased demand for health care and other facilities and services. School education also tended to facilitate the implementation of public health measures, related for instance to immunization, sanitation, or the prevention of epidemics. Additionally, schooling of young women led to many other social changes in Kerala, as women's empowerment tends to have a strong downward impact on the fertility rate and reduces the mortality rates of children. Education has also made an important contribution to reducing the historical burden of class, caste, gender, and other inequalities (Drèze and Sen 2013; El Khoury 2015).

Today, some of the characteristics of Kerala's development experience are found in other Indian states that have also made great progress in improving their quality of life. Like Kerala, Himachal Pradesh launched ambitious social programs, including universal elementary education, at a time when it was still quite poor – the early 1970s. The speed of progress has been impressive, and Himachal Pradesh is now on a par with Kerala as far as elementary education is concerned, and other social indicators are also catching up. Tamil Nadu is another interesting case of a state achieving rapid progress over a relatively short period. Though it started from appalling levels of poverty, Tamil Nadu initiated social programs and started putting in place an extensive social infrastructure of schools, health centers, roads, public transport, water supply, electricity connections, and much more as an outcome of democratic politics including organized public pressure (Drèze and Sen 2013).

The experiences of Kerala, Tamil Nadu, and Himachal Pradesh share a number of features. First, active social policies constitute an important aspect of the development process: this is particularly the case in public education, but it also extends to other domains, such as health care, social security, and public amenities. Second, these states have followed the principle of making school education, primary health care, drinking water, and other facilities available to all on a nondiscriminatory basis instead of being “targeted” to specific sectors of the population. Third, these efforts have been facilitated by traditional public institutions (functioning schools, health centers, government offices, and cooperatives) instead of private initiatives. Fourth, dealing with social inequality has been an important part of this shared experience, and in each case the historical burden of social inequality has been reduced in one way or another. Fifth, these experiences of rapid social progress are not just a reflection of constructive state policies but also of people's active involvement in democratic politics, reflecting a balance between top–bottom and bottom-up approaches. Last but not least, there is no evidence that the pursuit of human development has had a negative impact on conventional economic success, such as fast economic growth. On the contrary, today Kerala, Himachal Pradesh, and (to a lesser extent) Tamil Nadu have some of the highest per capita incomes and lowest poverty rates among all Indian states (Drèze and Sen 2013), leading to the possibility of “virtuous growth” dynamics where human development and economic growth start reinforcing one another positively (El Khoury 2015).

The main learning here is that a nation's or a state's (such as Kerala) performance in terms of development or progress can only be accounted for by a complete set of criteria of success that expands beyond the territory of GDP, to include not only environmental stewardship but also political, social, and economic justice, along with the improvement in the quality of life of the most vulnerable section of

the population and the improvement of women's rights in society (Parayil 1996). Kerala's development experience demonstrates ways of creating a decent life using fewer resources, highlighting a credible alternative to structural adjustment policies and a preoccupation with national income accounting as the sole yardstick of development (El Khoury 2015).

- * The idea of multidimensional poverty is that poverty manifests itself in multiple deprivations, such as poor health, lack of education, absence of sanitation facilities, and various kinds of material deprivations. A person is counted as "multidimensionally poor" if he or she experiences at least a certain proportion (for example, one-third) of these deprivations. This approach can help to make detailed comparisons of living standards across countries, going beyond income-based criteria such as the World Bank's universal benchmark of "two dollars a day" (Drèze and Sen 2013).

Box 3.5 Costa Rica

Costa Rica stands out for being one of the most politically stable, progressive, prosperous, and environmentally conscious nations in the world. Costa Rica's development model centers on a number of pillars, amongst which there are its long-standing democracy, an ambitious Social Compact, and its celebrated Green Trademark. This model has achieved many successes, including improvements in social indicators and one of the lowest poverty rates in the Latin America and Caribbean region. According to a 2015 World Bank report on Costa Rica, significantly titled *Costa Rica Development – From Good to Better*, with a poverty line set at USD 2.5 only 4.7 percent of the population was poor in 2015, about one-third of the Latin American average (Oviedo et al. 2015). Costa Rica's HDI has increased from 0.605 in 1980 to 0.763 in 2013 (UNDP 2014).

Probably the most iconic outcome of Costa Rica's development strategy is its outstanding environmental gains. Indeed, over the past decade, Costa Rica has been getting publicity for the sustainable character of its policies. More than 26 percent of the country's landscape is a protected area because of a set of policies meant to preserve and protect its cornucopia.

Costa Rica has had uninterrupted democratic regimes since 1953, making it the oldest working democracy in Latin America. This political stability, which has earned Costa Rica the label of being the "Switzerland of Latin America," has been attributed to several factors, including the abolition of the army in 1948 and the 1949 Constitution, which created one of Latin America's first welfare states.

The country has also forged a far-reaching Social Compact, with universal access to basic services and a long tradition of social rights. Costa Rica's Social Compact traces its roots back to the middle of the twentieth century and is founded on constitutional guarantees of basic social rights* and an extensive Labor Code, public education, and universal care system. At 20.8 percent of GDP in 2012, Costa Rica's social spending is one of the highest in Latin America and on par with OECD countries. The country's commitment to investing in education is particularly strong, nearly reaching spending targets of 8 percent of GDP. As a result, the literacy rate for adults 15 years old and above is almost universal (97 percent). The health outcomes are also impressive (live expectancy at birth improved from 61.6 years in

1960 to 72.5 years in 1980 and 79.7 years in 2012, similar to the OECD average of 80.7 years), and today most of the population is covered by either social security, the pension system, or both (Oviedo et al. 2015).

Finally, Costa Rica has also built a world-renowned “Green Trademark” centered on conservation, reforestation, and protected areas, and it is the only tropical country in the world that has reversed deforestation (Oviedo et al. 2015). Since tourism is also an important part of the picture, the preservation of national parks, biodiversity, and wildlife available in the country also becomes a critical task. These location-specific assets are maintained and protected through the tax revenue raised by the state (Cordero and Paus 2008).

Costa Rica takes up only 0.03 percent of the earth’s surface but is considered to be one of the twenty countries with the greatest biodiversity in the world, with 52 percent covered by forests and 26 percent in protected areas. This was not always the case. Although more than half of the country was covered by forest in 1950, deforestation had stripped this to just 26 percent by 1983 under the pressures of a growing population and massive conversion of forest to pasture, underpinned by policies that supported cattle ranching and agricultural development. It took years of policy debate and consensus building to develop a national approach of paying for environmental services – which now takes the form of the world-renowned Payments for Environmental Services (PES) program (Oviedo et al. 2015).

Friedman (2009, emphasis added) notes the following with respect to the Costa Rican model of development:

[Costa Rica] has created a holistic strategy to think about growth, **one that demands that everything gets counted**. So if a chemical factory sells tons of fertilizer but pollutes a river – or a farm sells bananas but destroys a carbon-absorbing and species-preserving forest – this is not honest growth. You have to pay for using nature. It is called “**payment for environmental services**” (PES) – nobody gets to treat climate, water, coral, fish and forests as free anymore.

The PES was formally established in 1995 when the government adopted the Forest Law No. 7575. This law established a framework for payments to landowners for these ecosystem services, established the National Fund for Forestry Financing (*Fondo Nacional de Financiamiento Forestal*, FONAFIFO) to manage the PES, and established a new certificate for forest conservation to reward landholders for their ecosystem services. Subsequently, the Fiscal Simplification and Efficiency Law No. 8114 (2001) fixed FONAFIFO’s share of fuel tax revenues to 3.5 percent, guaranteed through the Ordinary National Budget. In addition, the Decree of the President of the Republic No. 32868 in 2005 (“Inaugurating and Regulating a Water Charging Scheme”) introduced a mandatory payment for ecosystem services via instituting a water tariff structure through which 25 percent of the proceeds from water charges are allocated to the PES program (Oviedo et al. 2015). This effectively meant that the country was imposing a tax on carbon emissions as well as a water tax, whereby major polluters and water users had to pay indigenous communities and villagers to protect the forests around them and keep their rivers pristine (note: the taxes flowed into a national fund, FONAFIFO, and were redistributed by the government). In time, the taxes became a major source of income for poor people and actually enabled Costa Rica to reverse its deforestation (Friedman 2009).

All in all, the PES program provided incentives for forest conservation and rehabilitation of an average of 310,000 hectares per year of privately owned lands between 2005 and 2015 (Oviedo et al. 2015).

From an institutional point of view, when Costa Rica came to fully appreciate its incredible bounty of biodiversity – and that its economic future lies in protecting it – it did something no country has ever done: **it put energy, environment, mines, and water all under one minister**. In 1988, the Ministry of Natural Resources, Energy, and Mines became responsible for forests and protected areas, and in 1995 it became responsible for the environment and changed its name to the Ministry of Environment and Energy (MINAE). These changes created a very different way of thinking about how to solve problems. The environment sector was able to influence the energy choices, notably expanding the time horizon of decision-making.

As a result, Costa Rica hugely invested in hydro-electric power, wind, and geothermal. More interestingly, Costa Rica discovered its own oil ten years ago but decided to ban drilling – so as not to pollute its politics or environment! Today, Costa Rica generates approximately 90 percent of its electricity without burning fossil fuels, and in March 2015 Costa Rica's state-run electricity company announced that the country had gone 75 days using only renewable resources for electricity (The Guardian 2015). Costa Ricans are the first in the world to power their country for so long without the use of fossil fuels (Fendt 2015).

National parks and protected areas are another cornerstone of Costa Rica's sustainability strategy. National parks and protected areas comprise 26 percent of land area in Costa Rica, and they have become an important destination for tourists. Indeed, the country is one of the most visited nations in Latin America. In 2013, close to 2.5 million tourists visited it (Oviedo et al. 2015). The growth of the tourism sector has been heavily promoted in recent years, and it is seen as a very important part of the development process as it brings income to the rural areas of the country (Cordero and Paus 2008).

In May 2007, the Costa Rican government announced its intention to become 100 percent carbon neutral by 2021. If Costa Rica meets the target, it will likely become the first carbon-neutral country in the world. Efforts are underway to begin offsetting all of the country's carbon dioxide emissions using a wide range of budgetary, legal, and financial incentives, including measures to promote bio-fuels, hybrid vehicles, and clean energy. Another key component of the national strategy will be a "C-neutral" label to certify that tourism and certain industrial practices mitigate all of the carbon dioxide they emit. Under the new certification system, tourists and business would be charged a voluntary "tax" to offset their carbon emissions, with one ton of carbon valued at USD 10. The funds would be used for conservation, reforestation, and research in protected areas. To augment the development of C-neutral, the country is cultivating a carbon certificate market that aims to not only boost carbon capture and storage in the nation's forests, but also help maintain their scenic beauty (WorldWatch Institute 2015).

Today, Costa Rica's global leadership in environmental conservation faces some challenges, as the Payment for Environmental Services (PES) competes with raising land use opportunity costs, and the commitment to carbon neutrality (which entails reducing carbon emissions from transport and other sectors) creates significant trade-offs, as the PES model is itself dependent on revenues generated from taxes on gasoline. This happens in a context of fiscal deterioration stemming from countercyclical measures undertaken during the 2008 financial crisis, which might threaten to undermine the country's Social Compact and Green Trademark (Oviedo et al. 2015). Also, the development of tourist activities with new hotels in coastal and mountain areas is increasing the pressure on the environment (Cordero and Paus 2008).

Costa Rica will need to continue applying an integrated approach that enables the conservation of natural resources to be developed in parallel with other productive activities, in order to balance financial and environmental trade-offs and secure resources to finance its development strategy. Some countries have faced similar challenges in the past and have implemented effective measures in this sense, such as New Zealand and Finland, where the “green image” is supported with strong forestry and agricultural sectors (Oviedo et al. 2015). Costa Rica further intends to combine regulatory measures with different incentives. For example, the country is a pioneer in the use of behavioral economics to improve water management in a developing country, by considering including in the water bill information relative to the actual household consumption and comparison with the average consumption in the neighborhood. Pilot tests carried out in some municipalities have resulted in curbing water consumption and a significant improvement in water conservation (Datta et al. 2015).

* The article on social rights written into the Constitution of 1949 included health, housing, social assistance, public services, taxes, and minimum wages, among others.

Part two: emerging debates

3.5 What lies ahead for economic growth and development in industrialized and developing economies?

3.5.1 *The end of sustainable growth?*

Perpetual economic growth does not constitute a law of nature, but rather an extrapolation of past trends. Robert Ayres writes in *The Bubble Economy: Is Sustainable Growth Possible?* (2014, p. 47),

unfortunately, potential growth is currently taken to be an extrapolation of past growth adjusted for inflation. In other words, it assumes that the future will be like the past and that either energy[*] doesn't matter or that it will continue to be available in unlimited amounts at constant or declining (relative) prices.

R. Ayres argues that an actual slowdown in growth (or even negative growth in the industrialized countries) in the coming decade(s), due to higher energy prices, is more than likely (R. Ayres 2014; Warr and R. Ayres 2009).

This point of view is vastly different from that of the economic “optimists” who make the case that the pace of technological growth will continue in a series of industries, especially those related to the so-called converging technologies. Converging technologies represent a movement focused on the unification of science and technology and can be defined by interactions among nanotechnology, biotechnology, information technology,

* R. Ayres, like Alam (2008) and Morgan (2013), views (useful) energy as a “factor of production” as fundamental as labor or capital. In fact, the three of them (see Section 3.2.3) consider useful energy to be the “real currency” and understand its importance in the economic system as being much larger than implied by its cost share.

and pharmaceutical technologies (see Section 3.3.1.1). It is argued that, in general, converging technologies hold tremendous potential for improvements in health care, the production of clean water and energy, and increasing advances in information technology and telecommunications. Furthermore, the convergence of these profoundly transformative technologies and technology-enabling scientific fields could potentially constitute one of the central research initiatives of the twenty-first century.

More than a decade ago, R. Ayres (2006, p. 1190) cautioned that a series of drivers of past growth in industrialized countries indicated signs of saturation or exhaustion. These drivers were:

- 1 Division of labor (job specialization);
- 2 International trade (globalization);
- 3 Monetization of formerly unpaid domestic and agricultural labor as a consequence of urbanization;
- 4 Saving and investing;
- 5 Borrowing from the future, which also tends to increase consumption in the present without added value;
- 6 Extraction of high-quality and irreplaceable natural resources and destruction of the waste-assimilation capacity of nature; and
- 7 Increasing technological efficiency of converting resource (especially fossil fuel) inputs to useful work and power.

R. Ayres deemed that the first four trends had largely completed their full effect in the industrial world, even though they had just started making their impact in the developing world. According to R. Ayres, the benefits of scale from division of labor and international trade had probably already peaked, while the monetization of formerly unpaid domestic labor was fulfilled in the OECD countries (R. Ayres 2006). Perhaps the most interesting case is that of savings and investment. According to R. Ayres, the United States essentially stopped saving in the 1990s and actually started living on capital and on money borrowed from others, or even by borrowing from the future. In the same manner, exploiting non-renewable natural resources resembles borrowing from nature. This form of converting long-term assets into current income is also meeting its limits (R. Ayres 2006).

Hence, this leaves technological efficiency of converting resource inputs into useful work and power, along with unrealized technological progress from newer technologies, as the major determinants of economic growth. Technological efficiency emanating from the conversion of raw materials into useful work boomed during the end of the nineteenth century and the first half of the twentieth century, resulting in the substitution of labor by machines powered by fossil fuels. This led to significant increases in efficiency and labor productivity.* In the past, increases in efficiency led to lower costs, which in their turn led to lower prices and higher demand. The increase in demand was a driver for increases in investment and, ultimately, increases in supply and even lower costs. This “positive feedback cycle” is none other than the engine of economic growth and has been the primary driver of productivity gains in the last two centuries (R. Ayres 2006). Nevertheless, sources of primary energy are getting more expensive instead of cheaper, and the rate of increase in efficiency of energy conversion in industrial societies has decreased.

In the words of Robert Ayres (2006, p. 1195), “All of these [seven] phenomena taken together [. . .] suggest that US economic growth is almost certainly decelerating and could soon cease altogether,” a pattern already visible in a series of other countries in the

* From a binary economics perspective (see Section 3.6.1), this increase in labor productivity is due to the productiveness of capital rather than labor.

developed world. (See Section 3.2.3 for a discussion of R. Ayres and Warr's (2009) alternate model of economic growth that includes useful work or exergy [energy accounting for efficiency] as a factor of production.)

Six years after the emergence of the 2008 financial crisis, R. Ayres (2014) stays true to his 2006 analysis, but brings a new emphasis on **financial stability** and **energy security** (in the sense of access to cheap, reliable, non-polluting sources of energy) as necessary conditions for long-term economic growth. While some of the solutions he proposes to create those conditions are technological (e.g., creating energy-based securities using the revenue streams from diverse, uncorrelated Energy Efficiency Technologies (EETs) and Renewable Energy Technologies (RETs)), most are institutional (e.g., with a set of proposed rules for the recapitalization of banks, the reduction in excessive leverage, the reform of the tax code, etc.).

Jay Forrester, the father of system dynamics, which formed the basis of the work on limits to growth (see Section 2.3.2 in Chapter 2), addressed the question of whether sustainability crises would lead to new opportunities for needed technological change. Forrester argues that seeing the real opportunities in "the no-growth, no-population rise, no increase-in-industrialization areas" (in Hopkins 2009, p. 10) would require **a major (perhaps fundamental) change in our culture**, which assumes that "technology can solve all problems," that "growth is good and can go on forever," and that controlling population is "too treacherous a debating area" (ibid., p. 11). **Although Forrester does not explicitly say so, his analysis underscores the need to engage ourselves not only in technological innovation, but in organizational, institutional, and societal change as well.** Also see Kleiner (2009).

Finally, echoing the perspective of ecological economics, some critics go so far as to state that sustainable development cannot be achieved unless the current Northern model of economic development is abandoned (Sanders 2006).^{*} Others are less pessimistic and argue that (1) technological advance has not reached any kind of natural limit, and (2) a future shift to ecologically sustainable technologies will loosen nascent creativity and that the basis of (post)industrial activity will change. Still others have challenged how growth and development are measured and argue that the metrics we use are not measuring the actual development that is occurring (see Section 3.3.1.2 and Section 1.1.1 in Chapter 1).[†]

3.5.2 The impact of economic growth on employment and on the concentration of wealth and income in the developed world

Although there has been much discussion about the link between increases in productivity and economic growth, the effects of innovation and economic growth on employment have been discussed far less. In fact, perhaps the most central question about the consequences of economic growth from a societal perspective is the issue of increasing unemployment and underemployment. This question was gradually raised a little more than a decade ago, but has recently resurfaced with the aftermath of the economic crisis

^{*} The First Conference on Socially Sustainable Economic Degrowth for Ecological Sustainability and Social Equity (organized by Research and Degrowth, Institut TELECOM SudParis, the International Society for Ecological Economics, the Sustainable Europe Research Institute, and the Wuppertal Institute) was held in April 2008 in Paris, in which "degrowth" was explicitly addressed in a series of thoughtful papers (see the *Journal of Cleaner Production* 2010, 18:511–606) and presentations culminating in a declaration on degrowth. Also see the discussion of degrowth in the context of the "new economics" in Section 3.7.

[†] See also Section 3.6.1, which addresses the idea of broadening capital ownership in order to increase society's consumption of goods and services.

of 2008, trends in wealth inequality, and the work of Brynjolfsson and McAfee (2014) that are discussed in Section 3.5.3.

Rifkin (2004, emphasis added) argues that the logic according to which “technology gains and advances in productivity destroy old jobs but create new ones” in sufficient numbers does not appear to be true anymore. Productivity has traditionally been considered an engine of job creation and economic prosperity. The economic intuition behind this is that productivity allows firms to produce goods at declining costs, which leads to cheaper goods. These cheaper goods increase demand in the market, which leads to even more production and productivity, which further stimulates demand, and so on. According to Schumpeter’s specification, innovation and specifically the process of creative destruction constitute the locomotive of capitalist economic growth through the introduction of new technologies, processes, and ideas that displace old ones. Thus, it is argued that even if creative destruction displaces labor in the short run, the increase in demand for cheaper products, along with the new industries created through technological innovation, will ensure that additional people will be hired in the medium to long run. However, this is only theory. **In reality, productivity increases, at least in the United States, have been associated with increasing numbers of unemployed workers and/or lower wages, especially in the manufacturing industries (Autor et al. 2016, 2017).**

While the acceleration of productivity growth in the United States during the 1990s has been widely attributed to the rapid increases in investment in the information and communication technologies (ICT) industry – i.e., that ICT advances have led to decreasing costs, falling prices, and increasing demand – much has been written about the “ICT productivity paradox” that little productivity growth has actually occurred from the adoption of the computer (see Griffith (1997) and the prior discussion in Section 3.3.1.2). However, some authors have a different view. According to Robert Ayres (2006), for example, the applications of information technology outside its own sector seem to have led to the elimination of more jobs than the ones created, without corresponding impacts on consumer demand on products and services that would end up creating more jobs.

In their study of the employment effects of the new economy, van Ark et al. (2003) found that this inverse relationship between productivity and employment growth was much stronger in manufacturing than in services. This result is intuitive and largely depends on whether the labor force of a specific industry has skills transferrable to other industries. In updated work, van Ark et al. (2012) review Europe’s productivity trends and prospects. In a subsequent report, van Ark (2014, p. 8) supports the view that “in the longer term, improved economic conditions as represented by a rise in GDP can only be sustained through growth in labor productivity.” Specifically, van Ark (2014, p. 9) acknowledges that:

To be sure, productivity gains can sometimes destroy jobs – sweeping away the old as they make way for the new, and allowing many industries to do more with less. But the point is that policymakers must aim for a virtuous circle in which productivity gains are combined with job creation through new business and innovation, engendering a balanced path between jobs, investment and productivity gains. This virtuous circle is what creates long-term prosperity. Job growth and increased labor income generate the purchasing power which consumers need to buy the products and services companies produce every day. Productivity is the only sustainable way to produce the new products and services on a continuous basis at affordable prices. This then drives the demand which helps the economy to grow and ultimately creates more growths than it destroys.

Therefore, the cornerstone of van Ark’s virtuous circle is job creation through new business and innovation; furthermore, these newly created jobs must generate increasing labor

income with sufficient purchasing power to sustain demand and consume the products and services produced. The key questions to address are then (1) whether the amount of jobs created by new business and innovation exceeds the amount of jobs destroyed, and (2) whether these new jobs are generating an increasing labor income and sufficient purchasing power.

In response, Kenney and Zysman (2015) argue that if the Industrial Revolution was organized around the factory, today's changes are organized around digital platforms, with app stores, YouTube, Uber, Amazon, and TaskRabbit developing power roughly equivalent to that of Ford, General Motors, and General Electric of earlier eras. This "platform economy" is having a profound impact on firm organization, employment relationships, and types of work available in three main ways:

- In some cases, digital platforms are displacing or threatening existing, often regulated, service providers such as taxis or hotels.
- In other cases, digital platforms are formalizing previously less organized or locally organized work.
- Finally, other platforms such as app stores or YouTube are creating entirely new occupations or occupational branches.

Kenney and Zysman (2015) argue that employment appears to be more precarious than ever as existing and new firms deploy these new ICT technologies, overturn existing domestic employment, and challenge social policies. In this context, policymakers are pushed to support these transformations but also to prepare for disconcerting outcomes related to employment and equality.

To a large degree, the process of creative destruction is actually inevitable. The point is to acknowledge the effects of increases in productivity on the average worker of the economy and to implement policies that will alleviate those effects through social safety nets, labor retraining, and a variety of other options discussed in Section 13.3 in Chapter 13.*

Jackson and Victor (2016) summarize this productivity dilemma, stating that

as each hour of working time becomes more "productive," fewer and fewer people are needed to deliver any given level of economic output. Put simply, ever-increasing labor productivity means that if our economies do not also continue to expand, we risk putting people out of work [. . .]. There are, broadly speaking, two avenues of intervention through which to escape from this "productivity trap". One is to accept productivity growth in the economy and reap the rewards in terms of reduced hours worked per employee [. . .]. The second strategy is to ease up on the gas pedal of ever-increasing productivity – to shift economic activity to more labor-intensive sectors.

Jackson and Victor further explore the feasibility of these strategies in the context of a green economy (see discussion in Section 3.7).

Commenting on the impacts of technology-driven economic growth on employment, Avent (2014), Brynjolfsson and McAfee (2014), Kuttner (2013), and Rotman (2014, 2014) all agree that "the digital revolution is opening up a great divide between a skilled and wealthy few and the rest of society" (Avent 2014, p. 2), by "amplifying the talent and luck" (Rotman 2014, p. 4) of a small group of successful individuals. They are concerned with the emergence of a "superstar" or "winner-take-all economy" (Brynjolfsson and McAfee 2014; Autor et al. (2017).

* Also see the discussion of degrowth in the context of the "new economics" in Section 3.7.

A decade earlier, Liagouras (2005, p. 27) presciently warned that “if the vicious cycle of social exclusion is not stopped in the near future, social polarization risks becoming a structural feature of [the] post-industrial economy and society.” While most of the authors above collectively end up formulating a comprehensive set of policy recommendations – encompassing education and training, progressive taxation, minimum wages, the provision of a social or basic income (or alternatively a negative income tax), the regulation of finance, the recognition and monetization of work that is not labor (e.g., “human services”), the right to unionize, to name only a few – it is important to note that what is missing today “is not the policy tools, but the politics” (Kuttner 2013, p. 15). **Our values as individuals and as a society and the vision we define for our future will have fundamental repercussions on the shape and consequences of the digital revolution.**

Economic growth also relates to the concentration of wealth and income (see the discussion in Section 1.2.3 in Chapter 1), and it is important to note how they impact each other. Concerns about increasing inequality are growing. The evidence indicates that these concerns are not without foundation. Even though there are signs that global income inequality is falling (but even around this point there is considerable debate; see discussion below), inequality within countries is on the rise, and the concentration of income at the top has increased over recent years (World Bank 2016). Inequality and growth are structurally linked. In addition to normative concerns, a more equitable distribution of income is associated with positive outcomes, including stability and economic growth (World Bank 2017).

In order to frame the discussion, it is important to determine whether inequality is on the rise or not, and the answer will depend – to a certain extent – on what kind of inequality we are looking at and how we are measuring it. There seems to be little controversy regarding the steady upward trend of *wealth* inequality: an Oxfam study (Hardoon et al. 2016) provided figures showing that global inequality is worse than any time since the nineteenth century, and that the richest 1 percent now have more wealth than the rest of the world population combined. In fact, in 2017, it is estimated that 82 percent of all wealth created went to the wealthiest 1 percent of the earth’s population, with the bottom 50 percent seeing no increase (Pimentel et al. 2018). According to LSE professor Jackson Hickel (2016), inequality numbers are also very conservative, since the rich hide so much of their wealth in tax havens and secret jurisdictions, which if captured would make Oxfam’s metrics of wealth inequality look much worse.

But that is wealth. Many analysts object that we should not be measuring wealth inequality, but rather income inequality, which does not seem so bad – at least at the global level. Indeed, whereas there seems to be a common agreement that income inequality *within* countries is rising, there are conflicting views on whether *global* income inequality has been falling or increasing.

Some authors optimistically find that income inequality for the world as a whole has been falling for most of the last twenty years. See for example Lakner and Milanovic (2015), who state that while inequality is getting worse *within* countries, on a global scale it is actually getting better, with a global Gini coefficient (which takes the value 0 for the most equal society where all individuals earn the same and the value 1 for the most unequal society where one single individual gets all the income) slightly decreasing from 0.72 in 1988 to 0.71 in 2008.

Other authors, however, have different views. Hickel (2016) claims that the Gini index is a troublesome measure, since it only captures relative changes. Therefore, if the incomes of the rich and the poor increase by the same *rate*, then the Gini index remains the same, even though absolute inequality is increasing. In other words, if a person A earns \$10K and a person B earns \$100K and then both of them double their income, the Gini index remains the same, even though the income gap will have grown from \$90K to \$180K. For this reason some economists, such as Robert Wade (2013), argue that the Gini index is

a misleading measure that obscures the true extent of inequality and that we should be using the *absolute* Gini index instead: if we do, we see that inequality has exploded over the past few decades, from 0.57 in 1988 to 0.72 in 2005 (Hickel 2016).

These findings are consistent with the conclusions of a 2016 study by researchers from the United Nations University World Institute for Development Economics Research (Niño-Zarazúa et al. 2016). The study (“Global Inequality: Relatively Lower, Absolutely Higher”) shows that relative global inequality, measured by the Gini coefficient, has declined steadily over the past few decades, from 0.74 in 1975 to 0.63 in 2010. In contrast, absolute inequality, measured by the absolute Gini coefficient, has increased dramatically since the mid-1970s. The authors of the study claim that, although average incomes in large developing countries are now closer proportionally to those in high-income countries, the absolute gaps in income between countries are so high that even if domestic inequality were completely eliminated in all countries (which is obviously impossible), absolute inequality today would still be much higher than it was forty years ago. According to the authors, one interpretation of these results might be that, “for better or for worse, a degree of increased absolute inequality is an inevitable by-product of economic progress” and, while redistributive policies and investment in public goods (such as health and education) are likely to mitigate both types of inequality, “there would be huge implications for the fight against global poverty if attempts were made to halt economic growth in order to appease absolute inequality” (ibid.). But is it really so? Can we assume that inequality is an inevitable by-product of economic growth? Moreover, will growing inequalities eventually hinder growth?

The response to the first of these questions should be, not quite. If we take a look at the possible causes for rising inequality, we will find three different (and complementary) lines of thought attempting to explain this trend, and none of them seem to establish that inequality is an inevitable by-product of growth.

The first big category of explanations is represented chiefly by Thomas Piketty and focuses on the dynamics of returns on capital. In his widely cited book *Capital in the 21st Century* (2014), **Piketty suggests that the main driver of inequality is the tendency of capital return in developed countries to exceed the rate of economic growth, which will cause wealth inequality to increase.** Under these circumstances, inequalities due to inherited wealth and to rising wage disparities tend to widen. However, according to Piketty, political action has curbed inequalities in the past and may do it again in the future if the right measures (for example, redistribution through a progressive tax on wealth) are put in place.

The second line of thought attributes growing inequalities mainly to wrong policy choices that have resulted in the proliferation of underemployment, low wages for the largest segments of the population while CEO-pay sky-rockets, lack of transparency in the financial sector, etc. Stiglitz (2015) – see below for a more detailed discussion – has elaborated extensively on these topics and on how **misaligned laws, regulations, and institutions have determined unequal shares in the benefits of prosperity.** He argues that “inequality is not inevitable: it is a choice we make with the rules we create to structure our economy” (ibid., p. 7), and he puts forward a number of suggestions (such as strengthening workers’ rights, raising taxes on capital gains and dividends, and increasing transparency in all financial markets) to reverse this trend.

The third main attempt to explain increasing inequalities refers to unemployment as the main reason behind the inequality surges occurring from the onset of the financial crisis. This is particularly the case for European countries, as a Eurofound (2017) report points out. While the report limits its analysis to the EU context after the Great Recession (2008), the key finding that **unemployment has been the main driver of growing inequalities during the Great Recession** complements previous studies signaling widening wage differentials as the main reason behind growing inequalities in the decades prior to the

crisis. The report also underlines the role of welfare states in preventing a greater increase in inequalities by cushioning growing market income inequalities.

In summary, the three main lines of thought analyzing the causes of inequality seem to assume that it is not an inevitable consequence of growth, but rather a consequence of the way growth is taking place. They also underline the crucial role of the welfare state and the laws, regulations, and institutions we put in place to address and reverse this trend.

An additional line of thought is that expressed by Autor et al. (2017), in which they try to explain the declining workers' compensation share of GDP or labor's share of GDP (used sometimes as an indicator of inequality) observed in numerous countries. After analyzing U.S. data in six major sectors, Autor et al. sketch a "superstar firm" model with industries increasingly characterized by "winner takes most" competition, meaning that it is increasingly common that in each industry sector just a few firms account for the bulk of sales; **another relevant finding is that this concentration seems to be negatively correlated with labor's share.** In other words, the more concentrated an industry has become, the larger the decline in labor's share (see Section 5.2.1 in Chapter 5 for a more detailed discussion of this theory). Autor et al.'s findings are consistent with Brynjolfsson and McAfee's (2014) expectation that the U.S. is developing as a "winner-take-all economy."

As for our second question (will growing inequalities eventually hinder growth?), the answer seems to be, yes. There is mounting literature suggesting that inequality *harms* growth. Whereas much has been written about the effects of economic growth on the concentration of wealth and inequality, there is an increasing interest in how mounting inequality may hinder growth. In an interview with J. Derbyshire (2015), discussing his recent book *Inequality. What Can Be Done?*, Anthony Atkinson criticizes the economic textbooks' assumption of a trade-off between equity and economic efficiency and acknowledges instead that high levels of inequality are bad for growth. He declares that

we are now learning that we need to model or think about the economy in a way that takes account of all the warts there are – things like the existence of substantial monopoly power, involuntary unemployment – things that are very much at the frontier of modern economics.

(ibid.)

According to Anthony Atkinson, the trade-off between efficiency and any intervention (like redistribution) is only true in an economy where firms have no market power and everyone has perfect information, but in the actual world in which firms have monopoly power and information is asymmetrical, it is not clear that there is any such trade-off. He also highlights the interdependence between environmental problems and inequality and the amount of resources that will have to be spent dealing with climate change. These relationships mean there will be times when GDP is rising, but real incomes will not be rising as quickly.*

In his essay "Standard Economics Is Wrong: Inequality and Unearned Income Kills the Economy," Stiglitz (2016) criticizes the "trickle-down" notion, according to which regressive economic policies – policies that favor the richer classes – would end up benefiting everyone; he further argues in favor of alternative explanations of inequality, with particular reference to the importance of institutions, and he shows that, far from being good or necessary for economic growth, excessive inequality tends to lead to weaker economic performance.

Stiglitz explains that neoclassical economists developed the marginal productivity theory, which maintains that everyone participating in the production process earns

* See Section 1.2 in Chapter 1 for a more detailed discussion of inequality.

remuneration equal to her or his marginal productivity. This theory associates higher incomes with greater contributions to society, thus justifying inequality. However, as Stiglitz points out, inequality is heavily influenced by a number of institutions and political factors, such as industrial relations, labor market institutions, and welfare and tax systems, which can both work independently from productivity and affect productivity. For example, the huge increase in the compensation of executives in the U.S. since 1993 cannot be explained by firm performance or productivity increases; it has resulted instead from flaws in corporate governance that enabled managers in practice to set their own pay.

Conversely, recent years have seen a decline in the wages paid even to skilled workers. Stiglitz offers an alternative and more plausible explanation to inequality based on the observation that rents (the income that someone receives simply by virtue of owning land, controlling a monopoly, and similar ownership claims – and not because of anything he or she does) are increasing at the expense of wages, and institutional and political factors are further amplifying the resulting inequalities: favorable tax treatment of capital gains; easier access to capital markets and credit for those already well-off; weakening of unions and workers' bargaining power; asymmetric globalization where capital is free to move while labor is much less so; central bank policies targeting inflation and raising interest rates as soon as wages start to increase; etc.

Stiglitz also debunks the argument that inequality is necessary for growth (based on the observation that those at the top save and create jobs whereas those at the bottom typically spend) by claiming that what creates jobs is *demand*. He further argues that inequality is associated with economic instability and has a negative effect on medium-term growth, since inequality leads to weak aggregate demand, poses a risk for those at the bottom of the income distribution of not living up to their potential, and makes societies less likely to make public investments in infrastructures and facilities which enhance productivity, such as public education and public transport. Finally, he proposes a number of policies that can help reduce inequality: more investment in public goods; better corporate governance; anti-trust and anti-discrimination laws; a better regulated financial system; stronger workers' rights; and more progressive tax and transfer policies.

These same ideas are present in Stiglitz's (2015) "Rewriting the Rules of the American Economy: An Agenda for Growth and Shared Prosperity." In this report, he claims that "dominant economic frameworks over the past 35 years – like 'trickle-down' economics, and the idea that markets work perfectly on their own – paved the way for an onslaught of policies that decimated America's middle class" (ibid., p. 7). Stiglitz (2015, p. 7) presents an alternative framework based on the following principles:

- Markets are shaped by laws, regulations, and institutions. Rules matter.
- The rules determine how fast the economy grows and who shares in the benefits of that prosperity.
- Concentrated wealth can hurt economic performance. Under the right rules, shared prosperity and strong economic performance reinforce each other. There is no trade-off.
- A tentative, piecemeal policy response to help the neediest will not suffice. We must rewrite the rules of the economy with a focus on restoring a balance of power between the competing interests that make up the modern economy.

Like Stiglitz, the World Economic Forum's *Inclusive Growth and Development Report* (2017) acknowledges that the ultimate objective of national economic performance is broad-based and sustained progress in living standards, a concept that encompasses wage and non-wage income (e.g., pension benefits) as well as economic opportunity, security, and quality of life. However, the implicit income distribution system within many countries is in fact severely underperforming or relatively underdeveloped. The report aims to offer

a new policy framework and corresponding set of policy and performance indicators to help countries practice inclusive growth, and it presents a policy framework encompassing several principal domains which describe the spectrum of structural factors that particularly influence the breadth of social participation in the process and benefits of economic growth. The report concludes that how well growth benefits society as a whole depends on the framework of rules, incentives, and institutional capacities that shape the quality and equity of human capital formation; level and patience of real-economy investment; pace and breadth of innovation; effectiveness and flexibility of worker protections; coverage and adequacy of social insurance systems; quality and breadth of access to infrastructure and basic services; probity of business and political ethics; and breadth and depth of household asset-building.

As discussed extensively in their book *Why Nations Fail* (Acemoglu and Robinson 2012a), the authors claim that “economic inequality will lead to greater political inequality, and those who are further empowered politically will use this to gain greater economic advantage, stacking the cards in their favor and increasing economic inequality still further – a quintessential vicious circle” (Acemoglu and Robinson 2012b). Gilens and Page (2014) have also expressed concern about the effects of inequality in governance. In an earlier paper on inequality and democratic responsiveness, Gilens (2005, p. 778) examines the extent to which government policies are biased toward the preferences of high-income Americans and find that when Americans with different income levels differ in their policy preferences, actual policy outcomes strongly reflect the preferences of the most affluent, but there is “virtually no relationship” to the preferences of poor or middle-income citizens. The study shows therefore a vast discrepancy in government responsiveness to citizens with different incomes and illustrates the negative effects of inequality on democracy and governance.

Health is another area negatively affected by inequality. A study by Stringhini et al. (2017) argues that the negative effects of poverty and inequality on health and years-of-life lost are stronger than the negative effects of hypertension, obesity, and excessive alcohol consumption. The study urges the WHO to treat socioeconomic circumstances as a target for local and global health strategies, health risk surveillance, interventions, and policy.

The above shows that inequality has multiple negative effects on different areas such as health (Stringhini et al. 2017), the environment (Laurent 2013; see the discussion in Section 3.4.1), economic growth (Stiglitz 2015, 2016; Brynjolfsson and McAfee 2014), and governance (Stiglitz 2015, 2016; Acemoglu and Robinson 2012a; Gilens and Page 2014).

Sustainable consumption is yet another area closely intertwined with inequality (for a more detailed discussion about sustainable consumption, see Section 3.7). Halina Brown (2016) poses the relevant question of how to address income inequality while also promoting sustainable consumption. Her key finding is that household income is a strong predictor of a household’s carbon footprint. Specifically, as shown in Figure 3.4, among U.S. households the correlation is linear for the bottom 80 percent of income categories (up to approximately \$120,000 for a family of four) and accelerates above it (Ummel 2014). In other words, the more we earn, the greater our greenhouse gas (GHG) footprint is. As a consequence, if we were to decrease income inequality by reducing the number of households with the extremes of income (at the top and at the bottom) and increase the number of households in the central categories, total consumption-based GHG emissions would remain more or less the same. However, if we reduced the proportion of households in the lowest income bracket by moving them into the middle-income category, without touching the households in the top category, the total emissions would increase. **The conclusion of this analysis in terms of inequality and sustainable consumption is that raising the income of those who most need it will result in greater total greenhouse gas emissions unless we simultaneously reduce the income at the top. Of course, there are other complementary policies that can reduce GHG emissions.**

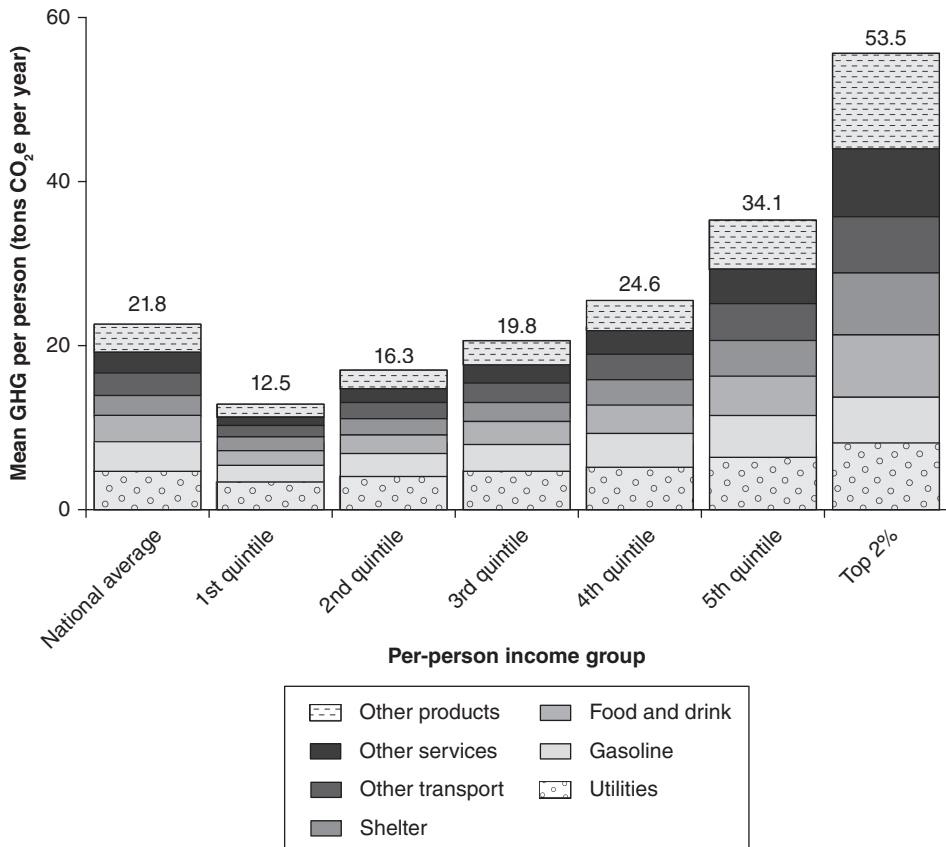


Figure 3.4 Average GHG footprint and income per person

Source: Adapted from Ummel, K. (2014). *Who Pollutes? A Household-Level Database of America's Greenhouse Gas Footprint*. Center for Global Development Working Paper No. 381.

Cohen et al. (2017) also explore the relationships between growth, consumption, and inequality. They claim that the emergence of a consumer society was enabled by the shared conviction that consumer capitalism was a superior system for generating and distributing societal wealth and for nurturing democracy. A particular interpretation of Keynesianism supported the idea that mass consumption should be the pillar on which to build a virtuous circle of economic growth. In the second half of the twentieth century, neoliberalism increased the dependence on economic growth and consumption as the interlinked engines of social progress, giving rise to economic and social policies that ultimately triggered the Great Recession of 2008 and are responsible for growing income inequality and other harmful social conditions.

What is clear from the above discussion is that **inequality is influenced by many factors and also depends on the utilization of the different factors of production, natural capital, physical capital, energy, ICT systems, and labor, which are in turn influenced by their relative prices, their price volatility, how easy it is to temporarily retire them from the production process, and their mobility – elements that are themselves influenced by laws and institutions.** Whether technological displacement is stimulated by one or more of these elements, the fact is that technological displacement has occurred and results in the

different utilization and reward of labor (see the discussion in Section 5.2.1 in Chapter 5). This conclusion explains how increasing productivity gains are compatible with both lower median family income since the 1980s and greater unemployment since the 2000s (N. A. Ashford et al. 2012; Jackson and Victor 2013; Schor 2010; Bernstein and Raman 2015).

3.5.3 *The next industrial revolution?*

Musings of the nature of the next industrial revolution provide different contrasting visions of the future. In an article titled “The NEXT Industrial Revolution,” environmentalists McDonough and Braungart (1998) argued that the greater use of natural capital and ecologically sound sources and uses of energy would spawn a new era of industrial activity to satisfy human needs, but they ignored the role of government in achieving this goal. A full decade later, Jänicke and Jacob (2009, pp. 2–3, emphasis added) – two established scholars identified with ecological modernization and who see a central role for government – described their vision for the future:

We assume that after a long phase of technological innovation towards the substitution of fossil energy and exhaustible raw materials, which started with the first oil crisis (1973), a phase of radically accelerated transformation now lies ahead. We expect that the starting point will be in Europe. In addition to the technological competence and the necessary capital available here, there is also a relatively demanding regulative environment which is simultaneously open to innovation. Those are three conditions necessary for rapid change to occur, but unfortunately they are not sufficient to guarantee success. There is a risk that conventional structures could weaken the dynamic, thereby only allowing for limited or marginal improvements to the status quo. Finally, such a disruptive development has the risk of devaluing investments and related skills in currently dominating sectors and regions. **In order to assure that the imminent Third Industrial Revolution will not be accompanied by distortions and social conflicts similar to those experienced during the First Industrial Revolution, there is a need for broad steering and decisive action. The relationship between economic markets and the state, which was for a long time characterized by the withdrawal of the state from the economic process, needs to be reassessed.**

Unlike proponents of market fundamentalism, Jänicke and Jacob (2009) see an important steering mechanism for government (see Chapter 8 for an extensive discussion of the government’s role in industrial policy).

Brynjolfsson and McAfee (2014) describe with enthusiasm the upcoming digital revolution which will produce dramatic increases in terms of diversity, quality, and affordability of goods and services to satisfy the needs of development. However, they warn against the “spread” challenge (i.e., how will that bounty be distributed? Who will benefit?) and the emergence of a “winner-take-all economy.” Their concern is with the “hollowing out of the middle class” and substantial reductions in purchasing power for both middle-class and low-skilled workers.

In confronting that challenge, they grant a significant role to both the private and public sectors and call for democratic participation and action to define and promote our vision and values as a society. Some of their recommendations include the reorientation of our education “from its industrial-era focus in math and reading to a broader set of personal and intellectual skills necessary for working alongside the new smart machines” (Pearlstein 2014);* the reduction of the regulatory and administrative burden that weighs

* As quoted by Pearlstein (2014, p. 3) who wrote a review of Brynjolfsson and McAfee’s work.

on startups, which are potential job generators; the taxation of economic rents and of negative externalities (via so-called Pigovian taxes); the implementation of a negative income tax to ensure a minimum income to all individuals; and other ideas like the launch of a “made by humans” labeling movement, the granting of credits to companies that employ humans, the launch of infrastructure and other public programs to ramp up hiring by the government, and the remuneration of people to do “socially beneficial” tasks.

All their policies aim to (re-)value the labor and work of individuals, making them race not “against” but rather “with” the machines, to ensure that they have the means to meet their essential needs and be an integral part of society. As individually all the policies suggested seem perfectly reasonable, we may wonder, like Pearlstein (2014), why they were not adopted long ago. Along with Kuttner (2013), Pearlstein (2014), and Stiglitz (2010), we understand the need to go one step beyond policy recommendations and dive deeply into the systemic intellectual, ideological, and political foundations and dynamics that are preventing progress in multiple areas of the sustainable development agenda. One such area, to which we now turn, is the financial system that has so far largely failed to provide an effective method for financing development. Also see the discussion on the global financial system in Section 4.6 in Chapter 4 and Robinson (2017).

3.6 Increasing the earning capacity of individuals, democratizing credit, and increasing investment in public goods

This section presents three different approaches to providing people with the means to live a healthy and productive life. Direct subsidization of income for individuals or families unable to earn enough to pay for essential goods and services has been recommended by many commentators (Speth 2010a, 2010b, 2010c; Jackson and Victor 2013; Goodwin 2014a, etc.).* However, there are many ways in which this objective can be achieved.

The first subsection introduces the theory of binary economics, which presents an approach to increasing non-wage income through broadening capital ownership. The theme of broadening ownership through other mechanisms by allowing individuals to invest capital from the future earnings of capital is continued in the second subsection, which discusses how democratizing ownership can increase individual or family earning capacity and protect public goods. Whereas the ideas of binary economics and democratizing ownership can be applied in any region of the world, the third subsection focuses on microfinance as a potentially critical approach to economic development in emerging economies.

3.6.1 *Binary economics*[†]

Binary economics (also called inclusive capitalism, two-factor economics, and the theory of universal capitalism) is a relatively new economic theory. **Its unique central premise is that a broader distribution of capital acquisition would provide the rational expectation of more broadly distributed capital income (and consumer demand) in future years and therefore greater market incentives for the fuller employment of labor and capital (and economic growth) in earlier years.** This premise is known as “the principle of binary growth” (R. Ashford 2016). The foundations of the theory were first introduced by corporate finance attorney, investment banker, and philosopher Louis Kelso (founder of the

* The new economics agenda is discussed in Section 3.7.

† The section was coauthored with Robert Ashford.

employee stock ownership plan [ESOP])^{*} and Mortimer Adler in 1958 and advanced with greater specificity in 1961.[†] Whereas, Kelso did not stress the novelty of this principle in his extensive writing, Robert Ashford identifies the principle as the basis for describing binary economics as a distinct paradigm for understanding market economics. The principle provides a theoretical foundation for structuring a private-property system that will tend more to broaden rather than concentrate capital ownership and thereby produce enhanced earning capacity for poor and middle-class people, greater and more broadly shared prosperity, and enhanced levels of sustainable growth (R. Ashford 1998, p. 26).

3.6.1.1 *The theoretical fundamentals of binary economics*

Binary economics can be distinguished from conventional economic theory through **three fundamental and related assumptions**:

- 1 Labor and capital[‡] are *independently productive*,
- 2 Technological innovation makes capital much more productive than labor in task after task; and
- 3 A broader distribution of capital acquisition would provide the rational expectation of more broadly distributed capital income (and consumer demand) in future years and therefore greater market incentives for the fuller employment of labor and capital (and economic growth) in earlier years.

Binary economics derives its name from the premise that there are only two fundamental factors of production: human and non-human (capital). According to the binary view of production, although labor and capital may cooperate (just as people may cooperate) to do work, each factor (the human and the non-human) does its own work, has its own productive capacity, and demonstrates its own independent productiveness (R. Ashford 1998, 2003, p. 7). The special meaning of “independent productiveness” and uniqueness of these premises are explained below.

The first crucial assumption underlying binary economics (that capital and labor are *independently productive*) implies that capital contributes to production and growth in a way that is *independent* of the productive contribution of labor reflected in labor productivity, including any labor input necessary to employ the capital. This assumption is fundamentally different from Adam Smith’s paradigm for growth, which assumes that capital has only an indirect effect on growth by facilitating labor specialization, making labor more productive, and enabling the employment of more workers (R. Ashford 1998, 2003). It is also fundamentally different from the analysis of wealth maximization reflected in neo-classical efficiency and growth theories premised on the optimal allocation of resources based on the marginal productivity of labor and capital.

The binary approach is also fundamentally different from the approach of John Maynard Keynes, who in his *General Theory of Employment, Interest, and Money* distilled the operation of the macroeconomy to three fundamental variables: time, money, and labor, with labor

^{*} First implemented by corporate finance attorney Kelso with a company known as Peninsula Newspapers in Palo Alto, California, the ESOP has grown into one of the most widely used methods for broadening capital ownership in the United States (NCEO 1996, cited in Gauche 2000).

[†] *The Capitalist Manifesto* (1958) and *The New Capitalists* (1961).

[‡] As used in this theory, capital includes minerals, wood, land, animals, structures, machines, energy, and intangibles protected as property – i.e., anything capable of being owned and producing income. It does not include financial capital or money, which are claims or bids on capital.

being the only fundamental “productive” variable. In the binary approach, labor and capital are two equally fundamental, independently productive (i.e., binary) variables; and the productiveness, productivity, and earning capacity of capital cannot be expressed merely as a function of the productivity of labor (R. Ashford 2003, p. 5).^{*} The binary analysis is likewise distinct from Solow’s approach to growth, discussed in Section 3.2.1, which attaches no fundamental significance to the distribution of capital acquisition and ownership.

Understanding how conventional and binary economics differ requires a clear understanding of the difference between “productivity” and “productiveness.” *Productivity* is usually understood to be the ratio of the output of all factors of production divided by the input of one factor (usually labor), although sometimes it refers to total factor productivity described as output divided by all factors. Thus, an increase in production can produce empirical measurements that show an increase in both labor and capital productivity; but such productivity measures do not reveal how much work each factor is contributing to the increased production, nor the marker value of that contribution. *Productiveness*, on the other hand, can be understood retrospectively to mean work done by each factor, and prospectively to mean productive capacity (R. Ashford 1998, p. 29, 2003, p. 8).

Consider examples used by Robert Ashford (1996, p. 10): Assume that in a pre-tool age, a person could dig a hole in four hours by hand. After the invention of a shovel, she can dig the same hole in one hour. Conventionally, she has four times the productivity because she can perform four times as much work in the same time period. In binary economic terms, the productiveness has changed from 100 percent labor before the invention of the shovel, to 25 percent labor and 75 percent capital with the employment of the shovel. In producing the hole, the worker contributes only one-fourth as much productive input, so her labor productiveness per hole has been reduced to only one-fourth of its former value. Seventy-five percent of the worker’s former productiveness has been replaced by an equal amount of capital productiveness.

The concept of “independent factor productiveness” is perhaps more clearly revealed by the work of hauling sacks: (1) a person can haul one sack one mile in one hour and is exhausted; (2) with a horse, five sacks can be hauled four times as far (yielding a 20-fold increase in output); (3) with a truck, five hundred sacks can be hauled forty times as far (yielding a 20,000-fold increase in output); and (4) with a self-driving truck, the work of the driver can be eliminated.

Although the increase in output can be explained via Smith’s labor specialization theory and via marginal productivity theory, the binary analysis offers a different explanation that may better identify the *cause* of the increased output: *because* of its increasing productiveness, capital is doing ever more of the work.[†]

Thus, based on its productiveness, **capital can be understood to have six powers important to production and growth.** Specifically, capital can:

- 1 Replace labor (doing what was formerly done by labor);
- 2 Vastly supplement the work of labor by employing capital to do much more of the kind of work that humans can do (such as the greatly increased hauling that can be achieved by employing autonomous trucks);

^{*} Thus, while the Keynesian approach to fuller employment is a short-run analysis in which the distribution of capital acquisition is not a variable, the binary approach is a long-run analysis of fuller employment in which the distribution of capital acquisition is a variable that affects prices and the earning capacity of labor and capital in both the long and short run (R. Ashford 2013–2014, pp 180–181).

[†] The assertion that capital does work and is independently productive does not negate the fact that both capital and labor are generally needed to complete specific kinds of work or the fact that labor is needed to invent, build, install, operate, maintain, store, repair, manage, and finance capital. But the labor work needed to employ capital is not the work of the capital itself.

- 3 Do work that labor can never do (for example, elevators lift tons hundreds of feet in the air; airplanes fly; scientific instruments unleash forces that create computer chips that cannot be made by hand; fruit trees grow fruit, while all farmers can do is assist in the process);
- 4 Work without labor (as in the case of washing machines, automated machines, robots, and wild fruit-bearing trees);
- 5 Pay for itself out of its future earnings (the basic rule of business investment); and
- 6 Distribute income to purchase its output (the logic of double-entry bookkeeping and foundational principles of business and corporate finance).

Each of these ways of contributing to growth (including mere labor replacement, which produces the same output as before, plus leisure and/or unemployment), is significant, but only the first power directly involves the mere *substitution* of capital for labor (marginal or otherwise).

When analyzing how production and productive capacity have changed since 1776, binary economists believe that in contributing to economic growth, capital (such as the shovel, horse, truck, airplane, washing machine, computer chip, and software) does much more than increase the productivity of the humans who employ it; these capital inputs are increasingly doing most of the additional work that comprises economic growth. In other words, not only does capital contribute to production beyond any labor needed to employ it, but also *most* economic growth is caused by increasing capital productiveness rather than increasing labor productivity. Although capital may be seen to concentrate higher productivity into fewer workers, as the general rule in the aggregate, the primary effect of technological advance is to not only replace but also vastly supplement the productiveness of labor with ever-greater capital productiveness.

From somewhat different conceptual reasons, Brynjolfsson and McAfee (2014) argue that the substitution of capital for labor may well destroy total employment, whereas complementary uses of ICT (the second power) may dampen or even overcome employment losses (see Section 3.5.2).

Building on the first two binary assumptions, consider the third (and most paradigm-altering) assumption: the principle of binary growth, which states that a broader distribution of capital acquisition would provide the rational expectation of more broadly distributed capital income (and consumer demand) in future years and therefore greater market incentives for the fuller employment of labor and capital (and economic growth) in earlier years.

Because of its independent productiveness, capital works on both sides of the production-consumption economic equation by providing vastly increased:

- productive capacity and production; and
- capacity to distribute income and leisure.

According to binary economists, in a private-property, market economy, it is the capacity of capital both to do much more work and to distribute much more income and leisure that explains how the distribution of its ownership has a positive impact on the fuller employment of unused capacity (i.e., labor and capital), capital accumulation, growth, and the distribution of earning capacity.

In this regard, consider the fifth and sixth powers of capital set forth above. Capital can:

- 5 Pay for itself out of its future earnings (the basic rule of business investment); and
- 6 Distribute income to purchase its output.

A broader distribution of capital acquisition, ownership, and income strengthens the promise of capital to pay for itself out of its future earnings, reduces the risk of business

failure, and makes profitable the employment of more (and increasingly more productive) capital.

The resultant binary growth is the result of the increasing productiveness of capital and the broader distribution of ownership. This distribution-based relationship to growth is not revealed by conventional classical and neoclassical analysis, which assumes that the productive input and value of capital are functions of labor productivity. It is not revealed by the growth analysis of Solow, which attaches no fundamental significance to the distribution of capital acquisition. Nor is it revealed by the short-run fuller employment analysis of Keynes, which reduces the operation of the economy to time, money, and labor and therefore cannot yield a conclusion that resource allocation and growth are independent functions of the productiveness of capital and the distribution of its ownership.*

Binary economists' view of economic growth has profound implications regarding how people can most efficiently participate and share in this growth. Conventional economists assume that the gains for most people must come via more jobs and higher wages, lower prices for goods and services, and welfare redistribution – all functions of productivity. Binary economists see far greater potential for most people via capital acquisition with the earnings of capital. They argue that if the effect of technological innovation is to displace and reduce the importance of labor in production while increasing the importance of capital, the preservation and enhancement of individual earning capacity in a market economy requires practical market mechanisms that enable all people to acquire a share of this growing capital productiveness (R. Ashford 1998, p. 34). Like well-capitalized people, everyone needs the opportunity to acquire capital, not merely with the earnings of labor, but also increasingly with the earnings of capital. According to R. Ashford, a widespread understanding of the principle of binary growth will enable market participants by way of non-redistributive, voluntary transactions to do exactly that.

3.6.1.2 Implementing binary economics

According to R. Ashford, an understanding of how the logic underlying the principle of binary growth can be implemented in an industrial market economy by considering the 3,000 largest corporations in the United States, which presently own over 90 percent of investable assets in the United States. Presently the ownership of this corporate wealth is highly concentrated: around 1 percent of people own 50 percent of this corporate wealth and 10 percent own 90 percent, leaving 90 percent of people owning little or none. Through these corporations, almost all new capital is acquired with the earnings of capital, and much of it is acquired with borrowed money (Brealey et al. 2004). Thus, capital returns its value at a rate reflective of its long-term (suppressed) earning capacity as it buys itself for a small minority of the population (Wolff 1995a, 1995b). The shortfall in effective demand that other economists see as a deficiency in productivity, wages, redistribution, and/or other government austerity and stimulus policies is seen by binary economists as a consequence of the concentration of capital ownership which fails to distribute sufficient consumer demand to employ the full productive capacity of available labor and capital. If broader ownership will promote substantial growth, as binary economics contends, then an increasingly widespread understanding of this principle of binary growth will reveal that corporations have a commonly shared incentive to broaden their ownership.

* This premise is in fact based on another assumption: the typically wealthy capital owners have a lower marginal propensity to consume than the laboring poor. If true, then a broader distribution of capital acquisition would produce greater consumer spending and therefore growth. "Binary growth is a distribution-based growth that is presently impeded by the prevailing pattern of concentrated capital acquisition" (R. Ashford and Shakespeare 1999, p. xi).

Through the existing system of corporate finance, to acquire capital with the earnings of capital, both corporations and well-capitalized people who own corporate shares use (1) the pretax earnings of capital, (2) collateral, (3) credit, (4) fiduciary trusts, (5) financial analysts, (6) market and insurance mechanisms to price, diversify, and reduce risk, and (6) a monetary policy intended to protect private property. R. Ashford maintains that **if capital can competitively pay for its acquisition costs out of its future earnings primarily for existing owners, the same institutions and practices that work profitably for well-capitalized people and corporations can do so even more profitably if all people are included in the acquisition process** (R. Ashford 2003, p. 15).

The institution that can be used to competitively acquire capital with the earnings of capital for poor and middle-class people is the professional trust fiduciary (such as Fidelity and Vanguard, which presently assist mostly wealthier people to acquire capital with the earnings of capital, roughly in proportion to their existing wealth). The prospect of binary growth reveals how such trusts can also assist poorer people to acquire capital with the earnings of capital – but in proportions not limited to their existing wealth. Operating with techniques akin to conventional real estate mortgage financing, but modified to meet corporate purposes, the trusts could borrow money and use it to acquire for them beneficial ownership of dividend-paying common shares issued to the trust fiduciaries by participating companies. The share acquisition loans would be repaid with earnings of the capital acquired. The beneficial owners (primarily employees, customers, and neighbors of participating companies) are selected by the participating companies in conformity with legislated eligibility and nondiscrimination rules. No income is earned by binary beneficiaries (employees, consumers, or welfare recipients) unless their capital has paid for itself, and thereafter beneficiaries earn net income only after all expenses of production are paid and all necessary reserves for depreciation and research and development are set aside to maintain the capital in a competitive technological condition. Thus, one recurrent political objection (and, therefore, an obstacle) to assisting the economically disadvantaged by conventional means (that is, an argument that such assistance is redistributive and therefore inefficient and a drag on growth) is eliminated if binary analysis is given credence.

Enabling all people to increase their earning capacity by acquiring capital with the earnings of capital requires no redistribution of prior accumulated income/wealth. Ownership-broadening binary financing offers the prospect of a competitive alternate distribution of the ownership of, and income from, future growth. Of course, any competitive alternate distribution of the benefits from the future growth of the economy will alter the distribution of political and economic influence. Accordingly, a competitive broadening of ownership of the distribution of future wealth may have the effect of reducing the relative influence of those who presently benefit from the substantial, concentrated wealth promoted by the existing economic system.

Thus, with a widespread understanding of the principle of binary growth, facing the usual prospect that recession is the exception and some level of growth is the rule, **to meet their annual capital investment needs (needed to maintain market-share) America's credit-worthy corporations will have (in addition to their use of retained earnings, direct borrowing, and sale of stock, primarily to people in proportion to their existing wealth) an additional, more profitable, ownership-broadening way of doing so.**

After the acquisition debt obligations are repaid with the dividends on the binary stock, the distributed earnings of capital acquired by members of the working and middle class will create more production-based consumer demand (and therefore greater corporate profitability) than if that capital had been acquired by richer people. Binary economists argue that the distributive effect of the broader ownership of capital will lead to a steady “binary growth” of the economy.

Predicted results of such broadening of capital acquisition include (1) enhanced earnings for poor and middle-class people, (2) enhanced corporate profits and growth,

(3) reduced need for welfare dependence, government spending, borrowing, and taxes, and (4) enhanced sovereign creditworthiness. These predicted results, if realized, would surpass expectations based on mainstream theories and would make economic growth strategies more affordable and politically feasible.*

The theory of binary economics has also been applied by the Center for Economic and Social Justice (CESJ) in their proposal to create the Capital Homestead Act, which can be considered as a modern version of Lincoln's Homestead Act of 1862.† Building on the theory of binary economics, the Capital Homestead Act presents a national economic agenda of monetary, tax, and expanded ownership reforms designed to lift barriers to universal access to the means for every person to become an owner of income-producing capital.

3.6.1.3 Some policy implications of binary economics

If the third basic premise of binary economics – that a broader distribution of capital acquisition provides the rational expectation of more broadly distributed capital income (and consumer demand) in future years and therefore greater market incentives for the fuller employment of labor and capital (and economic growth) in earlier years – is valid, it has implications that either do not follow from conventional economic analysis or may significantly vary from it. Several of these implications are that this premise provides:

- 1 An additional approach to fuller employment and growth;
- 2 An additional approach to enhancing the earnings of poor and middle-class people in the age of the robots beyond minimum wage legislation, government jobs programs, and guaranteed minimum income;
- 3 A means to reduce the need for welfare distribution;
- 4 An additional approach to environmental sustainability by (1) making greener technologies and regulations more affordable and politically achievable and (2) targeting ownership-broadening financing so as to promote the production of inherently sustainable goods and services;
- 5 An additional approach to development and foreign assistance;
- 6 An additional approach to globalization;
- 7 An additional approach to privatization; and
- 8 A means to reduce the need for economic immigration.

3.6.2 Democratizing ownership

The current ownership system constitutes a roadblock to sustainability, especially since markets, along with the regulatory incentive system, still do not appropriately reward environmentally and socially responsible behavior. Changing the structure of individual and corporate ownership to increase both individuals' earning capacity and investment in public goods is thus a crucial endeavor of sustainable development. While Section 3.6.1 focused on the individual, the present section examines "sustainability-oriented" models of business ownership and public investment, which turn out to be, more often than not, intertwined with the topics of "local ownership," "local investment," and "sustainable local development."

* See R. Ashford et al. (2012, p. 73) and R. Ashford (2016) for additional commentary on the potential impacts of binary economics.

† For more information on the CESJ and the Capital Homestead Act, see www.cesj.org/learn/capital-homesteading/

Since the publication of Schumacher's *Small Is Beautiful: A Study of Economics as If People Mattered* in 1973, the literature focusing on politics and economics at a local, community scale has burgeoned.* More recently, Kelly (2012, p. x), who argues "ownership is the gravitational field that holds our economy in its orbit, locking us all into behaviors that lead to financial excess and ecological overshoot," advocates for a broad and radical **transition from the current extractive ownership system to a generative ownership system embedded with sustainability**[†] (her terminology). This "generative ownership" is characterized by (1) a living purpose, (2) a (locally) rooted membership, (3) a mission-controlled governance, (4) stakeholder finance, and (5) ethical networks.[‡]

According to Kelly's (2012, p. 150) study, businesses and other entities based on a generative ownership structure seek not to maximize profits but rather to accomplish a greater social- or environmental-mission or "create the conditions for life." This is their "living purpose." Profits are set back in their rightful place: they are the means, not the end. While Kelly agrees that this is what profits were initially meant to be (means, not ends), she argues that businesses lost track of that important notion as ownership got moved further and further away from the enterprise itself (via stock ownership and financial markets). Therefore, she sets the requirement for a "rooted membership," i.e., "ownership in the hands of stakeholders intimately involved with the tangible workings of the enterprise" (Kelly 2012, p. 167). Such rooted members can be members of the founding family (e.g., S.C. Johnson), employees (e.g., businesses founded as partnerships), members of the community (e.g., municipal ownership of the town's electric facility), or "others connected to the real economy of jobs and homes and human life" (ibid., p. x). **This is the heart of Kelly's argument: generative rather than extractive ownership and rooted rather than absentee membership are more prone to sustainability.**

The main reason behind her argument is that generative ownership, with its five features, contributes to a locally grounded and multi-party ownership of the firm or entity, and as such establishes multiple "checks and balances" in the system. For example, consider a firm that is owned by its employees. Just like in the extractive scheme, employees will determine a reasonable level of profits to be achieved in order to maintain a healthy financial situation. This will enable them to pursue their initial vision and objectives of contributing to the betterment of their community (i.e., their "living purpose") over the long-term. However, unlike in the extractive scheme, in determining that level of profits, they are most likely to take into account (1) the availability and utility of their own jobs as well as the quality of their lifestyles (i.e., how many hours a week can they work before experiencing too much pressure or stress? What is the proportion of time they want to dedicate to working versus to developing their social relations? What is the amount of income that they want to obtain? etc.) and (2) the impact they have not only on their

* A good selection of recent works includes: *The Local Politics of Global Sustainability* (Prugh et al. 2000), *Community Currencies: Small Change for a Green Economy* (Seyfang 2001), *Keeping Wealth Local: Shared Ownership and Wealth Control for Rural Communities* (Kelly and Ratner 2009), *Humanizing the Economy: Co-operatives in the Age of Capital* (Restakis 2010), *Owning Our Future: The Emerging Ownership Revolution* (Kelly 2012); *Green Economy at Community Scale* (Jackson and Victor 2013), *Economic Direct Democracy: A Framework to End Poverty and Maximize Well-Being* (Boik 2014), and many others.

† Understand "extractive" as unsustainable and "generative" as sustainable. Both Kelly (2012) and Acemoglu and Robinson (2012a) use this term, albeit in slightly different contexts. The latter define extractive institutions "where an elite controls the economic and political system and uses its power to extract wealth from the society at everyone else's expense" (Acemoglu and Robinson 2012b).

‡ As such, it is distinct from the prevailing extractive ownership, characterized by (1) a financial purpose, (2) an absentee membership, (3) governance by markets, (4) casino finance, and (5) commodity networks (Kelly 2012).

community, but also on their environment. Indeed, employees who are also community members presumably will not be willing to extract and/or pollute the resources that provide for the subsistence of their own community and businesses. They might also be motivated to preserve the landscape of their surroundings.

Employee-ownership is not the only form of “generative ownership.” Kelly and Ratner (2009) provide other interesting examples and case studies of co-operatives, community land trusts, municipally owned enterprises, local ownership, tribal ownership, community covenants and easements, and mission-controlled ownership (e.g., benefit corporations,* limited liability companies, social purpose corporations, etc.). These may be supported or complemented by other mechanisms for communities to control wealth flows generated within their territory: community fees and taxes, community endowments, community benefits agreements, community loan funds and community development financial institutions (CDFIs), and community currencies. All of these structures contribute to redefining business success and community prosperity by voluntarily meeting higher standards of transparency, accountability, and performance, creating higher quality jobs, improving the quality of life, and “competing to be not just the best in the world, but the best for the world” (quote from “Why B Corps Matter,” Ryan Honeyman 2014, p. 1).

There are, however, significant challenges to be tackled for these sustainability-oriented local economic models to succeed and spread. Kelly and Ratner (2009) note: (1) the lack of financing; (2) the lack of understanding, expertise, and thus support for the creation of shared-ownership enterprises; (3) the aversion to collective action (“fear of socialism”); (4) the uneasy fit of these shared-ownership structures with the existing legal and financial frameworks; and (5) the lack of management capability. While they do not go into much more depth or offer solutions, we provide some insights with regards to challenges (1) and (4).

Because the financial rate of return on the broader ownership entities may be lower than those of more “conventional” profit-seeking investments, tax exemption for realized profits may be needed to incentivize their creation and funding. Haskell Murray (2012, p. 46) agrees that “tax advantages could give potential investors reason to invest in social enterprises,” but raises the concern that “traditional businesses may argue that those tax breaks facilitate unfair competition from social enterprises” (ibid., p. 47).

Without tax breaks (and if projected monetary returns for social enterprises lag behind traditional companies), social enterprises will have to raise capital from investors who value [. . .] positive social and environmental outcomes to compensate for the potentially less favorable monetary returns.

(ibid., p. 47)

Even then, while value-driven investors – foundations (USD 600 billion in assets in the U.S. in 2010) and impact investors (USD 4 billion in investments in the U.S. in 2011)[†] – “will serve as potential sources of capital for social enterprises” (Haskell Murray 2012, p. 47), both will be concerned with issues relating to challenges (2), (4), and (5), including board guidance and accountability, the objective measurement and monitoring of the

* Note that benefit corporations are not all B-Corps and vice versa. “‘Certified B Corporations’ are ‘social enterprises’ certified by the nonprofit organization B-Lab, while ‘benefit corporations’ are formed under the state of law of one of the states that have passed benefit corporation statutes” (Haskell Murray 2012, p. 21).

† This is the figure if we consider the narrowest definition of impact investing. The figure goes as high as USD 3.07 trillion if we consider all Sustainable and Responsible Investing (SRI) (Haskell Murray 2012, p. 48).

social and environmental benefits created, and the way the IRS currently treats grants to, or investments in, (for-profit) social enterprises. Indeed, “nearly all institutional funds” today “are managed to ERISA[*] standards, which demand that investment managers maximize financial returns on investments” (Sheehy Cates 2011, p. 6). Social enterprises and other shared-ownership structures cannot meet this return standard, cutting themselves from yet another large pool of potential funds.

While still in their infancy, recent financing innovations, including crowdfunding and social impact bonds, are progressively gaining traction. Haskell Murray (2012, p. 51) argues that by shifting “some of the risk inherent in a given social services project from the government to the market,” they could “become part of the social enterprise capital raising solution.”

Reports drafting policy recommendations to boost impact investing, including those by Sheehy Cates (2011), the U.S. National Advisory Board on Impact Investing (2014), and the G8 Social Impact Investment Taskforce (2013), have flourished recently. While varying in their approach, they all agree on a certain set of priorities, namely:

- 1 Removing regulatory barriers to unlock private impact investments (e.g., by clarifying that impact investments can be consistent with the ERISA standards);
- 2 Increasing the effectiveness of government investment programs (e.g., by encouraging agencies to fund enterprises and not just projects; rolling out Social and Development Impact Bonds);
- 3 Providing incentives for new private impact investments (e.g., by modestly lowering corporate tax rates for qualified impact businesses; lowering capital gains rates for investors supporting qualified impact businesses; allowing impact investors to write off losses as a charitable tax deduction; allowing individuals to deduct contributions to U.S. impact initiatives; allowing tax-advantaged repatriation of record levels of overseas profits to support an impact investing fund in the U.S. (U.S. NAB 2014, p. 35));
- 4 Supporting innovative impact enterprises (e.g., by developing a network of financial and technical assistance providers to build capacity and develop more and higher-quality enterprises and organizations); and
- 5 Standardizing metrics and improving data access (e.g., to make it easier for social investors to develop efficient underwriting and reporting systems, and to compare and evaluate the claims made by various enterprises).

New and creative ownership rights have also been considered as a means to protect the commons. Peter Barnes (2015) suggests the creation of **common wealth trusts**, legally accountable to future generations, which would have the authority to limit usage of threatened ecosystems, charge for the use of public resources, and pay per capita dividends.

According to Barnes, common wealth belongs to everyone equally. However, markets do not currently acknowledge such wealth or its common ownership, and as result private businesses use and pollute common wealth generally without paying its rightful owners for the privilege. This includes future generations, whose rights are not properly balanced against those of the living due to the fact that they do not vote. Barnes’s proposal to work around this flaw in democracy is to give future generations representation in our economic system – which is easier to do than representing them in our political system – by assigning property rights in critical ecosystems to trusts for which asset preservation is the

* The Employee Retirement Income Security Act of 1974 (ERISA) is a federal law that aims to protect the interests of employee benefit plan participants and their beneficiaries by establishing minimum standards for pension plans in the private industry; it also provides for rules on the federal income tax effects of transactions associated with employee benefit plans.

paramount mission. In order to achieve this goal, the trusts must be organized as “legal shells” (not-for-profit corporations with state charters, self-governance, perpetual life, and legal personhood) and must have fiduciary responsibility to future generations (the managers of these not-for-profit corporations would be required to protect their assets for future generations and to share current income – if any – equally). The common wealth trust would thus provide a counter-weight to profit-maximizing companies within a market economy; in this context, the state’s job would be to ensure a proper balance between business and organized common wealth.

Barnes claims that organized common wealth “can help fix the two greatest flaws in contemporary capitalism – its relentless destruction of nature and its equally relentless widening of inequality – while preserving the benefits markets can provide” (Barnes 2015, p. 2). Since the main reasons for the current decline in job security and pay seem to be globalization and automation, neither of which is going away, assuring a decent living for all and reducing inequalities will require some form of non-labor income, which organized common wealth could provide through the payment of per capita dividends.

It can be argued that similar goals (preserving the life-sustaining capacity of the planet and addressing the widening wealth gap) can be achieved by taxing the use of public commons. Barnes, however, favors the creation of trust-administered property rights over redistributive taxation on the grounds that property rights tend to endure, whereas fiscal policies can fluctuate with the whims of politics (*ibid.*, p. 6). Either way, it should be kept in mind that unless, or until, we tackle the fundamental flaws in our financial system and the corrupting influence of the concentration of wealth, the common wealth of people contained in the ecosystem will have a limited impact on unsustainability.

Building on the theory of binary economics (discussed in Section 3.6.1), the CESJ initiative of a Capital Homestead Act includes, as one of its vehicles for ownership democratization, a **Citizens Land Bank**:

The **Citizens Land Bank (CLB)**, also referred to as the for-profit **Citizens Land Cooperative (CLC)**, **Citizens Land Development Corporation (CLDC)** and **Community Investment Corporation (CIC)**, has been designed to serve as a for-profit land planner and private-sector developer geared to sustainable development and growth at the community level. The CLB would plan land use and develop the land within designated urban and rural enterprise zones for industrial, commercial, agricultural, residential and public purposes. It would sell and lease the land and structures for public and private uses and impose charges for improvement and maintenance. To avoid restraints on competition, the CLB would normally not own other businesses that choose to locate on CLB-developed land. [. . .]

[E]very man, woman and child would automatically receive as a fundamental right of citizenship (like the political ballot, at no cost), a single lifetime, non-transferable voting share in the CLB. (Children’s shares would be voted by their parents or guardians until the child reached the age of majority.) This share would be cancelled upon death or if the citizen changed his or her permanent residence to another community. As shareholders and through their representatives on the CLB’s board of directors, local citizens could hold land planners and CLB managers accountable for local land use decisions.

Through the CLB, each citizen would also share equally as an equity owner in the community’s appreciated land values, rentals and other fees when the CLB’s plan for market-based development becomes operational. Such widespread participation in profits (normally flowing to outside investors) would supplement local incomes from wages, welfare and other sources. All citizens could then better afford to contribute to

the costs of government, health, education and other services under the community's own growth model of comprehensive development.*

The CLB provides another example of the possibilities from articulating policies and initiatives that allow simultaneously the democratizing of ownership and bridging of inequality gaps, while promoting sustainable local development.

3.6.3 Microfinance

The global microfinance movement aims to expand access to small-scale loans, saving accounts, insurance, and broader financial services in poor and low-income communities. These services are typically provided by microfinance institutions (MFIs) with both a profit mission (related to the financial sustainability of MFIs) and a social mission (with focus on the ways that microfinance can reduce poverty, fight gender inequality, and strengthen communities). Their approach is that access to microfinance will offer opportunities for the poor to unlock their productive and entrepreneurship potential by developing small business through microcredits. Increasingly, the focus is also on helping customers save for the future through microsavings services and creating more stable lives through micro-insurance products.

Since its origins as a microcredit local experiment in rural Bangladesh in the second half of the 1970s, microfinance has extended worldwide, dramatically expanding the number of clients, existing MFIs, networks, and assets associated with the approach, and has expanded the range of services offered. In parallel, many MFIs have shifted from a mainly social approach toward more aggressive commercial banking strategies, not without consequences. Current debates on microfinance relate to its potential as an anti-poverty strategy and its capacity to integrate nonfinancial considerations, among other matters.

The larger concept of microfinance includes not only microcredit but also other services such as microsavings, microgrants, and microinsurance. Microfinance is still growing today as a global phenomenon. According to the 2015 Report of the Microcredit Summit Campaign (2015), at the end of 2013 more than 3,700 MFIs worldwide reported 211 million clients, the largest number ever, 114 million of whom were living in extreme poverty. Some clear trends can be identified. Even if the total number of clients increased from 203.7 million in 2012 to 211 million in 2013, and the number of women clients with loans outstanding also increased from 150.9 million in 2012 to 157.7 million in 2013, this **growth in total clients is slowing down** compared to previous years. On the other hand, **the total number of poorest clients with loans outstanding declined** for the third straight year, from 115.7 million in 2012 to 114.3 million in 2013. Following the international financial crisis that started in 2007 and the subsequent global recession, market growth and MFI performance started to deteriorate: asset growth slowed markedly, profitability declined, and portfolio risk (measured in terms of PAR30, i.e., the share of the portfolio for which payments are more than thirty days overdue) rose from 3 percent in 2007 to more than 5 percent in 2009, reflecting problems of overborrowing (Lützenkirchen 2012, p. 2).

There is an ongoing debate about the potential and limitations of microfinance as a development strategy. Muhammad Yunus, the founder of Grameen bank, is often hailed as the father of microfinance and usually describes the poor as natural entrepreneurs; there are indeed abundant examples of poor people who have managed to be entrepreneurs in the face of adversity. There are also, however, some troubling findings. Some of

* Source: Center for Economic and Social Justice, Citizens Land Banks (CLBs), www.cesj.org/learn/capital-homesteading/ch-vehicles/citizens-land-banks-clbs/ (accessed February 6, 2018).

the MFIs that have started to critically evaluate their own programs (Banerjee and Duflo 2011, pp. 170–171) have found that poor people who benefited from a microloan, even if they were indeed more likely to have started a business and to have purchased large durable goods, rarely showed signs of any radical transformation in their lives – e.g., there is no evidence that women were feeling more empowered and no visible differences in spending on education or health. Moreover, while many of the poor borrowers were operating business, these were mainly tiny businesses which, for the most part, were making very little money. This low profitability and limited potential of business run by the poor can thus explain why microcredit does not seem to lead to a radical transformation in the clients' lives. Banerjee and Duflo (2011, p. 226) introduce the idea of the “reluctant entrepreneur” by concluding that “perhaps the many businesses of the poor are less a testimony to their entrepreneurial spirit than a symptom of the dramatic failure of the economies in which they live to provide them with something better,” namely stable jobs.

Todaro and Smith (2015, p. 798) share this view. According to them, most people prefer a regular wage and salary to running a risky microenterprise, and interviews with factory workers in developing countries such as Peru and Bangladesh suggest that many are former microentrepreneurs who gave up their enterprises in favor of a regular job. Thus, the primary problem in developing countries might be the lack of available jobs paying a steady wage or salary. Stability of employment (Banerjee and Duflo 2011, pp. 228–234) appears to be the one thing that distinguishes the middle class from the poor. A good steady and well-paid job allows a person the mental space needed to do all the things the middle class does well. Households can then spend more on health and education, which means that children can grow up in an environment where they are able to make the most of their talents. The availability of secure jobs can thus have a transformational effect on the lives of the poor. It follows that there may be a case for using some governmental resources to help create enough large businesses by providing loan guarantees to medium-size ventures, for instance. This may set off a virtuous circle: stable and higher wages would give workers the financial resources, the mental space, and the necessary optimism both to invest in their children and save more.

In conclusion, according to this view of microcredit, micro businesses still have an important role to play in the lives of the poor by providing a survival mechanism for millions around the world. It seems unrealistic, however, to think that they can pave the way for a mass exit from poverty.

In this section, we have discussed emerging mechanisms that seek to increase the earning capacity of individuals, democratize credit, and increase investment in social enterprises and public goods, without necessarily having to resort to government-imposed redistribution. It seems clear that we are entering an era with a multiplicity of ownership models that together represent an alternative to the conventional extractive ownership paradigm and carry significant potential for advancing sustainable development. These income and ownership broadening approaches are embedded within broader theories and models of sustainable development and change that articulate the complementary political, societal, and environmental factors that also need to be addressed. The next section provides an overview of the different (sustainable) economic development models that have been proposed in the recent decades.

3.7 The new economics

Since the economic meltdown in 2008, economists (and others) have been trying to develop new insights into the causes of the crisis and a new theory of economics for the

industrial state upon which to build future policy interventions. Of course, the two are connected, but understanding the causes is easier than fashioning effective future policy.

Beyond the optimism associated with the enhancement of ICT innovation in traditional economic systems expressed by the OECD and the ICT industry groups, there are a number of contrasting views of the “end of exponential growth” (R. Ayres 2006, 2014) and the nature of future growth” offered by various scholars and commentators that are concerned with sustainable growth (although some academics – such as Georgescu-Roegen – believe that the term “sustainable growth” is an oxymoron).[†] These alternative schemes might be characterized as promoting a “new economy” based on the “new economics.”

A variety of names and pathways are offered for the new economics: “green economy” (Jackson and Victor 2013, 2016), “green growth” (Borel-Saladin and Turok 2013), “conditioned growth,” “sustainable de-growth” (Harris 2010; Jackson 2009; Kallis 2011; Kallis et al. 2009; Martinez-Alier et al. 2010; Victor 2008), “post growth,” “agrowth” (van den Bergh 2011), “selective growth,” “sustainable consumption” (Lorek and Spangenberg 2013), “sharing economy” (Cohen 2017), “new economy” (Goodwin 2014a, 2014b, 2010; Speth 2008, 2010a, 2010b, 2010c), “policy integration” (Spangenberg 2014, 2007), and sustainable consumption (Vergragt 2017). They focus on promoting environmentally and socially sustainable development through differing combinations of technological progress in dematerialization and energy efficiency, decreased overall consumption of products and services that are environmentally destructive, reduction of the workweek, and redistribution of wealth or income through a basic income guarantee and/or the reduction of individual working time accompanied by no decrease in purchasing power, thereby retaining existing wages for current employees while adding others to the employment rolls (Ashford and Kallis 2013; Hayden 2013 and Section 1.1.3 in Chapter 1). (See also the earlier discussion of the work of Perez (2016) in Section 3.3.1.1, who argues that the fifth industrial revolution may result in a boom provided that government directs development towards green growth.)

Many of these notions are the object of increasing criticism: the idea of “the sharing economy,” for example, has been lately under fierce scrutiny. Cohen (2017, p. 13) points out that there is “considerable divergence between idealized conceptions of the sharing economy and actual performance,” with detractors regarding it as a manifestation of growing reliance on contingent labor and spreading economic insecurity. Tom Slee defines the sharing economy as “a new wave of Internet platforms designed to facilitate exchanges between individuals” (Hugill 2016). He argues that today it is primarily a way of using Internet platforms to facilitate transactions in the service economy, but, as the money in the sharing economy has grown, it has promoted a business model that demands deregulation of a number of industries around the world. According to Slee, the sharing economy is “a kind of anti-authoritarianism that has become a full-fledged technolibertarianism” (ibid.).

Brynjolfsson and McAfee warn of the possible “hollowing out of the middle class” in *The Second Machine Age*. While not identifying themselves with those associated with the new economics, they nonetheless offer parallel policy initiatives. These include short- to medium-term reforms in the educational system (to teach children how to use technology to increase their productiveness), in the job market (to “make more matches” and “restart startups”), in infrastructure upgrades (to “welcome the world’s talent”), and in the tax system (to tax “economic rents”), as well as long-term recommendations (e.g., the

* Victor (2010a) distinguishes green growth, brown growth, black growth, and green degrowth according to whether GNP is increasing or decreasing, alongside changes in greenhouse gas intensity and overall emissions.

† See Martinez-Alier et al.’s (2010) discussion of Georgescu-Roegen.

elaboration of a negative income tax to provide a basic income to each individual). In the final chapter of their book, Brynjolfsson and McAfee also come up with an interesting list of “wild ideas,” such as the creation of a national mutual fund to distribute the ownership of capital equitably among all citizens (although they do not connect this idea to the theory of binary economics); the remuneration of people to do “socially beneficial tasks”; the creation of a “made by humans labeling movement” or the granting of credits for companies that employ humans; and the provision of vouchers for basic necessities to eliminate the extremes of poverty.

The idea of a universal basic income (UBI) is increasingly gaining traction not only in academic circles but also in the policy arena. One of its main proponents is Guy Standing, who in 1986 co-founded the Basic Income Earth Network (BIEN), one of the earliest groups to advocate UBI in its modern form. The idea behind UBI is a regular state payment to every adult regardless of working status. Standing (Colson 2017) argues that UBI is a matter of social justice, and additionally it would enhance individual liberty and give people a sense of control over their lives. Finally, in an era of chronic insecurity and growing inequalities, societies need to have new mechanisms for income distribution that give people a sense of security. The arguments often made by opponents of UBI are affordability, the idea that perhaps inevitability UBI would mean raising taxes, and the possibility that UBI would remove the incentive to work. Standing argues instead that in every industrialized country we currently apply means-tested benefits, which keep people on social insurance because the withdrawal of benefits that comes with entering low-paid work causes there to be little increase in overall income, creating thus a “welfare trap.”

Indeed, work plays a role not only in financial stability, but also in psychological well-being and social integration,* and a UBI could constitute in some cases a disincentive to find a job. This debate has been going on for some time in EU countries, where there are typically systems in place covering shortfalls in earning capacity, with the state providing allowances for underprivileged households and/or unemployment compensations. A “solution” has consisted of making unemployment benefits temporary and dependent of the amount of days previously worked, so that beneficiaries have incentives to find a job. However, this arrangement is proving insufficient in cases (increasingly frequent) of longtime unemployed who often see themselves unable to find a job and with their unemployment benefits finished.

It is important to recognize that a UBI could be provided through either a *redistributive* or a *distributive* approach. The former approach would finance the UBI by redistributing wealth through taxes on earned income/accumulated wealth. In contrast, the second approach would finance a UBI from broadly distributing the capital ownership and earning capacity related to future growth made possible by the binary economics mechanisms described in Section 3.6.1. The latter could cause a future, rather than current, distribution of financial capital.

Standing (2017) points out that basic income is now attracting support from many quarters. This interest has prompted the launch of several basic income pilots around the world. Finland’s pilot started on 1 January 2017, but was subsequently halted on political rather than evidence-based grounds (Jauhiainen and Mäkinen 2018). The pilot consisted of granting €560 as a tax-free monthly unconditional benefit to 2,000 randomly selected unemployed people for two years. The amount they received was not reduced if they earned an income, and they were not be obliged to search for jobs. Standing expects UBI to simplify social security systems and to deliver other positive effects, such as less ill-health and mental stress for recipients, a lower probability of dropping out of high school for children from recipient families, and better

* See the related discussion in Section 1.1.3 in Chapter 1.

school performance due to core economic security and better family relations. Other UBI-related experiments started to take place in 2017 in different parts of the world (Weller 2017):

- In Kenya, a charity called Give Directly launched in October 2016 a pilot version of the largest UBI experiment in history, consisting of giving a number of villages different amounts of money (from \$22.50 to several hundred dollars) during different periods of time (between 2 and 12 years) and observing the results.
- In Oakland, California, Silicon Valley's largest startup accelerator, Y Combinator, announced in 2017 it would soon begin paying out \$1,000 per month for three to five years to 1,000 randomly selected people (from a sample population of 3,000 people) across two states.
- In Utrecht, the Netherlands, the basic income experiment (originally slated for 2017, but which has now been deferred) would last for two years and involve 250 Dutch citizens on government assistance receiving about \$1,100 per month.
- In Ontario, Canada, the Ontario basic income pilot (which began in June 2017) will provide up to CA\$16,989 for a qualifying low-income single person and \$24,027 for a couple (less 50 percent of any earned income) for up to three years.
- In India, the government is moving closer to launching a follow-up basic income experiment to the two 2010 experiments in the state of Madhya Pradesh, in which more than 6,000 people received small monthly payments for 18 months.
- In Italy, the mayor of the 150,000-inhabitant city of Livorno began giving 100 people a monthly income of \$537. In 2017, he is expanding it to 100 more. Other Italian cities such as Ragusa and Naples are considering pilots of their own.
- In Uganda, starting in 2017 the nonprofit Eight began providing unconditional weekly cash transfers (through mobile payments) to 56 adults (~\$16 USD) and 88 children (~\$8 USD) in a rural village.

Thomas Piketty has also contributed to the debate. In his view, discussions of a basic income and its specific level are not radical enough and "leave the real issues unexplored and in reality express a concept of social justice on the cheap" (Piketty 2016). He points instead to progressive taxation, fairer approaches to education, a more prominent role for trade unions, fair pay, and control within corporations as topics deserving focus. According to him, "our ambition must be that of a society based on a fair return to labor, in other words, a fair wage and not simply a basic income" (ibid.). To move in that direction, "we have to re-think a whole set of institutions and policies which interact with each other: these include public services and, in particular, education, labor law and organizations and the tax system" (ibid.).

Additionally, Piketty raises administrative concerns on how a UBI would be effectively paid. In his own words, he believes that "it is high time to move away from the comfortable abstractions that often characterize this debate, and finally to say precisely how it is possible to proceed" (Piketty 2017). He notes that, in the case of France, there exist already some inefficiencies and poverty traps – for example, employees earning the minimum wage have their taxes and social contributions deducted from their wages at source, putting their net wage below the threshold for social assistance, which makes the worker have to apply and wait several months to receive assistance to bring their income back up to the minimum level. Piketty seems to be concerned that such inefficiencies and poverty traps would proliferate under a basic income scheme, and for this reason he proposes paying the universal income in a mixed form, using different methods of payment depending on different employment circumstances: for stable employees, direct payment of an income top-up on their pay slips is to be preferred. However, for all those without a job, or in a precarious work situation (part time jobs and similar), the only solution would be to pay the universal income in the form of an allocation managed by public agencies.

Neva Goodwin (2010), co-director of the Global Development and Environment Institute at Tufts University,* analyzes the core problems of a nation being guided by standard economic theory as having a preoccupation with wealth creation, as opposed to well-being; a bias towards monetary evaluation of non-monetary goods and amenities, discounting Pareto optimality rather than distributional equity; a preference for markets rather than government intervention; and the dominance of economists in the political process (issues that have been fully addressed in this work). While acknowledging the need for increased production and consumption in the short-run, she rejects Keynesian spending advocated by Paul Krugman in a non-growth economy (Krugman 2009). Curiously, she asserts that “in a non-growing global economy, there is only one way for the poor to have more: that is for the rich to have less” (Goodwin 2010). This contrasts with Robert Ashford’s call to broaden growth-enhancing ownership via binary economics, by which the poor also have the effective right to acquire capital with the future earnings of capital.†

In addition, Goodwin (2010, p. 5) states “if labor productivity continues to increase [...] in a post-growth world one result could be even greater unemployment.” Of course, this may be true if the source of increased labor productivity continues to be due to increased *capital* productiveness, leading to less earning capacity on the part of labor, with resulting increases in unemployment in terms of the number of jobs and/or lower wage rates. In contrast, if labor productivity increases as a result of increased *labor* productiveness, workers need not earn less, even if they work fewer hours. Increasing labor productiveness would require increasing the value of labor in production and services by deliberate design. Goodwin has argued for a re-conceptualization of economic theory, which she calls “contextual economics,” to describe a possible future pathway for industrial economies involving a different and more appropriate balance between the private sector, government, nonprofits, communities, and people. Just how this pathway is to be achieved remains unspecified.

Like others, Goodwin (2014a, p. 17) proposes a basic income scheme (“Basic Income/Core Support” (BICS) System proposal) to reward (i.e., pay) traditionally unpaid work.‡ Her ambition is to “find ways to set prices that will appropriately recognize human values, including equity, ecological realities, and present and future needs,” that is, to make “the returns to labor approach the human value to society of the workers’ output” (ibid., p. 16).§ Goodwin’s (2014a, p. 13) approach is motivated by the observation of three main tensions:

- (1) between work that produces relatively little well-being but is well-paid vs. the need for much work that now receives little or no monetary compensation, (2) between the need for income vs. the fact that many jobs are not useful to society, and (3) between the work time offered by employers vs. workers’ preferences about working time.

* See the Global Development and Environment Institute, Tufts University, www.ase.tufts.edu/gdae/publications/theorybooks.htm (accessed April 5, 2016).

† See the discussion of binary economics in Section 3.6.1.

‡ Five main areas of unpaid work are included in Goodwin’s proposal: food preparation, household maintenance, management of household finances, care for children (with different hours required for each age), and care for elderly or ill household members.

§ This comment could probably be further refined using Standing’s (2011) division of time into four main activities: “labor,” “work” (e.g., household and care activities), “leisure” (i.e., “participation in the public life,” whether that is in the cultural, artistic, or political sphere), and “play.” For Standing, one of the issues with the Western model is the higher value granted to labor over work and play over leisure. Hence, like Goodwin, he points to the need to reform our reward (or “price”) system.

While she recognizes the value of labor (i.e., providing income, creating goods and services, and having a positive meaning for the worker), she also argues that it does not always create human value (e.g., harmful production processes, products poorly designed and made, saturation of consumption in many areas, and negative environmental consequences). Therefore, she sees the BICS system as a means to lift “the requirement for all to take paid work” (or labor in our terms) and instead “reward and enable some of the unpaid work on which every society depends” (ibid., p. 14).

As revealed in her paper, Goodwin’s (2014a, p. 18) scheme gives “government a very large role, in levying taxes and supplying subsidies.” This brings us back to a very important comment made earlier, “the question behind all questions” (in Goodwin’s terms): **“Who decides?” This is the question of the politics behind policies.** While Goodwin presents some provocative and compelling ideas on rewarding socially (and environmentally?) beneficial work – rather than just labor – the ultimate question of the political feasibility of her program remains unaddressed.

More recently, Goodwin (2017, p. 1) addresses a special, but very important, part of the UBI reform, that of compensation for unpaid “household activities such as childcare, food preparation, care of elderly or ill persons in the home, and maintenance of the home and of household vehicles and appliances.” This work, though highly valuable, is not part of the “market economy.” She terms this intervention “core support” and provides a deep analysis of its benefits and challenges.

Harris (2010), also at Tufts University, argues specifically for an eco-Keynesian approach focusing on fostering human capital-intensive services, investment in energy-conserving capital, and investment in natural and human capital leading to **increases in well-being without growth in throughput**, a major concern of Herman Daly (1996), who long ago advocated a steady-state economy as the basis for ecological economics. Harris advocates policies geared towards achieving dynamic rather than static efficiency through innovation* and also argues for more **labor-intensive** production, recurrent themes emphasized throughout our present work. Focusing on investment (which can bring about disruptive innovation) rather than current material and energy consumption results in growth of a different kind of economic activity, without growth in resource throughput and harmful ecological consequences.

The Canadian Peter Victor (2008, 2010b), an ecological economist, in his book *Managing Without Growth: Slower By Design, Not Disaster* presents detailed models purporting to show how a good environment, shorter workweeks, greater spending, and wealth accumulation on the part of ordinary citizens are possible in an economy that is not growing by judicious choices ranging from population control to tax policies. In a similar vein, Tim Jackson (2009) in *Prosperity Without Growth: Economics for a Finite Planet*, argues for doing more with less, but also asserts that **striving for labor productivity at the expense of workers is the most important defect of the present economic system in need of attention.** While concentrating on dematerialization and eco-efficiency, Jackson focuses almost entirely on energy and not on other environmental problems, such as toxic pollution and ecosystem deterioration (see Section 2.1 in Chapter 2). He joins the cadre of others calling for “spreading out the work” – which may result in more employment of people working fewer hours for the time being – but without really addressing an essential flaw in the current industrial state, that of a continuing decline in labor hours needed in production and services (see the discussion of structural unemployment below). Without increasing labor content and its value in production and services, labor cannot demand an overall increase in its share of profits and thereby increase its purchasing power. More people working

* See the related discussion in Section 9.8 in Chapter 9.

with smaller wages does not help those with diminishing purchasing power, although its spreads out the diminished purchasing power and the resulting pain.*

More recently, Jackson and Victor (2013, 2016) jointly wrote *Green Economy at Community Scale and Towards a New, Green Economy*. In their articles, they review the role of enterprise, the quality of work, the investment opportunities and structures, the financial systems, and the governance mechanisms required to achieve a “green economy.” Jackson and Victor (2013) advocate for investment at the local level in low-carbon technologies, in resource productivity, in the building and maintaining of community assets (public spaces), and in the protection and enhancement of ecological assets (green spaces). Their ultimate objective is to provide the means (and examples) to build local, environmentally respectful, and socially inclusive economies “based around care, craft and culture” (ibid., p. 37), in the hope that these attractive and desirable models will then be replicated at scale. They argue that “action at the community level can stimulate changes at provincial and national levels either by example or by exerting political pressure, or both” (ibid., p. 60). Sustainability in this framing is “first and foremost about businesses or communities themselves rather than the wider systems of which they are a part” (ibid., p. 59).

Indeed, a green economy is not and end in itself, Jackson and Victor (2016) argue, but a means towards a shared and lasting prosperity defined in terms of the capabilities that people have to flourish on a finite planet. Therefore, the green economy must deliver the capabilities for individuals to flourish and communities to thrive. The role of work (good work) is particularly important, as it offers respect, fulfillment, involvement in the community, and a sense of purpose in life, well beyond just the means to a livelihood. Within the green economy, Jackson and Victor (ibid., pp. 20–25) outline a twofold strategy to reach high levels of employment, consisting of reorienting towards a service-enterprise economy – based on care, crafts, and culture – and reducing working hours to achieve a just distribution of working time.

While at its best, moving towards a green economy offers “a positive blueprint for a new economics – one firmly anchored in principles of ecological constraint, social justice, and lasting prosperity,” at its worst, it “provides cover for business-as-usual” (Jackson and Victor 2013, p. 59). And in fact, many, like Georgescu-Roegen – considered the father of the “degrowth” movement – point out that “sustainable growth” or “green growth” is an oxymoron and thus criticize the naïve and, to some extent, irresponsible attempt of carrying on with growth, even a green one.

Indeed, greener growth or “sustainable degrowth” – as some call it (EC 2010) – is one thing, but deliberate redistribution of the spoils of the industrial state is another. Redistribution options necessitate tax-based transfers of wealth and income from more well-endowed parts of a developed nation’s economy (both well-off persons and business entities) to working families (Spangenberg 2007). Neither (1) the legal (or market-based) tools that mandate the internalization of environmental damage costs (such as taxing resource consumption, placing caps on CO₂ emissions, or a establishing carbon tax) nor (2) wealth or income transfers to create more purchasing power in working families through “spreading the work out,” but *with fully compensated reduced working time that maintains wage parity*, is likely to be greeted enthusiastically by profit- and traditional growth-oriented enterprises, at least initially.† However, reflecting on the observation that labor

* Ashford and Kallis (2013) discuss the pros and cons of shifting to a four-day workweek while maintaining wage parity.

† The European Commission (2010, p. 1) recognizes this explicitly in its discussion of sustainable degrowth. An EC news alert – which carefully states that the opinions expressed therein “do not necessarily represent those of the Commission” – states that “sustainable de-growth has at its core a downscaling of economy and believes that economic growth, even if disguised as sustainable development, will lead to social and ecological collapse” and “has an obvious disadvantage in that it confronts powers in society.”

costs make up about 20 percent of business costs, while material and energy costs represent over half and 2 percent of business costs, respectively, Spangenberg (2007, p. 32) argues that by “stimulating resource productivity gains over labor productivity increases,” a reorientation of the economy is possible.

Of course, dematerialization and reduction of energy in production and the provision of services not only have the potential to decrease environmental footprints, but also offer some possibility of decreasing the capital and energy content relative to labor inputs, *providing* labor is not shed at the same time. It is well-established that whenever modernization of production and services occurs, management seeks every opportunity to shed and deskill labor as well, except in a minority of cutting-edge, emerging high-tech enterprises. The much-heralded opportunities for significant net job creation through “green jobs” may be more grounded in wishful thinking than in reality.* **Sustainable employment requires both increasing the overall claim, through wages, of workers on the profits of the enterprises in a nation and achieving a fairer distribution of job and earning opportunities.** Increasing the wages of some (higher skilled or supply-constrained workers) can lead to increasing wage disparities and result in decreases in the total wages paid.† Unless wages are subsidized, increasing the total wages paid requires increasing the labor content and value of all those that desire to be employed, hopefully in meaningful and rewarding work, but this approach requires rethinking the role of labor in the industrial state, including manufacturing and services.

Many commentators (e.g., Speth 2010a, 2010b, 2010c; Jackson 2009) advocate spreading out work without addressing the question of the level of overall wages paid. Increasing the number of workers employed can effectively redistribute wages among the working and potentially working population, but it does nothing or little to redistribute the share of profits of industrial production or the provision of services from capital or business owners to workers. Jackson’s (2009) focus on labor productivity sets his contribution apart from many others who ignore not only the importance of work for a sustainable society, but also the impacts of policy changes on employment. However, he assumes that most improvements in labor productivity will follow the historical patterns that come from increases in capital, rather than from labor, *productiveness*, resulting in fewer hours worked. As emphasized in this work, productivity and productiveness are not the same. Labor productivity can be increased by either capital productiveness, or by labor productiveness, or by some combination of both.‡ Other ways to increase labor productivity through increases in *labor* productiveness of course exist: better training, improved skills, and the redesign of jobs and work. Whether or not the total hours worked fall or not, *ceteris paribus*, labor would be more highly valued and paid as a result.

Technological advance is only one means to improve labor productivity; increasing the contribution of labor as a factor of production (and services) is another. Not only are we addicted to GDP and growth as a source of improved welfare – what some describe as a GDP fetish (Stiglitz 2009) – **we are also addicted to the idea that only improvements in technology can advance our development.** General Electric, Siemens, and Toyota sell products, not the services of people. Corporations own capital; people own their own labor, an unfortunately diminishing factor in how economies grow and are measured. Jackson describes the contributions of labor to labor productivity as “dismal” in economics parlance. But labor *productiveness* in the provision of non-material, non-energy-intensive

* See Section 5.3.2 in Chapter 5 on green employment.

† Of course, removing the “tax” placed on wages – such as unemployment insurance, workers’ compensation, etc. that are pegged to the number of workers – rather than a tax on production or profit, could decouple tax from wages and allow them to increase somewhat.

‡ One might well acknowledge that energy is a third relevant factor of production that goes beyond both the standard classical and Marxist description of economic systems.

services can be high, depending on the nature of the activity. **Jackson appropriately suggests that more community-based activities, rather than the production of “stuff,” might employ increasing numbers of people.** Not only do we need to abandon or at least refine our measures of well-being in terms of GNP, we also need to assign value to labor productivity. The major reason that the business enterprise does not care about labor productivity in this context is that they cannot profit from its deployment or sale as much as they can from improving the productivity of capital which they own.* **Business creates demand through advertising. Who will create the demand for community-based services such as education? This requires a cultural transformation.**

The creation of temporary increases in purchasing power (and consequential consumer demand) through traditional Keynesian spending to “get the economy moving” (Krugman 2009), though useful in the near term, is not a permanent fix. Further, Keynes’s “paradox of thrift,” encouraging people to save rather than to spend newly acquired increases in income, may blunt its effect (see Jackson 2009, p. 106).

Robert Ashford’s (2009) proposal to achieve more broadly distributed capital earning capacity avoids the pitfalls of both continued wealth and income redistribution, and the temporary solutions offered by traditional Keynesian spending. However, the basic binary proposition (that the broader distribution of capital acquisition with the future earnings of capital will both broaden the distribution of earning capacity *and* promote growth) has yet to be embraced conceptually by mainstream economists. In light of environmental concerns, Robert Ashford acknowledges that the **facilitation of ownership-broadening binary financing may need to be complemented with other governmental policies to ensure that the resulting increased purchasing power is not spent in an environmentally destructive way.** Increasing purchasing power and changing the nature of what is demanded by aggregate increases in disposable income needs to be factored and integrated into a coherent policy.

The 2009 Nobel Prize in economics was given to three economists who demonstrated that some unemployment is inevitable, even in economies that are in equilibrium because of “search friction” – also known as “structural unemployment” or “equilibrium unemployment” – because of the mismatch between the skills of the current workforce and the needs of employers (Cho 2010, p. 330). Unemployment exists alongside vacancies in jobs. While 2–3 percent unemployment was at one time considered structural, equilibrium unemployment seems to have now approached a number two or threefold that historical measure. See the *Economist* (2017) for a recent analysis of the “natural rate of unemployment”). Weaver (2017), in his essay “The Myth of the Skills Gap,” argues that the problem is not that not enough workers have the required skills, but that policies that link skills supplied are not coordinated with skills demanded.

Changes in the recovery time after recessions may also reflect mismatches between job skills demanded and workers available to fill them. Goodman (2010) reports that before 1990, it took an average of 21 months for the economy to regain the jobs shed during a recession. After the recessions in 1990 and 2001, 31 and 46 months respectively passed before employment returned. The length of the recovery after the 2008 economic crisis has yet to be revealed.

Is the continued increase in structural unemployment necessary and inevitable? Or does it suggest that we must find a way to change the nature of work and the

* Even if labor is inexpensive, in volatile economic times the business enterprise may prefer utilizing capital to labor because contractions of the economy are easier to wait out than a workforce that remains idle. To the extent that energy is increasingly understood to be – or is in fact – a significant factor of production, its utilization is also easier to decrease in downturns than the number of workers or their wages.

consequential skills required, and also increase the value to work relative to capital (and energy) in productive and service activities? Engineering and management schools have contributed mechanisms and strategies for decreasing the labor content of production. Can they now be redirected to increasing labor content? More than technical changes may be needed. **A societal evolution is needed that is centered on creating demand for labor-intensive goods and services**, such as the provision of extra-mural education in languages, music, art, money management, etc., that have a negligible environmental and energy footprint.

Jackson (2009, p. 109), while acknowledging that “meaningful employment is itself a key constituent in prosperity,” just hints at this by suggesting disposable income could be spent on “yoga lessons” (Jackson 2009, p. 129), but he otherwise does not explore how the demand for labor-focused activities can arise in a new economy. Instead, he focuses on the need to create green jobs in re-designed dematerialized and less energy-intensive production and services which only change the kinds of products and product-related services that the society provides and do not address the more difficult challenge of shifting demand to labor-intensive services.

The 2008 financial crisis has brought forth a stark reality that consumption-led growth may never be able to return to what it once was. With the end to borrowing from the future, there is simply not enough purchasing power (i.e., demand) – nor can there be enough – to return to the decades-old former high rate of economic growth. Thus, out of necessity, perhaps more than some moral or practical awakening, rethinking consumption – especially material and energy consumption – has taken on new importance. Not really “doing more with less” but rather “doing with less” and changing the very nature, not just the amount, of consumption is now on the table.* As opposed to a “revolution from below” to change the nature of governance that some hope for or predict (Speth 2008), an evolution of necessity may more accurately characterize the cultural transformation that may come upon us.

Vergragt (2017) characterizes sustainable consumption as an emerging normative concept that mainly refers to the environmental problems related to material consumption patterns in affluent societies, but which also applies to inequalities in consumption patterns between rich and poor. He recognizes consumption is part of a complex system, and therefore a shift towards sustainable consumption patterns will require systemic changes in the economy, technology, governance, culture, life styles, values, and institutions. Vergragt underlines the tension between the weak and strong versions of sustainable consumption, with the former striving to reform government policies on all levels, whereas the later argues that a systemic change is necessary. He suggests two possible developments in the future: the first is that the concept of sustainable consumption will succumb to its internal contradictions and will be replaced by more socially and politically acceptable alternatives. The other possibility is that the concept survives and gains more strength in the policy domain, but this would only happen if backed-up by a strong social movement, which in turn could only be triggered by major disasters (such as severe climate change) or by a fundamental cultural transformation that will need leaders with a strong vision and a public ready to make deep changes in lifestyles.

Lorek and Spangenberg (2013) and Spangenberg (2014) address this cultural transformation required for “sustainable consumption.” They consider that

social re-engineering, the promotion at all levels of a new cultural narrative explicitly oriented to overriding humanity’s innate expansionist tendencies, myopia, and greed

* See the Sustainable Consumption Research and Action initiative begun by the Boston-based Tellus Institute (Cohen et al. 2010). See www.scorai.org (accessed April 6, 2016).

(Rees 2012), is as important as re-engineering our infrastructural and production systems toward “better but less” instead of “more is better.”

(Spangenberg 2014, p. 74)

In the article, Spangenberg (2014) offers a portfolio of instruments and policy recommendations – notably insisting on the why and how of a strong underlying democracy and civil society sector – to shift the existing production and consumption paradigm towards “more quality **and** less quantity.”*

Strengthening democracy is a *sine qua non* for a sustainable society. Doing so will require limiting the influence of business lobbies and instead encourage civil engagement and a strong civil society. It is civil society organizations that – despite their dependence on the support of their own constituency – can most easily argue and campaign against the existing orientations, changing them over time and paving the way for politics to adjust the institutional mechanism consistent with the emergent change in orientations.

(Spangenberg 2014, p. 75)

The mechanisms of society need to change [. . .]. This will require an instrument mix including legal, financial, and informational measures, with a redistribution of income and wealth to be complemented by an unconditional minimum income, much of it in physical terms, and choice edition to support collective changes in consumption habits.

(Woersdorfer and Kaus 2011)

Achieving dematerialization and eco-efficiency of traditionally demanded products, production, and services can result in the deployment of increased disposable income elsewhere that “boomerangs” into more total consumption. Individuals spending more money on people serving people, unmediated by heavy environmental and energy footprints, could not only change the equation by bypassing economic activities that convert materials and energy, but also bypass interests promoted by the entrenched corporations and established businesses that lock-in the present economic system. **But will they allow this to happen? Remember the often-omitted question raised in this work: who is standing in the way of sustainable transformations?**

While some might balk at the concept of “degrowth” – partly intended to shock – the movement does have some cachet. The second International Conference on Economic Degrowth for Ecological Sustainability and Social Equity held in Barcelona March 26–29, 2010, issued the Barcelona Degrowth Declaration, in which it was stated:†

We assert that these proposals are not utopian: new redistributive taxes will address income inequality and finance social investments and discourage consumption and environmental damage, while reduced working hours with a reinforced social security system will manage unemployment. As the economy of wealthy parts of the world quietly contracts and our damage to the environment through new infrastructures and extraction activities is constrained, well-being will increase through public investments in low-cost social and relational goods.

* Note that the article specifies that the objective for the poor is “just enough” quantity, and above that, growth replaced by quality improvements.

† See the Degrowth Declaration Barcelona 2010, available at www.barcelona.degrowth.org/Barcelona-2010-Declaration.119.0.html (accessed April 5, 2016).

At that conference, van den Bergh (2011) categorized and critiqued five types of degrowth:

- 1 GDP degrowth;
- 2 Consumption degrowth;
- 3 Work-time degrowth;
- 4 Radical degrowth; and
- 5 Physical degrowth.

Van der Bergh (2010, p. 6) opines that degrowth is too ambiguous and imprecise a term; that focusing on GDP per capita (“the largest information failure in the world” (van den Bergh 2009, p. 6)) is too imperfect an indicator of social welfare to be the target of policy; and that the likely resistance to degrowth from various quarters will make degrowth – especially 1, 2, 4 and 5 – hard to sell. He instead offers a vision of “agrowth,” focusing on getting democratic and political support for (1) stringent and serious environmental regulation which may or may not reduce GDP growth; (2) encouraging people to work fewer hours, earn less income, and consume less; (3) regulate advertising, especially of status goods; (4) work on changing environmentally relevant consumption; (5) give less importance to GDP changes; and (6) develop and redirect alternative technological options and scenarios.*

In his view, focusing on consumption degrowth may result in rebound effects that can exacerbate environmental problems for a variety of reasons. Reducing working time and radical degrowth, while requiring cultural and social change, *per se*, may not result in significant environmental improvements. Van den Bergh would focus heavily on using regulatory and economic instruments directly to reduce environmental hazards and redirect technology development. His prescriptions do not address directly improving *economic* welfare or disparities, although he would probably argue that an improved environment would positively impact economic welfare. Finally, he does not directly advocate for redistribution of income or wealth, or for a replacement of the current market economy system (the latter being in contrast with the views of Sanders 2006).

Kallis (2011, p. 874), siding with Herman Daly’s steady-state economics which assumes a robust relationship between throughput and GDP and the need to reduce GDP, offers a rejoinder to van den Bergh’s critique by asserting that “big social change does not take place by appealing to those in power, but by bottom-up movements that challenge established paradigms” and that “scientists have a role to play as partners in these movements.” Kallis (2011, p. 874) calls for “a bit more belief on our collective capacity to plan a change.” He argues that sustainable or selective degrowth deserves to be considered, not dismissed as a vague concept. Kallis (2011, p. 875) acknowledges that:

there is a possible incompatibility between foundational institutions of market economies and the goal of degrowth to a steady-state. [. . .] It is in this sense that some people writing on degrowth recognize the need for systemic political, institutional and cultural change (what van den Bergh frames and dismisses as “radical degrowth”) in order to create a different system where expansion will no longer be a necessity and where economic rationality and goals of efficiency and maximization will not dominate all other social rationalities and goals [. . .]

[. . .] the crucial question here is whether the capitalist, market economies in which the majority of us live today can conceivably degrow and stabilise into a steady-state. [. . .] More than likely this will only be possible with such a radical change in the basic

* Activities 2 and 4 would be accomplished through communication and information provision to motivate changes in preferences, attitudes, and voluntary actions.

institutions of property, work, credit and allocation, that the system that will result will no longer be identifiable as capitalism. [. . .]. Van den Bergh (2011) has a point though: there is a problematic vagueness in the degrowth proposal in so far as the post-capitalist alternative to which it hints is not specified. However this is not a reason for discarding the diagnosis: i.e. that growth is unsustainable and that the institutions of what came to be known as “capitalism” that mandate it, have to change. In fact, it might be better to remain agnostic and pluralistic at this stage about what such an alternative could look like and let it emerge organically from the ground, rather than dictate it from any intellectual or political height.

In addition to taxing international capital movement and environmental damage, restricting advertising, and instituting both emission and salary caps, Kallis (2011), like others, calls for a basic income guarantee, redistributive taxation, and more employment of human capital where human contact adds value (e.g., health care and education). Addressing directly van den Bergh’s description of a GDP fetish, Kallis asserts that GNP is a manifestation, rather than the cause, of a growth fetishism. Finally, Kallis (2011) argues that growth is not a “policy” but rather a political alternative seeking a popular mandate for radical change.

Borel-Saladin and Turok (2013, pp. 215–216) make an additional step in the “degrowth” vs. “green growth” debate. Their underlying premise is that economic greening is not a significant departure from business-as-usual and was developed at the time of the financial crisis to promote regrowth. Along with Kallis, they argue for a more acute stemming of traditional economic growth to remedy the environmental damage caused by high throughput (*ibid.*, p. 216). Advocating a degrowth model in the midst of the recent financial crisis and with the prevailing North–South disparity is not politically prudent, even though according to Kallis (2011, pp. 874–875), the misperception that degrowth is associated with negative GDP masks the intent to grow and to develop in a socially sustainable way.

Environmental economics play a role in realigning the focus on growth from quantity to quality by reforming the metrics that we strive to achieve. Properly internalizing externalities would alter how natural resources are managed (Borel-Saladin and Turok 2013, p. 212). However, pricing alone is not enough to induce fundamental behavioral changes on the demand side (such as the ones advocated for by Lorek and Spangenberg 2013). Instead, degrowing the economy is a vast undertaking that is challenged by a lack of cohesion (Kallis 2011, p. 876) and **a failure to capture the full scope of sustainable development issues.*** This is what leads to Borel-Saladin and Turok’s (2013, p. 212) assertion that degrowth is not a strong catalyst for substantive improvements.

To grow within the steady-state as defined by Daly (1991) is to change production and consumption. On the supply side, innovation enhances factors of production and product content or develops substitutes that are more conducive to green growth. Innovation is the lowest hanging fruit in a modern economy, but the time it takes to transfer knowledge (see Section 3.7) and commit financial capital for implementation does not qualify it as the disruptive change needed to cure environmental degradation. Rather, present-day technological innovation such as efficiency, renewables, and battery storage makes incremental contributions to green growth. Such evolutionary changes are the basis for Borel-Saladin and Turok’s view that the value of green growth is not in revolutionary changes

* As population grows, even the most basic needs for resources continue to grow. In this case, one could argue that degrowth is likely to create a scarcity of goods and to widen the gap even more between the wealthy and the poor. Therefore, as long as no **feasible** outlines for wealth distribution (as well as a thorough discussion on the impacts on employment) are proposed, the model fails to adequately address poverty reduction.

but in conjuring ideas for a paradigm shift. Evolutionary changes (rather than radical ones) may also be viewed as more adaptive, leading to less significant “lock-ins” than radical ones. Thus, they conclude that green growth may be “the most effective strategy for beginning to foster greater understanding and appreciation of the environmental and social problems facing us” and the best way to generate support for subsequently more radical measures (Borel-Saladin and Turok 2013, p. 218).

As illustrated in this section, there is a significant body of literature that has emerged since the financial crisis of 2008 to address the challenges of sustainability, which present compelling visions of a possible sustainable world. Yet, this body of research wanes in comparison with the amount of literature available about advancing and perpetuating growth and the current neoclassical system. **This “intellectual lock-in” – vividly depicted and criticized by Stiglitz (2011), Varoufakis (2013; 2016), and Galbraith (2014), among others – coupled with political and physical/technological lock-ins, prevents the sustainable development discussion from moving forward.** The preeminence of vested interests committed to continued growth (Hoffmann 2011) is too often mentioned, but not properly addressed. It is no longer enough to say what changes would be required. We now need to specify **how** to make these changes happen. Section 3.7, the discussion of Jackson and Victor’s article, and Chapter 13 seek to advance this discussion, notably by shedding light on recent initiatives to promote local, democratic processes.

Finally, while each stream of literature presents strengths and weaknesses, a main limit of the collective body of work examined here is its failure to adequately address major topics such as **finance, trade, energy, population control, and the situation of developing countries.**

- **Finance:** While hints are given for how to revise the tax code (e.g., to tax polluting activities and encourage labor-intensive ones), the reform of the financial system remains largely unaddressed. Given the enormous influence the financial system has on the entire Western socioeconomic and political architecture, the fields of “degrowth” and “green growth” should spend more time discussing specifically what needs to change with regards to banks (and lending services), investment firms, the stock market, regulatory institutions, accounting principles (GAAP), credit rating agencies, international finance, etc. Chapter 4 will provide some insights on this topic.
- **Trade:** Having to reduce total throughput, and doing so by the re-localization of production and consumption systems (as proposed by Jackson and Victor 2013), could have significant impacts on trade and therefore geopolitical dynamics. Energy prices (and thus shipping costs) also significantly affect trade patterns. Reforming the trade agenda and trade agreements so that they are more resilient to and geared towards the demands of the sustainable development agenda, for both developed and developing countries, is a key challenge to tackle. While not addressed by the body of work examined here, it will be the focus of Chapters 11 and 13.
- **Energy:** A number of the articles reviewed in this chapter touched on energy, but given its profound implications for how we as a species live and organize, energy deserves a more central role in sustainability analyses. Alam (2008), Morgan (2013), and R. Ayres (2014) stress the importance of energy as a catalyst for all aspects of society. For developing countries, energy is of particular importance as they attempt to raise their standard of living to that of developed countries – with huge implications for the environment through direct pollution and increased consumption. This becomes especially complex if one considers that the efficiency gains and reduced emissions achieved by developed countries are caused by shifting resource consumption and polluting industries to developing countries (Hoffmann 2011). Chapter 12 will provide a detailed discussion of the energy challenge.

- **Population control:** With the Earth's population steadily moving towards 10 billion, talks of "absolute decoupling" and "dematerialization" are quite naïve. A large population with increasing affluence combined with a large poor population will surely stress environmental limits and, perhaps, make degrowth or green growth become ineffective as living within the earth's carrying capacity gets further and further out of reach. The population problem is not just a third-world problem. While cultural lock-ins may prevent governments from resorting to hard policies that directly interfere with civil liberties (e.g., the Chinese one-child policy, now a two-child policy), they can pursue less radical measures such as taxes and tax credits (along with the provision of adequate social programs and financial safety nets) to influence family planning.
- **Developing countries:** While the importance of engaging developing countries in green growth initiatives is acknowledged, policies must ensure that these countries can and will buy into the approach, given the probable high initial costs of the transition. Also, referring back to the lock-in challenges mentioned above, we need to ask how to ensure that developing countries will not be forced into the Western model of growth and all that it implies. It may well be the case that developing countries will first implement a transformative development agenda. For example, they could advance a binary economics approach to distributing capital ownership that targets investments in inherently sustainable goods and services as part of an endogenous and sustainable growth strategy.

3.8 De-[constructing] growth: decoupling profits from unsustainable production*

Degrowth has been described as a "movement" rather than an ideology (Kallis 2011), and as such it presents several variations. For some of its proponents, degrowth is a proxy for sustainable consumption, and to a lesser extent production.[†] A second group of degrowth advocates are those for whom an emerging discussion of "sufficiency" as a societal norm is taking shape, as a result of activism (Schneidewind and Zahrt 2014). Finally, a third group of advocates views anti-capitalism as central to the degrowth agenda. They see growth as the principal influence and root cause of sustainability challenges.

Most importantly, amidst these diverging perceptions within the degrowth movement, a continual dissatisfaction with the term degrowth has been voiced, acknowledging its unfortunate connotations and difficulty in influencing mainstream policy discussions.

While not offering a critique of the degrowth discourse, N. A. Ashford (2016) throws some light on the debate by offering a conceptualization that avoids the negative connotations of, and resistance to, "degrowth." Rather than simply describing the degrowth discourse by the descriptor "degrowth," N. A. Ashford recommends a more nuanced approach that gets rid of the jargon and negative aspects of the evolving concept of degrowth and makes a distinction between growth in production and growth in private-sector profit. His proposed formulation, *de-[constructing] growth*, achieves this by decoupling profit from unsustainable consumption and production.

3.8.1 Meanings and implications of growth

According to this formulation, growth widely understood has different meanings and implications:

* This section has been adapted from N. A. Ashford (2016) "De-[Constructing] Growth," *Sustainability* 8: 1140–1142.

† See the website of SCORAI, the Sustainable Consumption Research and Action Initiative, at www.scorai.org.

- Aggregate growth in products and services that consume energy and materials;
- Growth in profits (tied to subsidies, tax treatment of investment, profit, and the provision of producer and consumer credit, all of which encourage consumption);
- Growth in trade (avoiding internalizing the externalities by globalizing commerce);
- Growth in disparity in consumption, wealth, and income; and
- Growth in under- and unemployment.

From an environmental and energy consumption perspective, some of these kinds of growth need to be diminished, while in other areas, growth needs to be enhanced. For example, those members of society who do not have access to *essential* goods and services need to increase their consumption. Many in the global South cry out for more consumption, even if others there reject materialism as a model that should be emulated.

Others have emphasized the need to decouple GDP growth from environmental impact (Ward et al. 2016), but N. A. Ashford's assertion is that rather than reducing profits giving rise to economic growth as an overall goal, *profits* not only need to be decoupled from unsustainable production and consumption, but also enhanced by encouraging *sustainable* production and consumption. This decoupling is not simply "greener growth" or a green growth proposal, which in and of themselves would be welcomed by many, but rather changing the incentives for increasing profits from the incentives to produce and consume more – especially more *environmentally unsustainable* products and services, or ones that have a negative effect on work. To re-emphasize the point, it is important to note that N.A. Ashford's views do not contradict other authors who claim that growth in GDP cannot be decoupled from growth in material and energy use. N.A. Ashford states, however, that decoupling profit from growth is where useful policy opportunities lie. In addition, pursuing eco-efficiency gains while using less environmentally scarce resources may at the end of the day encourage more total consumption and impact, reflecting a Jevons paradox or "rebound effect."

3.8.2 Fundamental changes in law are indispensable

While cultural changes are needed, fundamental changes in law are indispensable to achieving degrowth and growth where they are needed. Growth means *different* things and requires *different* interventions:

- Aggregate growth in products and services that consume energy and materials.
 - *De-emphasize GDP and productivity; decouple physical growth from profit by internalizing externalized costs and by pricing policies.*
- Growth in profits (tied to subsidies, tax treatment of investment, profit, and the provision of producer and consumer credit, all of which encourage consumption).
 - *Change the nature of subsidies, tax incentives, and credit practices; anti-monopoly legislation/regulation that discourages profits linked to growth in production and consumption.*
- Growth in trade (avoiding internalizing the externalities by globalizing commerce).
 - *Changes in the trade rules: allow/encourage border adjustments and local investment to encourage sustainable production by taxing or banning products and services that have large negative environmental and labor externalities, or which discourage regional self-sufficiency and economic independence.*
- Growth in disparity in consumption, wealth, and income.
 - *Embody sufficiency in law; tax and inheritance reform; provision of guaranteed income.*

- Growth in under- and unemployment.
 - *Implement a shorter workweek with maintenance of wage parity (Ashford and Kallis 2013); incentivize employment; design work back into the production and service systems (Ashford et al. 2012). Recognize and arrange remuneration for unpaid work.*
- Reforms to the financial system (credit, wealth, and income) as well as control of monopoly (in products, energy, and media); environmental, health, and safety regulation; the economic treatment of investment, profit, and labor; and trade rules (Ashford and Hall 2011).
 - *Change the reward structure for profit and investment (see the discussion below for specific interventions).*

3.8.3 *Lessening the private sector resistance to sustainable transformations*

The current industrial system – especially with capture of legal/economic interventions – links profit to increases in production and services, with concomitant environmental destruction and energy consumption. **Ashford's insight is to de-couple profit-taking, not eliminate profit-taking, from unsustainable production and services.** By a judicious choice of policy interventions, society may be able to lessen the industrial/private-sector resistance to sustainable transformations that the degrowth movement has heretofore been unable to accomplish. These interventions may appear radical to mainstream economists and the larger public and, having never been tried, they may seem utopian. However, in various emerging discourses about sustainable development, changing the rules of the economic system is receiving serious attention,* and further, decoupling profits from production and consumption is far less radical than hoping for the end of capitalism.

Indeed, decoupling profit-making from unsustainable practices is a key challenge that could nevertheless be overcome provided that the right supply and demand side policies are applied.

The classical efficiency solution from the mainstream economics literature to reducing the adverse environmental effects of products and services is to internalize the social costs of consumption (for example by taxing production and perhaps consumption directly as well) to reflect environmental damage. This results in *increased* costs to consumers and *decreased* profits for producers. If these policy changes were implemented, it would of course be good. But both producers and consumers will balk. Therefore, by a judicious scheme of increasing costs to consumers (together with other policy-instruments to reduce social inequality), less consumption could be encouraged while, at the same time, rewarding producers – rather than penalizing them – for producing less. Pricing schemes have been used in the case of water policies in response to water shortages to encourage both less marginal increases in consumption and total consumption, but little attention has been devoted to lessen the resistance to subsequent profits to providers (Hentschke 2013).

3.8.4 *Why tax labor and subsidize pollution?*

Today, profit in the sale of most products and the provision of services is not only generally enhanced by the favorable tax treatment of investment and inputs, straight out-and-out

* See J. Stiglitz (2015). "Rewriting the Rules for the American Economy: An Agenda for Growth and Shared Prosperity." A Report of the Roosevelt Institute 2015.

subsidies, and by marketing practices reducing the cost of incremental increases bought by the consumer, but also by specific advantages sought by the provider of particularly unsustainable activities – e.g., as in the case of fossil fuels.

The law affecting tax incentives and regulation can be changed to encourage both less general and specific consumption by rewarding the provider not only for providing greener products and services – the classical green proposal – but, more importantly and beyond that, by:

- Rewarding allowable profit on both a per-unit basis and on total revenue secured by selling less by appropriate pricing – for example, not only charging an increased incremental price for more electricity use, but also raising the incremental price from the first increment sold onwards;
- Removing subsidies for, and taxing, unsustainable economic commerce; and
- Subsidizing/rewarding less production and more sustainable production by increasing the incremental profit per unit with smaller/more beneficial output.

By sustainable, of course, what is meant is both environmentally sustainable and job-enhancing economic activity. Herman Daly, amongst others, asks why we are taxing labor and subsidizing pollution if what we actually want is more employment and less pollution.

Carrying this idea into specific reforms would receive more support – and achieve realistic possibilities of success – if we were to redefine in legal and economic terms the nature of acceptable and allowable profit for the providers of goods and services that must be tied conditionally on engaging in sustainable production. The present advantages of profit tied to increased production are the result of decades of privileges lobbied for. In principle, these could be reversed and redefined.

At present, the substitution of physical capital and energy for labor is rewarded by both the tax and legal system. Relocating production abroad is rewarded, not penalized. In our tax system, an accelerated depreciation deduction from profit is allowed for end-of-pipe pollution control, but not for technological changes or other labor-related production changes focused on cleaner production. Focusing on the redefinition of acceptable profit is certainly worth thinking about.

Of course, increases in private-sector profits need to be reconciled with the overall concern with wealth and income inequality, but that concern can and should be addressed by other policies within an overall strategy.

3.9 Implications for policy

This chapter presents analysis and arguments for and against an industrial policy premised on innovation-driven economic growth. An underlying assumption of this premise is that an innovation deficit represents the most serious bottleneck for growth in developed countries. It embodies the traditional belief that “innovation is the engine of economic growth.” Unfortunately, that assumption may no longer be a sufficient foundation of growth-oriented industrial policy. See, for example J. Stiglitz (2016). See also N. Ashford and A. Renda (2016), in which it is argued that a *technology diffusion deficit* may be the most serious bottleneck problem facing efforts at deep decarbonization.

A contrasting and innovation-optimistic perspective of Carlota Perez (2016) builds on the history of four previous industrial revolutions to argue that the fifth (ICT) revolution, if guided by government initiatives towards innovation in technologies focused on environmental sustainability, can lead to a resurgence in economic development and employment and lessen disparities in wealth.

Unfortunately, incumbents often stand in the way of new technology adoption and have a dominant influence on political and social agendas, including innovation policy. In addition, as argued by Robert Ayres (2006, 2014) of INSEAD, plateaus are being reached in what innovation can provide, especially in energy technology. What is missing in both the EU and U.S. growth initiatives is more than serious supply-side structural changes; demand-side policies involving fiscal, tax, and regulatory initiatives also need to be fashioned to increase the *purchasing power* of workers and ordinary citizens. As Stiglitz argues, enhancing *demand* is more likely to create jobs and address inequality than approaches based on trickle-down economics.

Beginning in the 1970s and exacerbated by the 2008 economic crisis was a loss of purchasing power (demand) as a result of technological displacement. MIT's Brynjolfsson and McAfee in *The Second Machine Age* have warned of the "hollowing out of the middle class" by automation with a serious loss of wages, and recent work by Autor et al. (2017) at MIT has shown that the four to six dominant firms ("superstar" firms) in six important sectors in which industry concentration has increased in the U.S. have greatly reduced the share of wages going to labor in productivity advancements in both manufacturing and services. The trend occurs in Europe as well.

Sustainable development rests on three pillars: economic welfare, environment, and earning capacity (Ashford and Hall 2011). The growth-oriented EU reports are in a way a recast of EU's Lisbon Strategy and Europe 2020, but just as environment cannot be sufficiently addressed as an afterthought of industrial policy, so too must employment and earning capacity take a central focus and not be left to trickle-down expectations. Although a green economy is seen by some as the key to achieving a socially equitable economy (Jackson and Victor 2016; Perez 2016), others who are not so optimistic argue that "going green" is not enough (Hoffmann 2011). Growing economic inequality must receive the attention it deserves in industrial, environmental, and social policy formulation.

We return to a fuller discussion of policy options to advance sustainable development in Chapter 13.

3.10 Additional readings

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4 Globalization

Technology, trade regimes, capital flows, and the global financial system

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4.1 Introduction

Globalization and trade create new opportunities, alliances, and relationships among technology-based firms and nations. They also create new problems and challenges:

- There are opportunities to expand existing domestic production/services to international markets, but the international marketplace may present additional competitive challenges as well.
- There are opportunities to benefit from cheaper factors of production by locating facilities abroad, but the advantages of doing so may be undercut by currency and transportation costs fluctuations, political instability, inadequate infrastructure, and lower worker productiveness.

- There are opportunities to avoid costly domestic financial, environmental, or tax regulation by operating abroad, but future foreign regulatory systems may be uncertain, and foreign governments may be subject to unanticipated corruption.
- Shifting production and services abroad could reap substantial benefits from lower direct costs but create increased environmental burdens resulting from inefficient and increased use of polluting energy and growing amounts of global toxic pollution that do not respect national boundaries.

Operating in the international marketplace may change the access of potential consumers to credit for purchasing products and services, and of entrepreneurs to investment capital, with mixed results. In addition, different tax treatment of investment and profits and different rules for the expatriation of capital and requirements for domestic content can undermine the profitability of operating internationally. In contrast to the past several decades of globalization, we are now in a state of flux with some contraction of international economic activity (ERM 2016) and rising anti-trade sentiment.

In this chapter, we explore the several dimensions of globalization (Section 4.2), introduce the major emerging international trade regimes (Section 4.3), explore the relationship between trade and economic development (Section 4.4), examine the role of MNEs in the international economy (Section 4.5), and discuss the evolving world financial system, highlighting the current EU euro crisis (Section 4.6). Sections 4.4, 4.5, and 4.6 are especially important to fully grasp the forces that operate to expand international activities and financial flows. However, a note of caution is added here. Throughout this work we have attempted to use the terminology from each discipline that is covered. When addressing a highly complex subject such as the global financial system, this presents a unique challenge – do we write for the expert or novice? For the latter sections of this chapter, we have tried to find a balance between these two audiences. Thus, these sections may be a stretch for readers new to this subject, whereas financial and economic experts may desire more information. What this situation reveals is that reforming the global financial system in a way that makes its workings transparent and accessible to all is perhaps one of the most important challenges facing progress towards sustainable development. Without a robust, stable, and transparent system, efforts to advance sustainable development are at risk from future global financial crises. It is also important to recognize that potential solutions are still emerging, so having a foundation upon which to critique new ideas and approaches is essential.

Chapter 5, which follows, discusses the adverse effects of globalization on the environment and employment (including purchasing power) as a result of (1) the increased complexity of commercial and financial interconnectedness in the global economy and (2) the opportunity to *externalize* the social consequences of production resulting from differences in the willingness of trading nations to address issues such as environmental degradation, worker safety, and the need to provide a living wage.

4.2 Globalization

We take the international economy to be composed of the following **five highly interrelated aspects**:

- 1 **Trade in goods and services**;^{*}
- 2 **International distribution of production**[†] (more commonly called the international division of labor);

^{*} As explored later in this section, this kind of industrial globalization is known as “internationalization.”

[†] As explored later in this section, the location of production/assembly/service operations outside the parent country is a form of industrial globalization known as “multinationalization.”

- 3 **Flows of capital across national borders;**
- 4 **Flows of information and knowledge; and**
- 5 **Flows of labor across national borders (international migrations).**

The interrelatedness of the first three features of the international economy is quickly apparent. Trade in goods and services reflects the geographic distribution of production/generation of services – that is, inputs must go to production/service centers. The finished products/services (which may also be used as inputs) subsequently go to consumption centers/consumers. Capital flows across national borders as a consequence of production/service-system investments and because of speculation on the future value of produced goods and services and currencies.

In the age of the so-called knowledge-based economy and information systems using sophisticated information and communication technology (ICT) (see Section 3.3.1.2 in Chapter 3), information/knowledge transfer is crucial not only for optimizing industrial activity but also for the transfer of financial information and assets.

Labor mobility has two important but different dimensions: (1) the flow of intellectual capital (the “brain drain”) to places where it is most highly valued; and (2) labor migration to areas with shortages of people to perform physical or so-called low-skilled work (see the related discussion in Sections 5.2 and 5.3.3 in Chapter 5).

Not all aspects of globalization are seen to be positive. Nobel Prize-winning economist J. E. Stiglitz (2002, p. 248) notes:

Globalization has helped hundreds of millions of people attain higher standards of living, beyond what they, or most economists, thought imaginable but a short while ago [...] But for millions of people globalization has not worked. Many have actually been made worse off, as they have seen their jobs destroyed and their lives become more insecure. They have felt increasingly powerless against forces beyond their control. They have seen their democracies undermined, their cultures eroded.

The legendary investor George Soros (1997, p. 45) cautioned as early as 1997:

Although I have made a fortune in the financial markets, I now fear that the untrammelled intensification of laissez-faire capitalism and the spread of market values into all areas of life is endangering our open and democratic society. The main enemy of the open society, I believe, is no longer the communist but the capitalist threat.

When Stiglitz (2002) and Soros (1997, 2002) expressed such concerns about economic globalization, it sent a strong message that the prevailing trajectory of economic development was flawed. Six years later, in 2008, we saw the beginning of the worst world economic crisis since the 1930s. Since then, a large number of studies and writings – see, for example, the Working Group on Development and Environment in the Americas (GDAE) (2008), Brender and Pisani (2010), the South Centre (2010), McMillan and Rodrik (2011), Pavcnik (2011), Stiglitz (2011), Rodrik (2011, 2012), Stiglitz (2015), Piketty (2016), and Faux (2016) – have confirmed the initial fears, analyzing the disastrous consequences of economic and financial “hyper-globalization” for the stability of the world system, and the mixed results of globalization and trade for development within and across countries. More specifically, while most Asian countries have benefited from globalization and trade, this has not been the case for many in Latin America and Sub-Saharan Africa (Agosin 2008; McMillan and Rodrik 2011); and effects have differed across different groups of people and workers (Görg 2011).

In contrast to the early international debates about the environment and development, which focused mainly on national issues, **today’s discourse places sustainable development**

within the much broader concept of globalization. Indeed, globalization was described as adding a “new dimension” to sustainable development in the Johannesburg Declaration (2002).

There is no universally agreed-on definition of globalization, and the concept is still being formulated (Held and McGrew 2007; Rodrik 2012). However, globalization can be conceived as a process by which the world is becoming more interconnected, both in economic relations – encompassing trade, investment, finance, and the organization of global production systems – and in social and political interactions among organizations, communities, and individuals across the world (WCSDG 2004).

An important element of the globalization discourse is its links to discussions on the “nature and existence of the nation state, economically, politically and culturally” (Voisey and O’Riordan 2001, p. 34). **Because the nation–state has a responsibility to move toward the objectives of sustainable development** (see the Stockholm, Rio, and Johannesburg* declarations and Agenda 21), **any force that might influence the effectiveness of government in this task will have important implications for the design of national and/or international strategies to address sustainable development. Hence it is important to understand how globalization could enhance, undermine, or provide new opportunities for government action** (see the related discussion in Sections 5.1.2 and 5.2.5 in Chapter 5). In line with this expectation, Rodrik (2012) recommends that we “moderate our ambitions with regard to economic globalization” (p. 394), as it is the theater of a “political trilemma [...] between hyper-economic globalization, national sovereignty, and democratic politics” (p. 398). Looking at the reactions to the 2008 financial crisis and the current Eurozone crisis, he believes that “we are [now] moving into a phase of the world economy where national sovereignty is going to become much more important than before” (p. 401). He also comforts the reader in the fact that a less ambitious type of economic globalization – one that leaves significant room for local, democratic politics and policies, or “domestic calibration” – could lead to better outcomes both for individual nation–states and for the overall system (due to a better distribution of costs and benefits and a reduction in imbalances). We will come back to this point later in our analysis (see Section 4.4).

The OECD (1997, p. 19) described globalization “as a process in which economic markets, technologies, and communication patterns gradually exhibit more ‘global’ characteristics and less ‘national’ or ‘local’ ones,” and distinguished between four “effects” of globalization:

- *Scale effects:* Increased world output, thought to arise from the increase in economic efficiency that results as resources are freed to flow to uses that reflect their greatest marginal contribution (a very neoclassical argument).
- *Structural effects:* Shifts in the composition and location of production and consumption activities. Note that these shifts in production are *required* to realize scale effects. In general, “market structures [...] become] *deeper* (more geographic specialisation in production; more contracting-out to independent, but related firms) and *wider* (more countries participating actively in the global economy)” (ibid., p. 20). Further,

* The 2002 Johannesburg Declaration called on the private sector to recognize its role in achieving sustainable development. This evolution in strategy broadened the responsibility for action to effectively incorporate all stakeholders working to achieve sustainable development. However, governments – which have retained the sovereign right to use national resources as they see fit within certain international constraints – remain central to any transition toward sustainable development because they define the economic and regulatory environment within which the private sector operates. The major debate with the current process of globalization is that it holds the potential to undermine the ability of governments to establish this environment by transferring political and economic power to corporate interests. This concern is discussed throughout this section.

as foreign investment flows become larger, there is “an increase in overseas commercial transactions (especially for primary and intermediate products), and a greater tendency to export final goods. Expansion may also be expected in the number and extent of international co-operative agreements between firms, notably in the fields of R&D, product supply, distribution, and marketing” (ibid., p. 20).

- *Technology effects*: Promotion of different technology paths and increases in the rate of technological change. (This is difficult because technological change is seen both as an *enabler* of globalization – for example, modern capital markets would be impossible without sophisticated information and communication technology – and as a *consequence* of globalization. For example, free trade increases direct competition between manufacturing industries in Northern and Southern economies. Pressures toward continuous innovation as a means of maintaining comparative advantage thus become more intense in the North.)
- *Product effects*: Production and consumption of different product mixes; “globalisation might lead to more uniform consumer tastes, influenced by transnational mass media imagery and advertising” (ibid., p. 20).

More useful definitions characterize globalization as a linked set of trends in the international economy and elaborate on these trends by identifying their likely cause. Lee’s (1996, p. 485) comment still applies today:

The rapid growth in world trade, foreign direct investment, and cross-border financial flows over the past decade has been the main manifestation of the increasing “globalization” of the world economy. This phenomenon has been driven primarily by a worldwide wave of economic liberalization – the lowering of tariff and non-tariff barriers to international trade, the encouragement of foreign investment, and the deregulation of financial markets. At the same time technological developments have magnified the effects of this liberalization by reducing the costs of transportation and communications, hence expanding the scope and volume of goods and services that are internationally tradable.

In contrast, Judt (2005, p. 41) argues that globalization is not about trade liberalization or expanding communication networks, but rather “about the disappearance of boundaries – cultural and economic boundaries, physical boundaries, linguistic boundaries – and the challenge of organizing our world in their absence.” In addition, the disappearance of boundaries has placed limitations on the ability of national governments to address problems adequately* and has enhanced **the importance of international law and institutions**.

Although consensus on a definition of globalization has not yet been reached, there appears to be some agreement on its core drivers (Held and McGrew 2002; Lall 2002; Saha 2002; J. E. Stiglitz 2002). These drivers are:

- 1 **The gradual removal of barriers** to trade and to the movement of capital, services, knowledge, and (to a lesser extent) people between nations;
- 2 **The rapid reduction in the costs of transportation** (due to energy efficiency gains and logistical improvements)[†] and communication; and

* Many commentators in reports by the GDAE (2008), ILO and WTO (2011), and Pardee Center (2012) see this loss of “policy space” as one of the main evils of globalization for developing countries.

† Internalizing the environmental costs (pollution and global climate change) may very well offset or even reverse the trends toward the reduction of transportation costs. The end of cheap energy – as

- 3 **The creation of new institutions** to supplement existing ones to formulate and oversee normative rules of engagement (especially for trade, but also increasingly for the environment) **at the international level.**

There is an interesting observation to be made about the first driver. Although the mobility of goods, firms, and capital has grown significantly over the past two decades, the ability of people to crisscross national borders has not, which is an important difference from previous episodes of globalization (Bordo et al. 1999; ECLAC 2002; WCDG 2004). Some observers, like Rodrik (2012), have even attributed this lack of labor mobility as one of the causes of the more severe length of the 2008 crisis in Europe (as compared to the U.S.).* Rodrik (2012), who advocates for a “less ambitious” kind of economic globalization that leaves room for “domestic calibration” of policies, sees the liberalization of labor flows† as the area “where the greatest economic gains exist today for global cooperation” (p. 403).

The above drivers have the effect of bringing nations, people, societies, cultures, economies, and markets closer together. A concise description of the wide range of elements that form the process of globalization is put forward by Held and McGrew (2002, p. 3, emphases added):

Globalization has been variously conceived as **action at a distance** (whereby the actions of social agents in one locale can come to have significant consequences for “distant others”); **time–space compression** (referring to the way in which instantaneous electronic communication erodes the constraints of distance and time on social organization and interaction); **accelerating interdependence** (understood as the intensification of enmeshment among national economies and societies such that events in one country impact directly on others); **a shrinking world** (the erosion of borders and geographical barriers to socio-economic activity); and, among other concepts, **global integration, the reordering of interregional power relations, consciousness of the global condition and the intensification of inter-regional interconnectedness.**

discussed by Ayres (2014), Galbraith (2014), and Morgan 2013 and referenced in Chapter 3 – may also significantly impact the global logistics and transportation system. However, while some have pointed to “**reshoring**” as a phenomenon resulting from increased labor and transportation prices, research by Cohen and Lee (2015) shows the reality is more complicated: “There is actually little reshoring on a net basis in the U.S., while supply chain movements are crisscrossing more than ever. Even within the same company, one department may be outsourcing while another is reshoring.” Eurofound’s European Restructuring Monitor (ERM 2016), however, finds emerging evidence, at least in Europe, that the pace of globalization has abated. According to the ERM (2016, p. 1), “Recent data show that the global rebound of growth was not accompanied by a corresponding increase in international trade and that some indicators of activity in global value chains have declined.” This explanation suggests that while global uncertainties may still dampen offshoring investment, it may also be the case that the two decades that preceded the crisis of 2008 were exceptional periods in the history of globalization. The entry of China and the Eastern European states into the world trading system during the two decades that preceded the crisis in 2008 was a one-off event; today the number of offshoring cases and the associated job losses are, even as the global economy has picked up, appreciably below the pre-crisis levels and continue to decline.

* Even though European citizens are able to move freely across countries in the Schengen area, in reality, differences in languages and cultures constitute significant barriers to labor mobility in Europe. Anti-immigrant animus was a major factor in the UK deciding to leave the European Union and fuels the far right in European and U.S. politics.

† This topic is discussed more fully in Section 5.3.3 in Chapter 5.

Table 4.1 The great globalization debate

	<i>Skeptics</i>	<i>Globalists</i>
Concepts	Internationalization, not globalization Regionalization	One world, shaped by highly extensive, intensive, and rapid flows, movements, and networks across regions and continents
Power	Rule by the nation–state Intergovernmentalism	Erosion of state sovereignty, autonomy, and legitimacy Decline of the nation–state Rise of multilateralism
Culture	Resurgence of nationalism and national identity	Emergence of global popular culture Erosion of fixed political identities Hybridization
Economy	Development of regional blocs Triadization New imperialism	Global informational capitalism The transnational economy A new global division of labor
Inequality	Growing North–South divide Irreconcilable conflicts of interest	Growing inequality within and across societies Erosion of old hierarchies
Order	International society of states Inevitable persistence of political conflict between states International governance and geopolitics Communitarianism	Multilayered global governance Global civil society Global polity Cosmopolitanism

Source: Adapted from Held and McGrew (2002, p. 37).

As evidenced above, there are different types of globalization (see the five aspects mentioned at the beginning of Section 4.2), which are global to different extents (see the discussion on labor mobility, for instance). As such, the picture of globalization appears to be much less simple and uniform than can be initially thought, giving rise to a globalization debate between those who are skeptical that such a phenomenon exists and those who believe that it is an integral and unavoidable aspect of our lives. In addition, a third group is emerging, composed of an increasing number of scholars who are pointing to an ongoing “de-globalization movement” exemplified by the stall of trade negotiations (both at the multilateral level, namely the WTO Doha round, and at the bioregional/bilateral level, i.e., the TPP and the TTIP) and the growing restrictions to the international movement of labor.

Held and McGrew (2002) provide a useful summary of the perceptions of those who believe in the existence of the globalization process and those who are skeptical (Table 4.1). It is important to recognize that the perceptions presented do not necessarily represent the views of all skeptics and all globalists. By the very nature of the subject, it is highly likely that views on certain issues may begin to diverge within the skeptic and globalist camps.

A relatively skeptical view of economic globalization is presented by Hirst and Thompson (2002, pp. 2–3), who provide a convincing set of evidence to show the following:

- 1 The present highly internationalized economy is not unprecedented [. . .] In some respects, the current international economy is less open and integrated than the regime that prevailed from 1870 to 1914.

- 2 Genuinely transnational companies appear to be relatively rare. [. . .]*
- 3 Capital mobility is not producing a massive shift of investment and employment from the advanced to the developing countries. [. . .]
- 4 As some of the extreme advocates of globalization recognize, the world economy is far from being genuinely “global.” Rather trade, investment and financial flows are concentrated in the Triad of Europe, Japan and North America and this dominance [now adding China to the Asian pole] seems set to continue.
- 5 These major economic powers, the G3 [now G20], thus have the capacity, especially if they coordinate policy, to exert powerful governance pressures over financial markets and other economic tendencies. Global markets are thus by no means beyond regulation and control, even though the current scope and objectives of economic governance are limited by the divergent interests of the great powers and the economic doctrines prevalent among their elites.

Thus, some (like Held and McGrew 2002, p. 20) argue that instead of globalization, what we are witnessing is a “triadization of the world economy,” albeit between broader groups: Europe (instead of solely Western Europe), Asia-Pacific (instead of solely Japan) and the Americas (instead of solely North America). The formation of the North American Free Trade Agreement (NAFTA), MERCOSUR (involving Argentina, Brazil, Paraguay, and Uruguay), APEC (Asia-Pacific Economic Cooperation), and ASEAN (the Association of Southeast Asian Nations) multilateral agreements and the economic integration of the EU constitute the pillars of this broadened triad. The failure to link members of the triad through the proposed Trans-Pacific Partnership (TPP) and the Transatlantic Trade and Investment Partnership (TTIP) has been superseded by the emerging Japan-EU Economic Partnership Agreement (JEEPA) (European Commission (2017). Trade agreements will be discussed in greater detail in Section 4.3.

4.2.1 Industrial globalization

Globalization connects the world through the transfer and sharing of knowledge/information, financial systems, labor, and the production and consumption of goods and services. The last is termed “industrialization.” It is possible to identify three main types of industrial globalization – *internationalization*, *multinationalization*, and *transnationalization* (Gordon 1995) – the first two of which can have a direct impact on environmental degradation.

Internationalization is the expansion of product/service markets abroad while the locus of production remains within the parent country. The process of internationalization is primarily facilitated by cheap transportation services, with information and communication technology (ICT) and e-commerce taking a secondary – but, nevertheless, increasingly important – role. Technology or products that are produced in industrial nations and exported overseas can provide significant benefits to governments, firms, communities, and individuals in the importing nations.† However, these technologies and products can

* A transnational company or corporation is “an economic entity operating in more than one country or a cluster of economic entities operating in two or more countries – whatever their legal form, whether in their home country or country of activity, and whether taken individually or collectively” (United Nations Economic and Social Council [ECOSOC] 2003, p. 7). See Section 4.5.

† The idea of the developed countries selling inexpensive products to millions of people in the developing world is known as “trading from the bottom of the pyramid” – see Hart and Milstein (1999), Prahalad and Hart (2002), and London and Hart (2004).

also introduce new problems or worsen existing problems in these nations. For example, the sale of pesticides to a nation that previously had never used such chemicals can result in negative environmental and human health impacts. These problems are exacerbated by improper or uncontrolled use that can occur as a result of inadequate warnings, training, or monitoring. Of course, the impacts of such products need to be considered against the conditions that likely would have existed had they not been introduced.

Multinationalization is where a (multinational) company establishes production/service facilities abroad to be nearer to foreign markets and/or to take advantage of more industry-friendly labor and environment and tax policies while maintaining research-and-development (R&D) and innovation-centered activities in the parent country. In this situation, the parent company is no longer *sending* products overseas but is *manufacturing* or *assembling* its products overseas. However, it is important to recognize that very few companies actually operate branches abroad that are a direct extension of the parent company itself. As Clegg (1996, p. 104) comments, “the preponderance of firms work through foreign affiliates incorporated according to local law. The parent firm in the home country will normally own significant equity in the foreign affiliate.” The increased turbulence of the international business environment, combined with cheap and effective communication and transportation services, provides the incentive for parent firms to coordinate with foreign affiliates (Clegg 1996). Consequently, as with internationalization, the process of multinationalization has provided significant benefits to societies outside a multinational enterprise’s (MNE’s) home nation (e.g., through investments, R&D spillovers, skills training, access to markets, etc.).

In a study of the U.S. manufacturing industry, Whitford (2006) provides a more nuanced description of how firms have outsourced much of their productive capacity to other firms in the United States and abroad. He observes that

most of what matters to manufacturing firms no longer happens under roofs they own or control. This has made the quality of relationships between firms much more important and their structure much more complex. How (and where) these large firms choose and direct their armies of suppliers has tremendous consequences for the regional economies in which they are embedded, because firms selling in the more profitable markets where competition depends as much on innovation and quality as it does on price are more likely to use skilled and better-paid workers.

(*ibid.*, p. 3)

Whitford (2006) also argues that the structure of manufacturing networks has more to do with how a firm is embedded in a particular historical and institutional context than with factors such as trade policy or international regulatory arbitrage.

Performing a cross-country analysis, Agosin and Machado (2007) arrive at a similar conclusion, namely that “the most important determinants of variations in FDI [foreign direct investment] flows across countries and over time are country size, the level of educational achievement, and growth” (we could add to that infrastructure and per-capita income) and not necessarily openness of the investment regime, which is only “slightly associated with FDI inflows” (Agosin 2008, p. 8).

These considerations are important as they impact the structure of global manufacturing networks, and consequently the patterns of development associated with globalization and trade for different countries. For instance, in examining the structure of the IT industry in Mexico, Zarsky and Gallagher (2008) explain that:

In the early 1990s, IT multinationals embraced a new strategy of outsourcing their manufacturing functions, reconfiguring the industry into a three-tiered “global production network.” At the top are the global “flagships” – companies like HP, Dell,

IBM – who have brand name and global marketing and design capacities and who earn the highest profits. Next are the contract manufacturers (CMs) who assemble components into a variety of electronic products under contract to global flagships. On the third rung are component suppliers – from large companies to mom-and-pop outfits – who sell inputs mainly to the CMs and operate on razor-thin margins.

Rather than a “regional” strategy – outsourcing to companies located in the countries where the flagships already had a presence – the flagships embraced a “global” strategy, turning to Silicon Valley firms like Flextronics, Solectron, Jabil Circuit, and SCI-Sanmina. Relatively small at the outset, these contract manufacturers (CMs) soon swelled to become large multinationals in their own right, largely by developing a highly efficient, very low-margin global supply base.

Under the new strategy, the flagships bypassed Mexican IT manufacturers and invited “their” CM assemblers to co-locate in Guadalajara, driving local IT firms out of business [. . .] Both the flagships and the CMs also bypassed other potential downstream supplier firms: [by 2002] over 95% of all the products and services used by both flagships and CMs were imported.

(Zarsky and Gallagher 2008, pp. 41–42)

This illustrates what McMillan and Rodrik (2011) see as a major challenge of industrial globalization: the fact that “labor [most notably in developing countries] has moved in the wrong direction, from more-productive to less-productive activities.” In the above case, Mexican IT companies and workers have been reduced to producing low-margin components for the high-margin products assembled by CMs and sold by U.S.-based flagships. Section 4.4 will discuss this issue of trade and development in more detail.

Multinational enterprises (MNEs) are also responsible for some of the world’s worst industrial accidents.* The more industrial globalization occurs in the form of multinationalization, the more concerned we should become, because the impacts on other nations can be extensive.†

Benton and Redclift (1994) present another way to consider multinationalization by discussing how the spatial relocation of the Japanese car-manufacturing industry has led to both positive and negative environmental impacts. On the one hand, the relocation of car-manufacturing plants in other nations is seen to have reduced the environmental pollution problem in Tokyo. On the other hand, the creation of new consumer markets for Japanese cars is seen to have increased the per capita consumption of energy and material at the global level, with a corresponding increase in the amounts of total pollution and waste. Hence, the authors argue that this second type of industrial globalization has the effect of redistributing environmental costs and benefits.

This effect has also been described by Hoffmann (2011), who sheds light on the “rebound effects” that appear when the efficiency gains and reduced emissions achieved

* An example of an MNE’s operation that had devastating consequences for society in the recipient nation was the Bhopal incident in India. In 1984, a leak of deadly intermediate methyl isocyanate at a Union Carbide pesticide plant killed some four thousand people and affected the health of tens of thousands more in the city of Bhopal. Although Union Carbide batch processing plants in the United States are subject to strict health and safety and environmental controls, the state of Madhya Pradesh in India did not have the motivation to deploy a similar monitoring/control regime. Indeed, it has been argued that health and safety violations at the Bhopal plant were overlooked in the name of industrialization and agricultural self-sufficiency. In this case, the problem was not due to the sale of products or equipment but to the transfer of manufacturing capacity – see Lopatin (2004).

† Note, however, that MNEs have come under greater scrutiny by NGOs and stockholders and have increasingly responded to these concerns by adopting “at-home practices” abroad. See the codes of conduct and principles developed in the context of foreign investment discussed at the end of this chapter.

by developed countries are countered by shifting resource consumption and polluting industries to developing countries. Another recent example is the impact of China's increasing imports of corn and soy on the land and water uses of other developing countries, like Brazil and Argentina, and even developed regions, like California. While Brazil now devotes "more than 25m hectares of land – parts of which were once Amazon rain-forest" to agriculture (The Economist 2014), Argentina and California are also chopping down thousands of hectares of forests (thereby altering their regions' climate) and using their water resources* to cultivate feedstock for China's dramatically expanding swine industry (West 2015).† Confronting these facts with news of historically severe droughts affecting the entire populations of São Paulo and California brings a sobering realization of the magnitude of challenges of globalization to sustainable development.

What is evident from these first two types of industrial globalization is that when technology is transferred between nations – primarily by MNEs (see Section 5.1.2 in Chapter 5)‡ – both the positive and negative aspects of the technology are transferred with the equipment and products. If the receiving nation's ability to control the new technology or industrial processes is limited, then what might well be an environmentally sound technology in an industrialized nation can become environmentally destructive if it is used in an uncontrolled manner.

The third type of industrial globalization, which we will call *transnationalization*, is the creation of strategic alliances in which two different foreign enterprises merge/share their R&D and other capabilities to create a new entity or product line, reduce expenditures, and open up new markets (Mowery and Rosenberg 1989; Gordon 1995). An example of a strategic alliance was the ultimately unsuccessful Daimler–Chrysler merger, where different technological and managerial capacities were combined, ostensibly to create a whole that was expected to be greater and more efficient than the sum of its parts. This form of industrial globalization is not as common as the first two and is most likely to occur between developed nations, as opposed to between developed and developing nations. In addition, tax avoidance, for example, by having a U.S. firm merge with a European firm in order to qualify for lower U.S. tax rates as a foreign firm, is also a recent motivating factor.

4.3 Trade regimes

The most significant trade regimes are the World Trade Organization (WTO), the North American Free Trade Agreement (NAFTA), the Association of Southeast Asian Nations (ASEAN), and various agreements involving countries in Central and South America. A detailed examination of the WTO and other emerging trade agreements in terms of their ability to address environmental and employment effects is provided in Chapter 11. The exploration of ASEAN and trade agreements involving South America is beyond the scope of this text. The WTO, NAFTA, and the still-emerging Transatlantic Trade and Investment Partnership (TTIP) and unsuccessful Trans-Pacific Partnership (TPP), as well

* "A hundred billion gallons of water per year is being exported in the form of alfalfa [hay] from California," according to Professor Robert Glennon from Arizona College of Law (Leithhead 2014).

† In 2010, China's soy imports accounted for more than 50 percent of the total global soy market (The Economist 2014).

‡ The recent growth inflows of foreign direct investment (FDI) have been primarily driven by global production systems that are made up of some 65,000 MNEs with around 850,000 foreign affiliates (WCSDG 2004). Within these production systems, high-tech industries (e.g., electronics, semiconductors) and labor-intensive industries (e.g., textiles, garments, footwear) have experienced the most pronounced growth (ibid.).

as the emerging Japan–EU Economic Partnership Agreement (JEEPA), are discussed in the following sections.

4.3.1 *The World Trade Organization*

The WTO describes its agreements as follows:^{*}

The WTO agreements cover goods, services and intellectual property. They spell out the principles of liberalization, and the permitted exceptions. They include individual countries' commitments to lower customs tariffs and other trade barriers, and to open and keep open services markets. They set procedures for settling disputes. They prescribe special treatment for developing countries. They require governments to make their trade policies transparent by notifying the WTO about laws in force and measures adopted, and through regular reports by the secretariat on countries' trade policies.

The agreements are often called the WTO's trade rules, and the WTO is often described as "rules-based." The "rules" are agreements that governments negotiated, which can be renegotiated or further clarified through the resolution of trade disputes. The legal texts consist of about sixty agreements, annexes, decisions, and understandings. The main agreements fall into a simple structure with six main parts: an umbrella agreement (the Agreement Establishing the WTO); agreements for each of the three broad areas of trade that the WTO covers (goods, services, and intellectual property); dispute settlement; and reviews of governments' trade policies. See Chapter 11 for a further discussion of WTO trade rules and agreements and their relationship to environmental and public health concerns. Also see Section 10.4.3 in Chapter 10.

4.3.2 *The North American Free Trade Agreement*

NAFTA differs from the WTO in that, like the ASEAN, it is a regional trade agreement involving the United States, Canada, and Mexico. It is also unique in that in order to get the support – or at least lessen the resistance to its adoption – of environmental groups and organized labor, it contains two side agreements on the environment and labor. Unlike the WTO, which speaks directly to environmental agreements but obliquely to labor issues, the initial NAFTA did not address either, which necessitated the side agreements. In contrast to multilateral environmental agreements (MEAs) and conventions of the International Labour Organization (ILO)[†] and to the preference for uniformity among trading partners of environmental safeguards expressed by the WTO, **the NAFTA side agreements do not encourage uniformity but rather adherence of each separate country's requirements to its own laws and standards.** Two separate institutional dispute-resolution mechanisms that operate outside other traditional (economic) trade-dispute mechanisms are established for environmental and labor issue disputes.[‡]

Interestingly, although NAFTA was originally intended to expand its membership to Central and South America, the Bush administration's resistance to including side agreements

^{*} Source: WTO, www.wto.org/english/thewto_e/whatis_e/tif_e/agrml_e.htm (accessed February 7, 2018).

[†] See Chapter 10 for a discussion of regional and international regimes to protect health, safety, and the environment.

[‡] See Deere and Esty (2002), Hufbauer and Goodrich (2004), and Hufbauer and Schott (2007).

caused the United States to attempt to negotiate an entirely separate agreement under a Free Trade Agreement of the Americas (FTAA) banner, but this ultimately failed in 2004. The United States then resorted to negotiating separate bilateral agreements with selected South American countries, undermining the likelihood of a regional approach to trade. The last Summits of the Americas (the Sixth Summit in Cartagena, Colombia in 2012; the Seventh Summit in Panama City, Panama in 2015) confirmed this trend, as the region's socialist actors (including Cuba's Rafael Castro, Venezuela's Hugo Chavez, Ecuador's Rafael Correa, and Bolivia's Evo Morales) voiced their opposition to the U.S. promotion of development via free trade and private sector solutions (Medea 2015). And indeed, with interventions at the "side forum" of top representatives of Coca-Cola, Cargill, Boeing, Associated Petroleum Investors, AES Corporation, Citigroup Latin America, and Wal-Mart Latin America (to name a few), one can legitimately wonder whether the type of regional agreement put forward by the U.S. and the Business Forum can ever achieve the Summit's objective of "prosperity with equity."

Economic Policy Institute researcher Jeff Faux (2016, p. 3) has said of NAFTA and TPP (see next section) that

despite the labeling, NAFTA and the NAFTA-like deals that have followed agreements are not 'free trade' agreements. [See also Section 11.3.2 in Chapter 11 on NAFTA.] Only six of 30 chapters of the TPP directly address questions of trade. The rest lay down rules that protect the interests of multinational investors above those of workers, the environment, and human rights. It is rife with restrictions on domestic policies – including restrictions on government policies to favor local procurement – that protect multinational corporate rights to future profits. To enforce those rights, the TPP would establish an Investor–State Dispute Settlement system by which corporate-affiliated judges can override the decisions of democratic governments.

4.3.3 The Trans-Pacific Partnership (TPP) and the Transatlantic Trade and Investment Partnership (TTIP)

The Trans-Pacific Partnership (TPP) and the Transatlantic Trade and Investment Partnership (TTIP) are two trade agreements originally involving the U.S. that exemplify the ongoing trend of reversing the globalization process. The TTIP negotiations, involving the U.S. and the EU, have been on a hiatus since the end of 2016. The TPP negotiations, involving the U.S. and other countries from the Pacific region, received its death blow with President Trump's decision to withdraw from the agreement. It is now probable that neither of these agreements will be implemented in the near future, at least with the U.S. as a signatory party. The Trump administration's withdrawal from the TPP agreement was rationalized politically based on the alleged negative effects of the agreement on U.S. jobs and the economy.

While TPP and TTIP differ in geographical coverage,* they present certain similarities, especially in their focus on non-tariff measures, some of their highly controversial clauses, including ISDS, and the secretive processes through which they have been crafted and negotiated. While neither may enter into force, both agreements are worth discussing as they illustrate some aspects of the growing de-globalization movement.

More and freer trade was defended by the EU Commission as the best pathway to economic growth and prosperity as reflected in mainstream economic and political thinking.

* The TPP concerns twelve countries bordering the Pacific – in alphabetical order: Australia, Brunei, Canada, Chile, Japan, Malaysia, Mexico, New Zealand, Peru, Singapore, the United States of America (withdrawn in January 2017), and Vietnam. In contrast, the TTIP covers only two economic areas: the United States of America and the European Union.

Four widely cited econometric studies – Ecorys (2009), CEPR (2013), CEPII (2013), and Bertelsmann Stiftung (2013) – constituted the basis for the European Commission’s (EC’s) reflections and arguments in favor of maximum trade liberalization and a TTIP as comprehensive as possible. As an illustration, CEPR (2013, p. vii) argued that:

An ambitious and comprehensive transatlantic trade and investment agreement could bring significant economic gains as a whole for the EU (€119 billion a year [USD \$146 billion]) and US (€95 billion a year [USD \$117 billion]). This translates to an extra €545 [USD \$669] in disposable income each year for a family of 4 in the EU, on average, and €655 [USD \$816] per family in the US.

Income gains are a result of increased trade. EU exports to the US would go up by 28%, equivalent to an additional €187 billion worth of exports of EU goods and services. Overall, total exports would increase 6% in the EU and 8% in the US.

The increased level of economic activity and productivity gains created by the agreement will benefit the EU and US labor markets, both in terms of overall wages and new job opportunities for high and low skilled workers. Labor displacement will be well within normal labor market movements and economic trends. This means a relatively small number of people would have to change jobs and move from one sector to another (0.2 to 0.5 per cent of the EU labor force). The agreement would have negligible effects on CO₂ emissions and on the sustainable use of natural resources.

However, these four studies presented significant shortfalls, in both methodology and scope.

With regards to **methodology**, Capaldo (2014) points out three main issues. First, the studies’ **lack of independence**. The two first studies were commissioned by the EC, and all the studies (except for Bertelsmann Foundation 2013) use the same econometric models and versions of the same database.* “The convergence of their results is, therefore, not surprising and should not be taken as providing independent confirmation of their predictions” (Capaldo 2014, p. 5). Second, the models’ **unrealistic assumptions and methods**, most notably the “assumption on the process leading to a new macroeconomic equilibrium after trade is liberalized,” in particular, the “full employment mechanism” (ibid., p. 6).† And finally, the models’ **neglect of the distribution of impacts**, although the issue of distribution of gains and losses (e.g., of income) is critical. Indeed,

if workers in competitive sectors may benefit from higher salaries, while those in shrinking sectors lose, the economy as a whole may be worse off. This is because in

* The studies used the World Bank-style Computable General Equilibrium (CGE) models from the Global Trade Analysis Project (GTAP).

† Capaldo (2014, p. 6) argues that “the main problem with these models is their assumption on the process leading to a new macroeconomic equilibrium after trade is liberalized. Typically, as tariffs or trade costs are cut and all sectors become exposed to stronger international competition, these models assume that the more competitive sectors of the economy will absorb all the resources, including labor, released by the shrinking sectors (those that lose business to international competitors). However, for this to happen, the competitive sectors must expand enough to actually need all those resources. Moreover, these resources are assumed to lack sector-specific features, so they can be re-employed in a different sector. Under these assumptions, an assembly-line employee of an automobile factory can instantly take up a new job at a software company as long as her salary is low enough. Supposedly, this process is driven by speedy price changes that allow an appropriate decrease of labor costs and, consequently, the necessary expansion of the competitive sectors. In practice, however, this ‘full employment’ mechanism has rarely operated. In many cases, less competitive sectors have contracted quickly while more competitive ones have expanded slowly or insufficiently, leaving large numbers of workers unemployed.”

some countries domestic demand is mostly supported by the incomes earned in traditional occupations.

(*ibid.*, p. 6)

Thus, trade liberalization may lead to net drops in demand in certain trading partners. This outcome would be in addition to drops in demand caused by workers' purchasing power reductions due to technological displacement.

Using another methodology (based on the United Nations Global Policy Model), Capaldo finds that TTIP would lead to net losses in terms of GDP, employment, personal incomes (notably via the transfer of income from wages to profits, from labor to capital), and government revenue in the EU,* as well as increases in financial and macroeconomic instability. In a similar vein, Rosnick (2013) discusses the potential economic winners and losers from the TPP, and concludes that while the net effects from the TPP might be slightly positive, 0.13 percent worth of GDP gains for the U.S. by 2025, the distributive effects may be more problematic. As a matter of fact, "most workers are likely to lose – the exceptions being some of the bottom quarter or so whose earnings are determined by the minimum wage; and those with the highest wages who are more protected from international competition" (Rosnick 2013, p. 1).

With regard to **scope**, it is important to note that the pro-TTIP reports only address the economic consequences of the potential TTIP. More qualitative and non-economic factors such as impacts on the trading partners' geopolitical status, bargaining power, legal and social contexts (i.e., "content" of the agreement), and the processes through which the trade agreement is being crafted and negotiated (i.e., "process" of the agreement) are not discussed and critically evaluated.

In terms of "**content**," the most controversial aspects of both the TTIP and the TPP were:

- 1 **The loss of policy space for trading partners and, in particular, emerging ones.** Zarsky and Gallagher (2008) already warned about the loss of policy space Mexico suffered after agreeing to NAFTA, as compared to Brazil and China, who only engaged in trade with the U.S. under the WTO. Similar concerns could easily be formulated for South American and East Asian participants in the TPP negotiations, and even for the EU and U.S. due to the establishment of the ISDS mechanism (see point (2) below and Section 4.3.4).
- 2 **The establishment of an arbitrary Investor–State Settlement (ISDS) mechanism,** which "allows companies to bypass national courts and sue governments for damages on lost investments in extra-territorial arbitration panels" (Traynor 2015). This is one of the most polemic clauses of the agreements under discussion. Indeed, for critics – one of the most vocal being U.S. Senator Elizabeth Warren – this amounts to a surrender of national political sovereignty to private interests (Warren 2015a). Even more disturbing are the facts that the ISDS panels wouldn't employ independent judges but instead expert corporate lawyers; that the mechanism would only be available to international investors (or corporations) but not to, say, international

* Compared to the baseline "no-TTIP" scenario, TTIP would lead to: *losses in terms of net exports after a decade* (worth up to 2.07 percent of GDP in Northern European economies), *net losses in terms of GDP* (up to a 0.50 percent of GDP reduction in Northern countries), *a loss of labor income* (between 165 Euros [USD \$ 202] and 5,500 Euros [USD \$6,746] per worker depending on the country), *job losses* (approximately 600,000 jobs in the EU), *a reduction of the labor share of GDP* (or transfer of income from labor to capital, worth up to 7 percent of GDP in the UK, calculated before Brexit), and *a loss of government revenue* (worth up to 0.64 percent of GDP in France) (Capaldo 2014, pp. 2–3).

nonprofit organizations or unions* (ibid.); and that the decisions of the arbitration panels would not be subject to appeal (Baker 2015a). (See also Section 4.3.4.)

- 3 **The lowering of (consumer, labor, and environmental) norms and standards.** Although proponents of the TTIP argue that it “offers [the U.S. and E.U.] a chance to fasten down high standards of consumer, environmental, and legal safety that China and the emerging economies will be forced to emulate” (Traynor 2014), others fear that the ISDS will subject national standards and regulations to foreign corporate and investor interests and lead to a “race to the bottom.” To illustrate this point, Neslen (2015) explains how the “EU moves to regulate hormone-damaging chemicals linked to cancer and male infertility were shelved following pressure from US trade officials over the [. . . TTIP] free trade deal [. . .] Draft EU criteria could have banned 31 pesticides containing endocrine disrupting chemicals (EDCs). But these were dumped amid fears of a trade backlash stoked by an aggressive US lobby push.” This case illustrates how the TTIP and TPP may reduce the policy space of trading partners and fail to respect different national preferences and attitudes towards regulation impact assessments in the U.S. vs. the precautionary principle in the E.U. (see point (1)).
- 4 **The stringency of the intellectual property and copyright protection clauses.** Baker (2015b) explains how “the TPP will also be very much protectionist in the areas of patents and copyrights making these protections stronger and longer.” While the pro-trade argument is that added protection increases the incentives for innovation and investment, as indeed “such protections can raise the price of products by several thousand percent above their free market price” (ibid.), it is doubtful that societies as a whole (especially in emerging countries) will gain. Baker argues that in addition to making products (such as drugs) unaffordable to people, patent monopolies may lead to all sorts of corruption (e.g., lying about the effectiveness and safety of drugs).
- 5 **The potential geopolitical impacts.** Drezner (2015) explores the potential effects of the TPP on regional security and on the Sino–American relationship. While the TPP may be perceived “as a means to advance U.S. interests while preventing China from writing the rules of the game in the Pacific Rim [. . .] the pact could also help China, by making it easier for Beijing to pursue its own regional agreements without facing [Western] criticism that it should instead pursue ambitious global free trade pacts” (ibid.). Even though it may be difficult to evaluate the net impacts of TTIP and TPP [now withdrawn] on the geopolitical might and power dynamics within and between signatories and non-signatories, this topic as it relates to a potential global “race to the top” or “race to the bottom” for consumer, labor, and environmental standards, deserves further attention.

* As Warren (2015b) argues, “if a Vietnamese company with U.S. operations wanted to challenge an increase in the U.S. minimum wage, it could use ISDS. But if an American labor union believed Vietnam was allowing Vietnamese companies to pay slave wages in violation of trade commitments, the union would have to make its case in the Vietnamese courts.”

† While some view the TPP as a U.S. retaliation on China’s stand on IP rights and protection, Medea (2015, p. 2) explains that the TPP may also be viewed as the U.S.’s attempt to tighten its links to countries in Latin America and “divide and weaken the Latin American alliances such as MERCOSUR and UNASUR” in order “to counter the economic influence of the socialist government of Venezuela” in the region. In addition, the TPP may also be an attempt to contain China’s growing economic influence in Latin America. Indeed, “China’s trade with Latin America has mushroomed from \$10 billion in 2000 to \$257 billion in 2013 and estimates for the end of the decade are \$500 billion. China is now the top trading partner for Brazil, Chile and Peru. Chinese investment in the region is mainly in the extractive and agricultural sectors, but China is also a major source of financial loans. Venezuela has received upwards of \$50 billion in Chinese lending since 2005” (ibid.).

- 6 **The increase in financial and macroeconomic imbalances and instability.** On this topic, Capaldo (2014, p. 3) explains that the “TTIP would lead to higher financial instability and accumulation of imbalances. With export revenues, wage shares and government revenues decreasing,^[*] demand would have to be sustained by profits and investment. But with flagging consumption growth [notably in the E.U.], profits cannot be expected to come from growing sales. A more realistic assumption is that profits and investment (mostly in financial assets) will be sustained by growing asset prices. The potential for macroeconomic instability of this growth strategy is well known.” The Pardee Center (2012) also cautions against trade agreements, such as the ones discussed here, that forbid capital account regulations (CARs) (or capital controls) in order to liberalize trade and investment. As they explain it, “those nations that deployed CARs in the years leading to the financial crisis were among the least hard hit when the global financial crisis wracked the world economy” (The Pardee Center 2012, p. 1). And so, the loss of policy space over this issue associated with trade liberalization agreements has the potential to result in the level of global financial and monetary interconnectedness and instability that precipitated the 2008 meltdown. In other words, these trade agreements can make it harder for regulatory authorities in the U.S. and trading partners to prevent future financial crises.
- 7 **The creation of an environment hostile to journalists and whistleblowers.** A letter, written by the Electronic Frontier Foundation and Fight for the Future and co-signed by more than 250 tech companies, was released after some portions of the TPP bill were leaked. The letter expresses concern that the TPP will “create new threats for journalists and whistleblowers” (Electronic Frontier Foundation 2015a, p. 1). Indeed, the “dangerously vague language” could enable signatory countries to “enact harsh criminal punishments against anyone who reveals or even accesses information through a ‘computer system’ that is allegedly confidential” (Electronic Frontier Foundation 2015b), or to “enact rules that would ban reporting on timely, critical issues affecting the public” (Thielman 2015).
- 8 **The lack of enforcement mechanisms.** Richard Trumka, the President of the American Federation of Labor, Congress of Industrial Organizations (AFL-CIO), (i.e., federation of labor organizations), explains that while the current agreements have been said to carry the strongest labor and environment provisions ever, it is all very relative. First, the historic bar has been set low. Indeed, “the United States has never had a trade agreement that protects basic rights and raises wages and living standards for working people” (Trumka 2015, p. 1). Second, the lack of transparency around the agreements’ design and negotiation processes is such that the public is currently unable to judge whether the aforementioned claims are indeed true. Finally, and most importantly, even if the labor and environment provisions turned out to be strong, they could only be taken seriously if accompanied by appropriate enforcement mechanisms. Indeed, “Vietnam, Mexico, Brunei and Malaysia – all TPP countries – are notorious labor and human rights violators, currently out of compliance with the standards supposedly in the TPP” (Trumka 2015, p. 2). The fact that “there is [currently] no known plan to withhold TPP benefits until these counties comply” (ibid., p. 2) leaves room for doubt regarding the respect of labor and environment in the trade agreements.

With regards to the design and negotiation “**processes**” of the agreements, the two main issues relate to:

- 1 **Secrecy and lack of transparency.** The secrecy surrounding the drafting and negotiation processes of the TTIP (i.e., who is involved? Whose interests are being promoted? What do the clauses actually stipulate? Etc.) made stakeholders nervous on both sides

* See his aforementioned analysis.

of the Atlantic. For instance, it is only after a hard-fought battle that Members of the British Parliament were allowed to consult the deal's current text, albeit in a restricted reading room and for limited time periods. Even then, they were not able to share what they discovered with constituents or with journalists (Scott Cato 2015). Similarly, even though dissent against the TPP was plenty, the means for public advocates to get involved were few: "public interest groups that want to be on trade advisory committees in order to participate in the negotiations are required to sign non-disclosure agreements, which robs them of the voice to object" (Srinivas 2015, p. 5). To quote Scott Cato (2015, p. 2), these elements do not give us "any sense of reassurance either that the process of negotiating th[ese] trade deal[s] is democratic, or that the negotiators are operating on behalf of citizens." This is especially true when one considers the number of corporate advisers that have been able to inform the drafts of both the TTIP and TPP, which brings us to the next point.

- 2 **Over-representation of corporate interests in the process.** While MEP Scott Cato cannot share much from what she has learned during her limited consultation of the TTIP text, she writes that: "What we do know is that 92% of those involved in the consultations have been corporate lobbyists. Of the 560 lobby encounters that the commission had, 520 were with business lobbyists and only 26 (4.6%) were with public interest groups" (Scott Cato 2015, p. 2). Srinivas (2015) makes a similar observation regarding the TPP. It may now be easier for one to understand why so much secrecy (see point (1)) has been maintained around the deals' drafting and negotiation.

At a higher level, these observations lead us to critically reconsider the overall process of globalization (Section 4.2) and the trade deals that shape it. **Who or what gets globalized? Who or what gets protected?** Baker (2015b) raises the point that:

Our trade deals could have been written to facilitate the process of putting our most highly paid professionals in competition with workers from the developing world, rather than autoworkers and textile workers [. . .] But because professionals have so much more political power, we don't allow this type of globalization.

This touches upon the essential questions that one needs to raise when thinking about sustainable development today: what does it mean, how can it be achieved, who/what will help, and who/what will stand in the way of progress?

After the above analysis emerged from the Tufts University Global Environment and Development Center (GDAE), engendering significant resistance from both environmentalists and labor, both the TPP and TTIP seemed doomed to failure. Griffith et al. 2017 offered a political analysis concluding that the "era of the Washington Consensus is firmly behind us" (ibid., p. 588) and that "the apparent withdrawal from these agreements [has] worsened the geopolitical landscape and created a geo-strategic vacuum (ibid., p. 589).

Interestingly, trying to "restore balance to global trade agreements" is also one of the main pillars of Stiglitz's (2015, p. 60) strategy to rewrite the rules of the American economy. Stiglitz criticizes the TPP (touching upon most of the aforementioned arguments, e.g., IP, ISDS) and concludes that "getting the rules right on trade begins by not exporting to other countries the economic rules that have led to skyrocketing inequality in income, wealth and political influence" (ibid., p. 61). Stiglitz (2016a) also argues that

the failure of globalization to deliver on the promises of mainstream politicians has surely undermined trust and confidence in the "establishment." And governments' offers of generous bailouts for the banks that had brought on the 2008 financial crisis, while leaving ordinary citizens largely to fend for themselves, reinforced the view that this failure was not merely a matter of economic misjudgments [. . .]. If globalization is to benefit most members of society, strong social-protection measures must be in place.

Additionally, trade deals that aim for global sustainable development, should ensure “investor protections are not prioritized above protections on the environment and labor, and [. . . there is increased] transparency in the negotiation process” (Stiglitz’s 2015, p. 9). Rodrik (2012) (already mentioned in Section 4.2) provides interesting clues in terms of what the new trade deals should focus on – namely, **liberalizing human capital flows, stabilizing the international financial and monetary system, and increasing the space for domestic calibration**. Analyzing the evolution and state of transatlantic economic relations (TERs), Meyer and Barber (2011) see the **greater engagement with major stakeholders (representing businesses, consumers, labor, the environment, and the law) and the broadening of the political agenda as keys to break the current deadlock and intensify transatlantic cooperation**, in view of increasing economic challenges from other parts of the world. Currently, “the main purpose of TERs is the abolition of tariff and non-tariff barriers to trade and investment” (ibid., p. 108), but this “narrow political agenda [is] at odds with the institutional structure which, at least on the transnational level, include[s] a wider variety of stakeholders”* (ibid., p. 109). Therefore, new interregional initiatives should focus on the restatement of existing commitments in today’s context and the introduction of a new monitorial institution (ibid., p. 110), rather than on solely reducing tariff and non-tariff barriers.

Along the same line as Rodrik and Stiglitz, Piketty (2016) claims that we must rethink globalization. He convincingly argues that the question of liberalizing trade should no longer be the focus of new agreements, and that

trade must once again become a means in the service of higher ends. It never should have become anything other than that. [. . .] Globalization must be fundamentally re-oriented. The main challenges of our times are the rise in inequality and global warming. We must therefore implement international treaties enabling us to respond to these challenges and to promote a model for fair and sustainable development.
(ibid.)

Josh Bivens (2017, p. 1) of the Economic Policy Institute has weighed in heavily in clear and detailed terms against globalization as currently practiced:

Globalization was always likely going to depress wage growth for the majority of American workers. But policy failures have significantly amplified these damaging effects, turning this from a manageable challenge into a deep economic wound for these workers – and into a political disaster for the country.

These policy failures include:

- Failing to secure any reasonable compensation for those on the losing end of globalization
- Failing to address currency misalignments that have led to large trade deficits and hemorrhaging employment in manufacturing
- Passing trade agreements that have consistently aimed to undercut workers’ economic leverage while carving out ample protections for corporate profits

The effects of globalization and our failed policy response to it are not just a problem for white manufacturing workers in the Rust Belt, but in fact affect the majority of workers and likely fall disproportionately on the wages of nonwhite workers. [. . .]

* These stakeholders include the existing Transatlantic Business Dialogue (TABD), Transatlantic Consumer Dialogue (TACD), Transatlantic Labor Dialogue (TALD), Transatlantic Environmental Dialogue (TAED), and Transatlantic Legislator’s Dialogue (TLD) (Meyer and Barber 2011, p. 108).

What can be done about it

To remedy the situation, the United States can:

- Use domestic policy to compensate (offset the losses to) negatively affected workers – but the first step is acknowledging the large scale of these losses.
- Stop pursuing new omnibus trade agreements that protect returns to capital while undercutting wages.
- Reorient international policy away from regressive trade agreements and toward measures that will benefit workers in the U.S. and in other countries – addressing currency misalignments; developing international policies to enable countries to tax capital income, including clamping down on abusive tax havens; instituting an international financial transactions tax; and harmonizing national policies aimed at combating global climate change.

In conclusion, trade agreements contribute to shaping the globalization process. As such, their potential consequences on the three pillars of sustainable development – economic, employment, and environment – and their distributive characteristics should be critically evaluated and considered during the drafting, negotiation, and implementation processes. While this may seem obvious, trade deals like NAFTA (currently in place) or the TPP and the TTIP (which will probably not be implemented, at least in the near future) demonstrate that it is extremely challenging to get unbiased and comprehensive evaluations or cost–benefit analyses of trade deals *a priori*. Evaluations, even produced by reputable organizations and think tanks, present shortfalls in methodology and scope and need to be interpreted carefully. Assuming that all elements would be available to be fairly considered, there remains an essential question, that of the actual negotiation and ratification process. Who gets a voice in writing and approving the ultimate agreement is of utmost importance. Here again, past and current agreements provide multiple examples of capture of the public agenda by vested interests. While some commentators (Meyer and Barber 2011; Rodrik 2012; Stiglitz 2015) advocate for more balanced globalization and trade deals, both globalization and trade are still perceived to have some major benefits. The rationale behind this conception is discussed both earlier in this section and in Section 4.4.

4.3.4 *The Investor State Dispute Settlement (ISDS)*

ISDS stands for Investor-State Dispute Settlement. During the last several decades, ISDS provisions have typically been included in international investment agreements signed by two or more countries. They were originally intended to protect firms that invest abroad against hostile acts by host countries, in particular against expropriation, and to ensure fair and equitable treatment and guarantee of security and access to justice. However, the scope of ISDS has broadened, and it has become *de facto* a mechanism allowing foreign firms that invest in a country to sue the host country if its government makes any kind of policy decision which erodes the foreign firm's expectation of profits, even if competing domestic firms will also be affected by the host country's policy decision.

ISDS first appeared in a bilateral agreement between Germany and Pakistan in 1959. Its goal was to encourage foreign investment by protecting investors from discrimination or expropriation, providing them with a system more reliable than local courts in the host country. Since then, ISDS has been in hundreds of bilateral investment treaties (BITs) and, more recently, in free trade agreements as FTAs have started to include investment chapters.*

* Note that until recently it was not that common to include investment chapters in free trade agreements. NAFTA in 1994 was the first free trade agreement the U.S. has negotiated where investment

Typically, foreign investing firms can use ISDS provisions to request compensation for expropriated property or to challenge local governments if they are not granting them the same rights and benefits as local firms or are not giving them fair and equitable treatment.

ISDS allows foreign firms to challenge government decisions that affect their expectations. The suits are usually heard by only three private arbitrators (lawyers) who are appointed ad hoc by the investor and the challenged government and who are not accountable to any domestic legal system.* Parties cannot appeal the arbitral ruling.

Opponents believe that the whole idea of ISDS gives foreign firms a veto over democracy. Recently, there has been a sharp rise in contentious arbitrations, as multinationals have learnt how to exploit ISDS clauses and vague definitions of expropriation or the fair and equitable clause to sue governments for any legitimate changes in policy (for example, measures to protect the environment, public health, workers, or consumers) that happen to have harmed their interests. Some domestic companies have gone even as far as buying foreign firms in their own countries simply to gain access to the ISDS mechanisms available to foreign investors.

Procedure-wise, arbitration is a lengthy, opaque process. Arbitrators are paid at least \$600–700 an hour, giving them little incentive to dismiss cases out of hand. They are often corporate lawyers who cycle in and out of the industry. They cannot be held accountable for their rulings, and it is not possible to appeal. The nature of the arbitration process is secretive and it is not required to consider precedent, which allows plenty of scope for creative adjudications.

There are several recent examples of situations in which ISDS has been used against host countries:

- Following the Fukushima disaster in Japan in 2011, the German government decided to shut down its nuclear power industry. Soon after, Vattenfall, a Swedish utility that operates two nuclear plants in Germany, demanded compensation of €3.7 billion (USD 4.5 billion) under the ISDS clause of a treaty on energy investments.
- Occidental, an oil company, won a \$2.3 billion award against the government of Ecuador over its (apparently lawful) termination of an oil-concession contract.
- Australia briefly forswore ISDS in the wake of a complaint by Philip Morris about its requirement for health warnings on cigarette packets. Philip Morris tried the same tactic against Uruguay, claiming that its anti-smoking regulations unfairly hurts profits, violating a bilateral trade treaty between Switzerland and Uruguay.
- The oil firm Trans Canada filed a lawsuit (in June 24, 2016) against the U.S. government under NAFTA rules, seeking \$15 billion in compensation for the rejection of the Keystone XL pipeline project by the U.S. government, which was acting in the interest of the U.S. and its citizens.
- Firms have also used ISDS provisions to challenge an astonishing range of laws, from minimum-wage laws in Egypt to core aspects of patent law as they apply to medicines in Canada.

There are several alternative ways for host countries to deal with foreign investors and their claims without using ISDS. Some countries, like Brazil, have historically refused to

chapters were included. The EU, however, has never (until the CETA – Comprehensive Economic and Trade Agreement – with Canada, signed in October 2016) included an investment chapter in a free trade agreement before. This is because the EU obtained jurisdiction on international investment issues with the Lisbon Treaty (2009); before 2009, international investment agreements (including ISDS provisions) were negotiated individually by member states.

* Arbitrations are usually conducted under the auspices of the International Center for the Settlement of Investment Disputes (ICSID) housed in the World Bank, which can provide the secretariat.

sign any treaty with an ISDS mechanism, thus forcing foreign investors to sue in local courts. Other countries, like South Africa, India, and Indonesia, are considering following Brazil's lead.

Some advocate for keeping ISDS with improvements – e.g., using far more precise definitions of expropriation, requiring firms to exhaust domestic legal remedies before an arbitration can begin (although this would make the process very lengthy), and making arbitration more transparent, with greater reliance on precedent.

The EU has acquired competences in international investment with the Lisbon Treaty (2009) and is rejecting the inclusion of arbitration mechanisms in its FTAs with investment chapters, suggesting instead a new system based on the WTO dispute settlement mechanism (which decides on trade issues, but not on investment issues): a permanent international public investment court would deal with international investment disputes through a transparent process based on jurisprudence and with the possibility to appeal rulings.* The CETA (Comprehensive Economic and Trade Agreement) between the EU and Canada is the first agreement in which this arbitration system for the resolution of investment disputes is included.

4.3.5 The Japan–EU Economic Partnership Agreement

In July 2017, the EU and Japan announced they had reached consensus on the Japan–EU Economic Partnership Agreement (JEEPA), which was finalized in December 2017. It is the largest and most comprehensive free trade agreement ever negotiated by the EU. The agreement – which creates a trading block roughly the size of NAFTA (Swanson 2017) and constitutes 40 percent of global trade and approximately 30 percent of the world's GDP – reduces many tariffs on agriculture, manufacturing, and services. (See the discussion in Section 11.3.2 in Chapter 11.)[†]

The agreement creates an economic zone with 600 million people and covers financial services, e-commerce, telecommunications, and transport (EU Commission 2017), and includes commitments to the Paris Climate Accord. The EU Commission has always promoted more and expanded trade, even if environmental and worker organizations were as wary of its effects as they were in the U.S. The agreement is seen as a reaction to the U.S. having ceded leadership of trade activities in Asia to China. The putative partnership hopes to be able to resolve differences in standards and procedures, but Japan is reluctant to embrace the EU's ISDS dispute settlement alternative (The Economist 2017a).

4.4 Trade and economic development

Trade consists of the flow of goods and services between nations. These flows are heavily mediated by the **international division of labor** (that is, the location of production versus consumption) and by the **institutional organization of that labor** (for example, MNEs, which conduct significant inter-firm transfers of goods and services). But the international trading system is also founded on **theoretical beliefs** about the gains from trade, and the international agreements that codify and regulate the conduct of trade reflect evolving beliefs or ideologies. As the reader may already be familiar with trade theory from previous courses in micro- or macroeconomics, this section provides only a short summary of the topic, focusing in particular on the relationship of trade theory to development/economic prosperity and to the practice of trade as embodied in trade agreements. We

* See The European Commission, The Multilateral Investment Court project, <http://trade.ec.europa.eu/doclib/press/index.cfm?id=1608> (accessed May 31, 2018).

† See also the European Commission, *EU and Japan Finalise Economic Partnership Agreement*, <http://trade.ec.europa.eu/doclib/press/index.cfm?id=1767> (accessed February 13, 2018).

provide an evaluation of the implications of trade for work and the environment in Chapter 5.

4.4.1 *Free trade: winners and losers*

Since the time of Adam Smith, most economists have considered free trade to be a beneficial activity toward which most, if not all, societies should strive. The most fundamental argument for free trade lies in the existence of efficiency losses associated with the enforcement of protectionist policies, such as tariffs, quotas, and subsidies, which do not take advantage of lower factor costs elsewhere and which could be avoided through the imposition of a free-trade policy regime.

It is becoming increasingly apparent that developed nations (the United States in particular) believe that trade is critical to achieving not only economic growth but sustainable development as well. It is seen as the mechanism through which poverty will be reduced, human well-being will increase, and environmental problems will be addressed. However, focusing on trade as a driver of sustainable development has its defenders and its critics.

On the one hand, economists have identified a series of gains associated with free trade which could help advance the different pillars of sustainable development. These include:

- An increase in economies of scale in production (Krugman and Obstfeld 2003);
- A reduction in prices and an increase in the amount of goods and services available (Driesen 2001);
- An increase in innovation and learning (i.e., **spillover effects**); and
- Job creation.

And specifically in less developed countries:

- The spread of advanced technology; health, safety, and environmental standards; and environmental management techniques (OECD 1997);
- An increase in the tax base – and thus in the amount of financing available for environmental and social programs that governments can implement in response to increasing demands for a healthier environment (Bhagwati 1993; Speth 2003);* and
- An increase in a governments' ability to manage their economic affairs – which they are likely to leverage to address (social and) environmental concerns (Speth 2003).

However, while free trade is a preferred policy measure in theory, it does not uniformly advance all social interests. **It is important to ask who wins from free trade and who loses** Three main theories provide insights into this topic:

- **David Ricardo's theory of comparative advantage** (early nineteenth century), which states that countries can better their financial position by specializing in what they do *comparatively* best (and therefore even if a country is worse at everything, it can still benefit from trade by specializing in what it is less bad at).
- **The Heckscher–Olin theory** (1920s), which focuses on countries' differing "factor endowments" (see Section 3.1.2 in Chapter 3) and postulates that each country specialize *in commodities* that are intensive in the factor of production that is more

* This type of argument is often put forward by those who believe in inverted-U-shaped or environmental Kuznets curve relationships – i.e., environmental quality falls during the initial stages of economic growth and industrial expansion but later improves with increasing GDP. See the discussion in Sections 1.3.2 and 5.1.1.1 in Chapters 1 and 5, respectively.

abundant in that given country (i.e., capital-rich countries specialize in goods whose production requires an abundance of capital, labor-rich countries in labor-intensive goods, and land-rich countries in land-intensive, agricultural goods) (Heckscher et al. 1991). The underlying rationale is that instead of making goods that would primarily require the factors they possess the least, countries could trade for them and acquire more goods overall.*

Interestingly, **the Hecksher–Ohlin theory recognizes that trade will not benefit everyone uniformly**. For instance, it anticipates that capital in labor-rich countries will lose from imports of capital-intensive goods. This helps explain why capitalists in low-wage countries, such as Brazil, opposed trade with capital-rich countries for capital-intensive goods, because this threatened their scarce factor of production. On the other hand, capitalists in capital-intensive Britain were among the primary proponents of free trade. Symmetrically, labor in capital-rich countries will lose from imports of labor-intensive goods, which explains why labor unions in rich countries are usually anti-trade and also why the United States and Europe have been reluctant to reduce subsidies of agricultural production.

- **The Stopler–Samuelson scheme** (1940s), a central theory of the politics of trade, concludes, in line with the Hecksher–Olin theory, that trade makes the national owners of an abundant factor of production better off and the owners of a scarce factor of production worse off.

According to comparative advantage and factor endowment trade theories, the most efficient (worldwide) allocation of resources will be achieved if all countries specialize in their relative strengths and trade their surplus for commodities (or goods) that are more easily produced by others. This view of trade ultimately leads to the integration of regional and national markets, increasing the importance of transnational corporations (TNCs) and the need to transport resources and commodities between nations (Korten 2001).

Nevertheless, while international differences in factor costs and endowments have been important in the determination of the international division of labor and the patterns of international trade, **Ricardo’s comparative advantage does not have sufficient explanatory power** (Coffey 1996).† **In fact, most world trade seems to be taking place between countries with similar factor endowments and costs.** Therefore, **according to Porter (1990), the notion of competitive advantage‡ constitutes a much more elaborate scheme for understanding international trade.**

* The early theories of comparative advantage were based on a set of *static* (endowment/core) factors, namely, labor, natural resources, land, and population size. However, comparative advantage is now understood to be more of a dynamic process (Dicken 1994). Possibly the best-known description of the factors that determine a nation’s competitiveness is M. E. Porter’s (1990) “diamond of competitive advantage,” discussed later in this section.

† Prasch (1996), Rodrik (2007), and Acemoglu and Robinson (2012) also provide interesting critics of the theory of comparative advantage and free trade. Prasch effectively points out some of the theory’s gaps and unrealistic assumptions (e.g., the absence of externalities, the free and costless capital mobility of capital and labor skills within a given country, the restriction of capital movement to national borders, etc.).

‡ Four attributes or interacting factors constitute Porter’s diamond of competitive advantage (Porter 1990): *factor conditions* (such as resources, labor, and infrastructure – these are created rather than endowed), *demand conditions* (characteristics of consumers in domestic markets), *related and supporting industries* (suppliers, collaborators, competitors), and *firm strategy, structure, and rivalry* (market conditions, competitive structure, and company organization, that is, the factors that influence an industry’s/firm’s attitude toward competition and innovation). **A clear omission from Porter’s (1990) theory, however, is the failure to include government as a factor** (Dicken 1994). Instead, government is described as having a proactive “influence” on the four core endowment factors.

While the above analyses presented the limitations of comparative advantage theory, important works by Daly (1993) and Greider (1997), still highly relevant today,* have criticized the very notion of “free trade.”

Succinctly, Daly (1993) reminds us that the real debate is not over being for or against “free trade” (because there is no such thing as purely free trade), but over what sets of regulations and restrictions should be put in place and what goals are legitimate. According to Daly, a more accurate name than “free trade” is “deregulated international trade.” Greider (1997, p. 137) agrees with this point of view as only a small share (about 15 percent) of global trade is “genuinely conducted in free-market circumstances.” The rest is managed, openly or covertly, by governments through various non-tariff [trade] barriers and multinational corporations through intrafirm trade among their own subsidiaries (Greider 1997, pp. 137–138). While that specific number may have changed since 1997, the high-level observation remains valid: genuinely free trade is rare. Instead, the debates on TTIP and TPP (see Section 4.3.3) reveal that free trade comes with “many, many strings attached” (Nesbit 2015).

In other words, it appears **government has an important role to play in “(free) trade” – via the establishment of infrastructure, tax and subsidy policy, education policy, norms and standards, regulations, and other measures.**

Daly (1993, 1999) makes an additional observation, often disregarded by some economic theorists. According to Ricardo’s specification, following trade liberalization, countries can specialize on the basis of comparative advantage, with the possibility of investing all of a country’s capital in a single product. However, the hidden assumption of the theory of comparative advantage, according to Daly (1993, 1999) and Prasch (1996), is that capital earned from trade cannot cross borders, as was the case in the pre-1970 Bretton Woods world, and will be invested in the country in which the product is produced. The problem here is that **if capital is mobile, then absolute advantage rather than comparative advantage can be established. That is, one country can conceptually end up attracting all foreign capital and producing everything** if it cumulates lower costs, better infrastructures, larger or better markets, financial competencies, and other advantages.

There are other significant arguments against free trade, regarding the frictions or defects that exist in the capital and labor markets. These prevent resources from being transferred as rapidly as they should be to sectors that yield high(er) returns, thereby creating win–lose (rather than win–win) trading situations. There is also an argument to be made about the protection of nascent domestic industries that can be particularly innovative and produce technological spillover effects. For instance, Agosin (2008) makes a clear case that overall, foreign direct investment benefited South-East Asia much more than Latin America, because of the more directive industrial policies that accompanied it (e.g., selecting which industries/firms to protect and nurture vs. to expose to competition). These examples of beneficial government interventions reveal the limits of theories of free trade, maximum liberalization, and *laissez-faire*.

In general, the proponents of free trade claim that it lowers import prices, a case that becomes all the more clear when one thinks of cheap Wal-Mart products. However, this is not what theory claims to be the case. **In fact, comparative advantage theory states that free trade affects relative rather than absolute prices.** Absolute prices are actually determined by monetary and macroeconomic policies, including currency manipulation. The effect of a country’s liberalization of its trade regime is that the relative price of imports decreases relative to exports, or, equivalently, that the relative price of exports increases relative to imports. The determinant of whether consumers will be better or worse off will be the extent to which their consumption basket is dominated by imports,

* For example, see Greider’s (2013) criticism of Krugman’s positions on free trade.

after accounting for the net change in the amount of jobs. However, one cannot argue from first principles that this relationship will always be positive, especially in countries that seem to be running significant trade surpluses.

Nevertheless, on many occasions, trade restrictions, such as tariffs and import quotas, are undertaken not in the context of an elaborate and well-planned industrial policy but in order to protect the income of particular interest groups.*† Given the fact that trade restrictions are associated with efficiency losses, one would automatically make the case that such trade restrictions would reduce national welfare. However, there are theoretical grounds to believe that activist trade policies can in some instances, apart from protecting the income of certain segments of society, increase the welfare of a nation as a whole, as examples from South-East Asia reveal (Agosin 2008).

Faux (2016) particularly criticizes the moral argument according to which workers in developed countries should support free trade in order to create jobs in developing regions of the world and help workers in poorer countries. He argues instead that the trade agreements of the last twenty years radically redistributed the benefits of trade upward without increasing the total gains; meanwhile, the gap between U.S. and Mexican wages remains as wide as it was twenty years ago, and distribution of income and wealth is worse. Therefore, according to Faux (2016, p. 10), “the assertion that that American workers should sacrifice their jobs and their children’s future so that Third World plutocrats can bid up real estate prices in Manhattan, Los Angeles, and Miami makes a mockery of moral compassion.”

In contrast, the developed nations are more or less united in promoting both technological innovation and trade as the vehicles for increasing prosperity for all. The July 2017 annual meeting of the G20 (made up of nineteen developed countries with the EU, France, Germany, Italy, and the UK maintaining separate membership, representing 80 percent of the world’s gross domestic product, and comprising almost two-thirds of the world’s population) produced a fanfare of trickle-down optimism with articulated concern for those who are less fortunate. The meeting in Hamburg produced the G20 Hamburg Action Plan for achieving “strong, sustainable, balanced and inclusive growth” (G20 Germany 2017, 2017a). The theme for the 2017 summit was “shaping an interconnected world,” and the meeting adopted a declaration (G20 Germany 2017, 2017b) focusing on (1) sharing the benefits of globalization, (2) building resilience, (3) improving sustainable livelihoods, and (4) assuming responsibility (European Council 2017). The summit regarded the Paris Climate Agreement to be irreversible, although it weakened its initial draft G20 Climate Plan to appease President Trump (Neslen 2017), only to be sabotaged by his announced withdrawal from the agreement.

4.4.2 *Effects of trade on the structure of markets*

Aside from economic effects accruing to an individual nation from trade – which provides new markets for exports and new opportunities to acquire cheaper and/or better imports used to promote export-bound production or domestic consumption – **the structure of markets may change appreciably** for the better or for the worse. Ricardo’s theory of comparative advantage argues that trade promotes win–win scenarios among the trading partners, while others have argued that there are also win–lose scenarios (Kaplinsky 2005; Kaplinsky and Messner 2007; Kaplinsky and Morris 2007).

* Olson’s (1982) “logic of collective action” has long been invoked by economists in order to explain seemingly irrational trade policies as a result of small concentrated groups capturing the political process.

† See our discussion on the TPP and TTIP (in Section 4.3.3) and the polemic surrounding their corporate-biased Investor-State Dispute Settlement (ISDS) mechanisms.

In the context of win-win opportunities in international trade, **Ricardo's theory of the benefits of specialization and exchange between countries (the theory of comparative advantage) depends on three crucial assumptions** (Kaplinsky 2005, p. 209):

- 1 **The existence of full employment in both exporting and importing economies;**
- 2 **The mobility of capital and skilled entrepreneurship,* and**
- 3 **Implicitly, that income transfers must be easily made to facilitate producers moving from one economic activity to another.**

These assumptions may not hold in the real world. Perhaps the most succinct observations are offered by Raphael Kaplinsky and colleagues (Kaplinsky 2005; Kaplinsky and Messner 2007; Kaplinsky and Morris 2007). Found in the writings of Malthus and Marx, an alternative perspective to the clearing of labor markets is that there is a systematic tendency toward structural unemployment† consisting of a “reserve army of labour” that can depress the wage rate (Kaplinsky 2005, p. 210). Thus, Kaplinsky (2005, p. 230) argues that “there is a structural excess in the global economy, not just in productive capacity, but also in the labour market.”

Tectonic changes in both developed and developing nations have occurred in the past three decades that threaten global economic and financial stability. These involve not the theoretical benefits of competition brought on by international trade, but rather monopoly/oligopoly in manufacturing and services (predominantly in China and India, respectively), which, combined with monopsony in retailing (for example, Wal-Mart and Tesco), have squeezed out competition through concentration of both producers and (mostly) corporate buyers and price reductions. **The result is that there are a few national winners and many national losers, resonating with our discussion, in Chapter 3, on the “winner-take-all economy”** (Brynjolfsson and McAfee 2014), **and the concentration of a few firms in major manufacturing and service sectors of the economy** (Autor 2017). On the supply side, the tendency toward a concentration of large producers is enhanced by the fact that the costs of advancing technological progress may require large markets to sustain profitability and an attractive return on investment (Kaplinsky 2005, p. 11). The easing of financial flows following the globalization of finance has largely facilitated the creation of most of the profitable large centers of production, moving world production from undercapacity to overcapacity in what Kaplinsky terms “the ‘outward-inward’ breath of the global economy” (Kaplinsky 2005, p. 23). The ideology that fanned an uncritical endorsement of free trade also concentrated developed-nation currency holdings in the hands of those few nations to the extent that geopolitical stability may be threatened.

* It has been argued that a critical (but little-noticed) assumption of Ricardo's theory of comparative advantage is that capital is *immobile* between nations (Daly 1999). If capital can move freely between nations, the idea of comparative capital advantage becomes less important because capital can move in search of absolute advantage. See the discussions in Section 4.4.1 and in Section 5.2.4 in Chapter 5.

† See Section 5.2.5 in Chapter 5 for a detailed discussion on the potential effects of trade on employment – in terms of number of jobs, sectoral location, earning capacity, skill-level, and adaptability to changing circumstances – in developed vs. developing countries. For instance, in terms of sectoral location, it is interesting to note that on one hand, “there is evidence that the structural change away from manufacturing towards services in advanced economies goes hand in hand with the process of globalization” (Görg 2011, in Bacchetta et al. 2011, p. 5), while, on the other hand, in Latin American and Sub-Saharan African countries, “labour has moved in the wrong direction, from more to less productive activities, including, most notably the informal economy” (McMillan and Rodrik 2011, in Bacchetta et al. 2011, p. 5). Overall, the ILO & WTO (2011) report on *Making Globalization Socially Sustainable* is an informative read on these topics.

Kaplinsky (2005, p. 196) argues that the worst price squeezing (that is, the price falls) occurs in products embodying low technological content and in low-income economies and that “a significant degree of poverty and inequality are relational outcomes of globalization [arising from] excess global capacity and constrained global consumption, [leading] to **a race to the bottom in real incomes**” (ibid., p. 197, emphasis added). The key relationships of falling prices involve (1) the extent to which prices of the *nation’s* exports fall relative to the prices of the products it imports, (2) the extent of price falls received by *producers* relative to the prices of the inputs into their production processes, and (3) the extent of price falls received by *producers* relative to the cost reductions enabled by productivity improvements (Kaplinsky 2005, p. 199). Productivity improvements derived from replacing labor with capital adversely affect workers, depressing wages, unless they are accompanied by sufficiently larger revenues from greater sales derived from lower prices, whatever the source. **Whether serious structural unemployment in manufacturing is caused by technological displacement or by the import of labor-intensive goods, it is now acknowledged in both developed and developing countries, including China and Brazil** (Kaplinsky 2005, p. 199).^{*} Structural unemployment is also evident in services, especially those that can be outsourced, such as ICT and banking. To the extent that a country builds up a large trade deficit, fueling a buying spree supported by credit-driven purchases, structural unemployment may be delayed and may not be instantaneously visible. According to Varoufakis (2013, p. 101), this was largely the case in the U.S. since the 1970s, when the country decided to strengthen its economic and geopolitical hegemony by willfully enlarging both its trade and budget deficits and establishing its power as the consumer (of last resort). The 2008 financial crisis and its jobless recovery can be seen as a rude awakening in this regard.

China not only has greatly increased its share of manufacturing markets but also has become a very large market for the exports of other – especially Asian developing – countries (Kaplinsky 2005, p. 206), thereby surpassing the U.S. and becoming the world’s largest economy in 2014 according to official statistics (BBC 2014). Paradoxically, the massive expansion of industrial capacity in China is destroying jobs (Kaplinsky 2005, p. 208). It has also squeezed out many developing-country producers, especially in Latin America, the Caribbean, and Sub-Saharan Africa (Kaplinsky 2005, p. 167). Global capital has also shifted to Asia and, in particular, to China (Kaplinsky 2005, p. 209). However, some critics, like Varoufakis (2013, p. 162), are skeptical that China will be the leader of the Second Machine Age – pointing to its increasing poverty rate, falling private expenditure rate, and declining consumption rate (as a proportion of GDP). Instead, India is seen as the potential future leader (BBC 2014). Whichever country ends up becoming the global superpower, the economic processes involved in these power shifts are “likely to radically transform regional and global economic, political, and social interactions and to have a major impact on the environment” (Kaplinsky and Messner 2007, p. 197).[†]

Kaplinsky (2005, p. 240) concludes that

market forces alone, as the Washington Consensus proposes, will neither solve the problem of absolute poverty nor result in a more equal world. On the contrary, they

^{*} See our discussion on the evolution of skills, employment, and inequality in Section 3.3.1 in Chapter 3.

[†] Lee (2008) reinforces the views of Kaplinsky (2005) by arguing that the successful integration of China and India into the global economy leaves little space for other developing nations to enter and succeed. While several developing nations could successfully pursue an export-led development strategy, if many developing nations followed suit, the same success is unlikely to be realized. Foreign direct investment (FDI) flows are unlikely to be diverted from the two Asian giants now playing such a large role in the global economy. The problem is compounded by the fact that there are potential limits to the growth of consumer demand in developed countries (Lee 2008).

are likely to exacerbate both. [. . .] Thus to achieve a different outcome requires policies to promote and sustain innovation.

For further policy discussions related to technological, organizational, institutional, and social innovation, see Chapters 8 and 13 of this work.

In summary, there are two perspectives on globalization, poverty, and inequality: (1) global poverty is the result of the failure of producers and nations to engage in globalized commerce, and (2) the global economy deepens global poverty for many producers who are unable to compete effectively in a world of growing surplus capacity (Kaplinsky 2005, p. 208). Add to the latter the artificial expansion of demand by credit promotion and debt that encourages borrowing from the future that is not likely to be better than the present, and we have a recipe for a global economic disaster.

Finally, to return to the geopolitical arena, whenever a country holds a very large reserve of another country's currency, mischievous political actions may ensue, leading to interference in the other country's internal affairs, straining international relations and agreements, or even to economic subjugation and war. Globalized trade needs to be evaluated along many dimensions.

4.5 The role of multinational enterprises in the international economy

A discussion of globalized commerce would be incomplete without a discussion of the role of multinational enterprises (MNEs), also referred to as multinational corporations (MNCs). The most straightforward and least technical definition is perhaps that of Gilpin (2001, p. 278), who defines the MNE as "simply, a firm of a particular nationality with partially or wholly owned subsidiaries within at least one other national economy."

4.5.1 MNEs and neoclassical economics

Gilpin (2001) offers an extensive overview of the different schools of thought with respect to the role of MNEs in the international economy. One key point he makes is that despite the central role of MNEs in the international economy, mainstream economists have chosen to focus elsewhere. Gilpin (2001) provides the reasons behind this observation. In his view, economists:

- have a strong belief in the primacy of markets and not in the importance of institutions;
- believe that a firm's behavior is determined primarily by market variables, thus making its location selection of secondary importance;
- assert (through the Mundell equivalency)* that trade and investment constitute perfect substitutes for one another, with trade preceding investment;
- expect that production will be located where it is most efficient, in line with the theory of location and Ricardo's theory of comparative advantage; and
- have chosen not to focus on MNEs because of methodological obstacles in the analysis of oligopolistic firms in imperfect markets.

* The Mundell equivalency argues that trade in factors of production, such as labor and capital, has essentially the same effect as trade in goods. Hence exporting labor-intensive goods and importing capital-intensive goods is exactly the same as the labor-abundant country exporting labor directly for capital (Gilpin 2001).

The last point is a crucial one. **MNEs arise in the context of market distortions.** International manufacturers such as IBM, for instance, elect to invest in many countries for reasons other than economics, such as **good public relations**. An interesting point that Gilpin (2001, p. 280) raises is that

some market [distortions] are created by national governments through such policies as trade protection and industrial policy; in fact, a government sometimes creates market imperfections to encourage foreign [MNEs] to invest in their economies. A notable example is the erection of trade barriers and the provisions of tax breaks to encourage FDI [foreign direct investment]. Without such [distortions], a firm might find it more efficient to export its products from its home economy,[*] or to license its technology to a foreign firm.

Alternative motivations or rationales for FDI have been put forward by other neoclassical theories of the MNE, including:

- Vernon's product cycle theory, which stipulates that "foreign direct investment is principally a device used by firms **to preempt foreign competition and to maintain their monopoly rents**" (Gilpin 2001, p. 282, emphasis added). It is interesting to note that this theory was largely a product of the 1960s, which saw the primacy and overseas expansion of the American corporation. As such, it did not account for a series of other variables like the erection of trade barriers, market proximity, falling transportation costs, and currency risks (Gilpin 2001).
- The Reading's school eclectic theory, which emphasizes **the role of technology** as a factor in MNE development (Gilpin 2001). According to this theory, MNEs "usually possess some proprietary or firm-specific advantage that they want to exploit rather than lose to a rival firm; such an internal advantage may be a trademark or possession of a particular technology. Although some of the most important [MNEs] are not high-tech, it is not coincidental that many [MNEs] predominate in industries characterized by extensive and expensive research and development activities" (ibid., p. 284).
- And Porter's theory, in which **the firm's own strategy** actually determines its structure and its location of economic activities, in coherence with the fact that "the transnational firm has available to it more extensive options and techniques than do even the largest domestic firms" (Gilpin 2001, p. 285).

Given all these possible motivations, it is not surprising then that MNEs and their associated foreign direct investments (FDIs) constitute a major driver of globalization, and more specifically international trade, investment, and development.

4.5.2 The centrality of foreign direct investment for development

MNEs expand outside the reality of the nation-state mainly through foreign direct investment (FDI). In general, FDI occurs when the residents of one country acquire control over, or create, a business enterprise in another country. This acquisition may involve buying enough stock in an existing enterprise to become a controlling shareholder (10 percent

* Note, however, that this holds true only up to some level of transportation costs, because proximity to suppliers can be an important consideration.

of ownership), taking over the enterprise outright, or building a new factory or enterprise from scratch, including the purchase of real estate (Caves et al. 2006).

FDIs can be categorized in different ways:

- **By distinguishing greenfield FDI from mergers and acquisitions (M&A) FDI**, based on the nature of the transaction. Greenfield FDI refers to direct investment in new facilities or in the expansion of existing facilities, whereas M&A FDI is investment that takes the form of acquisition of existing assets. Cross-border mergers take place when resources and management of firms from different countries are assembled in order to create a new legal entity.* Cross-border acquisitions refer to the transfer of control from a local company to an MNE, with the local company becoming an affiliate or branch of the MNE.
- **By distinguishing between four distinct types of FDI based on the motives of the investing firm (in line with Dunning 1993):**
 - *Resource-seeking (RS) investment*, in which TNCs focus on the exploitation of physical resources and labor differentials;
 - *Market-seeking (MS) investment*, which usually takes place in order to penetrate new markets or defend existing markets (Georgopoulos and Preusse 2006);
 - *Efficiency-seeking (ES) investment*, which builds on existing firm activity (RS or MS) and aims at rationalizing the firm's activities by optimizing the intrafirm division of labor (Georgopoulos and Preusse 2006) and taking advantage of economies of scale and scope and of the benefits of common ownership; and
 - *Strategic-asset-seeking (SAS) investment*, which aims to augment the existing set of assets through merger and acquisition activities.

Governments may employ clusters[†] both to become more successful in attracting FDI and to increase the economic value that FDI generates for their economies (Porter 1998). FDI flows seem to target existing or emerging cluster locations instead of avoiding them (Ketels 2004). Empirical evidence suggests that attracting foreign companies through the existence of clusters at a national and/or regional level not only generates direct benefits through job creation and wage increases but also improves the quality of the location for the companies that already participate in the cluster by improving the overall cluster business environment, which will further attract foreign companies. This strategy boosts continuous FDI attraction and helps avoid short-term arbitrage opportunities that destabilize the economy.

* This constitutes what we have defined as “transnationalization” in contrast to “multinationalization.”

† According to Porter (1998, pp. 215–216), “A cluster is a geographically proximate group of interconnected companies and associated institutions in a particular field, linked by commonalities and complementarities. The geographic scope of a cluster can range from a single city or state to a country or even a network of neighboring countries. Clusters take varying forms depending on their depth and sophistication, but most include end-product or service companies; suppliers of specialized inputs, components, machinery, and services; financial institutions; and firms in related industries. Clusters also often include firms in downstream industries (that is, channels or customers); producers of complementary products; specialized infrastructure providers; government and other institutions providing specialized training, education, information, research, and technical support (such as universities, think tanks, [and] vocational training providers); and standards setting agencies. Government agencies that significantly influence a cluster can be considered part of it. Finally, many clusters include trade associations and other collective private sector bodies that support cluster members.”

The **effects of FDI**, as studied in the literature, vary and include **positive spillovers*** in productivity and efficiency, cluster formation, innovation (via direct or indirect knowledge and technology transfer), and real GDP growth. However, it proves to be significantly difficult to measure and quantify these effects.

These spillover effects are also not omnipresent in each economy in question and mainly depend on the sector and country under consideration. In their analysis, Blomstrom and Kokko (1998, p. 247) note that “the positive effects of foreign investment are likely to increase with the level of local capability and competition.” **The internalization of spillovers from multinational firms thus largely depends on the absorptive capacity of local firms.** That is, only firms with the technological abilities to absorb spillovers are expected to profit from multinational operation in the context of their sectors (Barrios et al. 2004).

In addition, reports by the Working Group on Development and the Environment in the Americas (GDAE 2008) and the South Center (2010), respectively focusing on Latin America and least developed countries (LDCs), emphasize **the importance of domestic policies in shaping the quantity and quality of benefits and spillovers from FDI.** In the LATAM context, Agosin (2008, p. 9) draws some guiding principles for channeling investments, arguing it is better to have: (1) greenfield investments rather than purchase of existing assets; (2) investments that broaden the country’s export portfolio than investments that come to do “more of the same”;[†] and (3) investments outside export-processing zones that use domestic inputs, rather than investments inside export-processing zones that have no connection with the domestic economy other than using labor and paying for utilities. We could add to that: (4) investments in more-productive (e.g., manufacturing) rather than less-productive (e.g., minerals and natural resources, services, informality) activities (McMillan and Rodrik 2011, in Bacchetta and Jansen 2011, p. 6). As an illustration, Hiratuka (in GDAE 2008, p. 11) explains that

despite an increase in quantity, the 1990’s FDI boom [in Brazil] had three broad characteristics that mitigated against industry upgrading. First, it largely targeted services rather than the manufacturing sector [. . .] Second, FDI inflows mostly took the form of mergers and acquisitions, rather than new “greenfield” investment [. . .] Third, MNC expansion in Brazil was aimed primarily at the domestic or Latin American market [rather than export markets].

Similarly, the South Center’s report explains that at early stages of development, public guidance and regional cooperation should take precedence over markets in establishing industrialization, trade, and investment policies “to serve the objectives of industrialization and development of the home country” (South Center 2010, p. iii). In particular, and in priority, “the development of a competitive industrial structure requires development of the agricultural sector – where feasible – in order to enhance the supply of food, [as] international food prices may remain high in the future” (ibid., p. iii).

* Blomstrom and Kokko (1998) identify three main channels of spillovers: (1) movements of highly-skilled staff from multinational to domestic firms; (2) “demonstration effects” through complementary production relationships between domestic and foreign firms; and (3) competition between multinationals and domestic firms, which provides the firms with efficiency and productivity incentives.

† “When does FDI crowd in domestic investment in developing countries? In general, *the relationship between FDI and domestic investment is likely to be complementary* [‘crowding in’] *when investment is in an undeveloped sector of the economy* (owing to technological factors or the lack of knowledge of foreign markets). On the other hand, *FDI is more likely to substitute for* [or ‘crowd out’] *domestic investment when it takes place in sectors where there exist plenty of domestic firms.* The same may occur where domestic firms already have access to the technology that the MNC brings to the country” (Agosin 2008, in GDAE 2008, p. 8).

As already mentioned in Section 4.2, the application of these guiding principles supposes that emerging countries are able to maintain **significant policy space to express their domestic preferences**. This requires changing the WTO rules and the policies of International Financial Institutions (IFIs) towards LDCs – which currently promote the “Washington Consensus” rationale – and a basic reconsideration of established Economic Partnership Agreements (EPAs). Indeed, some of the major reasons why LDCs have made only limited progress in industrial development in the past four decades result from these international rules and agreements, and include:

- 1 The steep reductions in industrial tariffs that LDCs are able to impose to preserve and promote their domestic industries (South Center 2010, p. 3);
- 2 The existence of a range of non-tariff barriers on LDCs’ products, as well as very high agricultural subsidies in developed countries, which deny LDCs the ability to fulfill their export potential in products such as cotton (*ibid.*, p. 4); and
- 3 The predominance of foreign direct investment (FDI) inflows in LDCs on the raw materials sector (*ibid.*, p. 4).

As a result, LDCs remain overall characterized by a light manufacturing sector, a heavy raw materials sector, and “marginalized in international trade, with their share of world exports falling from 12 percent in 1960 to 0.6 percent in 2005” (South Center 2010, p. 4). And importantly, decreasing economic power (due to a declining position in international trade and investment flows, for instance) subsequently results in decreasing geopolitical voice, fueling a downward spiral in which LDCs progressively lose the policy space they need to shape their development trajectory.

Another interesting point is that spillover effects can be connected to the extent to which a firm is considered to be foreign. An interesting example of this can be found in the analysis of Barrios et al. (2004, p. 699), who, when estimating the effects of foreign presence in the productivity levels of the Greek market, found that “majority-held foreign firms [with more than 50 percent foreign ownership] may be more independent and hence more isolated from the host country environment, causing less technology transfer.” In contrast, minority-held foreign firms (with less than 50 percent foreign ownership) are likely to have more interaction with foreign and domestic firms, increasing spillover effects. Hence, **foreign ownership should not be considered merely a “relabeling” of firms but rather a “potential transformation of the economy”** (Barrell and Pain 1997, p. 1778, emphasis added), since these technological spillovers will affect not only productivity rates but also innovation, R&D, and many other technologically critical variables.

Despite some mitigated results in Latin America (GDAE 2008) and Sub-Saharan Africa (South Center 2010), inward FDI has proved to benefit and increase the growth rates of many developing countries (Blomstrom et al. 1994). In particular, East Asia provides convincing examples of governments guiding investments for development (GDAE 2008) (e.g., by setting minimum local content requirements to intensify linkages between MNEs and domestic firms and/or export obligations to trigger a burst of export-focused investments). While less research has been performed about the impact of FDI on the economic performance of developed countries, **on the whole, one can be quite confident that causality between FDI and growth rates flows in both directions, with countries that grow quickly attracting increasing volumes of FDI, and FDI leading to increasing real GDP growth rates**. This section focused mostly on the relationship between FDI and economic growth and development. Chapter 5 will address the social and environmental aspects of this discussion, further nuancing our understanding of the role of MNEs and FDIs in international (sustainable) development.

4.6 Evolution of financial institutions

The earlier sections of this chapter have described the phenomenon of globalization and its relationship to trade and economic development. Importantly, the globalization of financial flows, i.e., the (almost entirely) free circulation of money across borders, is the main requirement and enabler of such broad-based globalization of trade. As Arner and Buckley (2010, p. 52) put it:

if money is a good, then trade in it is beneficial. The doctrine of comparative advantage, the idea that trade between nations is mutually welfare enhancing, is almost universally accepted, and if the playing field is roughly fair, trade certainly works. And if we treat money as an end in itself, more trade in money must make countries better off. This is an intellectual trick, and it is the trick that underpins financial globalisation. The globalisation of finance offers real benefits: cheaper credit and more sophisticated hedging instruments with which to manage risk. But money is different from goods. So the globalisation of finance brings with it real risks.

The 2008 financial meltdown is one example of what can happen when these risks come into realization. Because of their stakes for all pillars of sustainable development, the institutions (and associated riskiness) that make up our global financial system deserve careful examination.

4.6.1 Bretton Woods and its aftermath

In the aftermath of World War II, a new system of financial architecture was created. The pillars of this system were initially put in place in 1944 during a conference in Bretton Woods, New Hampshire. Formal arrangements for interactions between nation-states were established in four main areas: economic coordination and cooperation (through the United Nations, UN), trade and investment liberalization (through the International Trade Organization, ITO), monetary arrangements (through the International Monetary Fund, IMF), and reconstruction and development finance (through the International Bank for Reconstruction and Development, IBRD, now part of the World Bank, WB) (Arner and Buckley 2010, pp. 4–5). These laid the foundation for a new international financial system, in which “never again” would a great depression occur.

Relevant to this discussion is the notion of the Mundell–Fleming “**unholy**” **trinity** (Obstfeld and Taylor 2002): **fixed exchange rates, capital mobility, and monetary independence**. A country can choose to have any two of these attributes, but it cannot choose all three.* **The financial architecture of Bretton Woods constructed a world of fixed exchange rates (with all currencies being pegged to the dollar), low capital mobility (due to the “gold standard,” i.e., the dollar being pegged to gold at the fixed rate of USD 35 per ounce of gold), but relatively high monetary independence.** In that era, the IMF established capital controls as a means to prevent currency crises and bank runs, which lent some level of autonomy to governments by providing more power to monetary policy (Obstfeld and

* Fabella (2008, p. 5) writes “China devalued the yuan by 40% in January 1994 and stayed with the old-fashioned regime of fixed exchange-rates and capital controls to maintain an undervalued Yuan. That effectively burned portfolio investors and cooled off the then-simmering asset-price bubble. That set of policies, known otherwise as the ‘East Asian model’ and declared dead and buried by the braintrusts of Western banks, effectively kept the Mundell–Fleming ‘Unholy Trinity’ from making a beachhead and saved China from the Asian Crisis contagion.”

Taylor 2002). The system did not include global financial regulation as finance was to be largely nationally constrained (Arner and Buckley 2010, p. 1). Nonetheless, by the late 1960s, it was difficult to contain global capital in the confines of the nation-state.

Key countries in the Bretton Woods system, such as the United States, Germany, and Japan, fearful of sluggish growth and increased inflation, respectively, proved unwilling to accept the domestic policy implications of maintaining a fixed exchange rate regime. Even in the pre-1970s world of low capital mobility, furious speculative attacks on the major currencies led to the collapse of fixed exchange rates. The “adjustable-peg” system of fixed exchange rates was, to a large extent, unstable. If a specific country faced economic difficulties and it started to look as if the country would consider a devaluation of its currency, speculators would start selling its currency in anticipation. This would force the central bank of the country to raise interest rates (which would worsen the slump), devalue the currency, or impose capital controls (Krugman 2009).

Varoufakis (2013) provides an alternative understanding of the Bretton Woods system and its disintegration. What is quite distinctive in his vision is the establishment by the U.S. (who, by imposing the dollar as the global currency of reference, became the real administrator of the Bretton Woods system) of a “global surplus recycling mechanism” (GSRM) “to prevent the build-up of systematic surpluses in some countries and of persistent deficits in others” (*ibid.*, p. 62). More specifically, via their administration of the Marshall Plan, the U.S. invested money in Western Europe and Japan in order to rebuild devastated regions in the aftermath of World War II. In return for this investment partly granted for free, the recipients committed to buying American manufactured goods to address their consumption needs and rebuild their industrial production system. In particular, the U.S. selected the two major losers of World War II, namely Germany and Japan, as the primary recipients of its surpluses and the leading countries in their respective geographic area responsible for generating surpluses and recycling it in neighboring countries in a similar pattern as the U.S. at the global level. While investing in these two nations and turning them into future leading producers (that would come to compete with the U.S.) may have been counter to the U.S.’s explicit economic interests, it satisfied the political priorities of its “Global Plan”* (*ibid.*, p. 65): countering the Soviet expansion and establishing privileged relationships with countries that would become respectively leaders in the European and Asian regions. In that respect, the Global Plan “involved not only the exercise of military and political might, but also the kind of massive redistribution of surpluses across the globe that the market mechanism is utterly incapable of effecting” (*ibid.*, p. 89). However, as the combined costs of (1) the policies favoring surplus accumulation by German and Japan manufacturers, (2) the Vietnam War, and (3) President Lyndon Johnson’s Great Society began to mount, “the government was forced to generate mountains of U.S. government debt [. . .] By early 1971, liabilities exceeded \$70 billion, while the US government possessed only \$12 billion of gold with which to back them up” (*ibid.*, p. 92). The U.S. turned from a surplus into a deficit country, and on August 15, 1971, President Nixon “announced the effective end of Bretton Woods: the dollar would no longer be convertible to gold. Thus the Global Plan unraveled” (*ibid.*, p. 94).

* “The United States, which emerged from the war as the world’s powerhouse, had no interest in restraining its own capacity to run large, systematic trade surpluses with the rest of the world. The New Dealers, however respectful they might have been of John Maynard Keynes, had another plan: a Global Plan, according to which the dollar would effectively become the world currency and the United States would export goods and capital to Europe and Japan in return for direct investment and political patronage – a hegemony based on the direct financing of foreign capitalist centers in return for an American trade surplus with them” (Varoufakis 2013, p. 66).

After the system of fixed exchange rates was abandoned in March 1973, several major countries no longer needed the capital controls that had been put in place in order to protect their monetary policy independence. That, along with the emergence of enhanced communication technologies, made the removal of capital controls imminent.*

In general, we can distinguish between **two broad types of capital controls**. One category aims to control capital inflows, while the other aims to control capital outflows. In West Germany, the controls in place by the early 1970s were designed to discourage the acquisition of assets by foreign residents. The German government prohibited the payment of interest from large bank deposits to non-residents, taxed new credits by non-residents to German banks, and prohibited non-residents from buying German bonds (Caves et al. 2006). The German government was essentially trying to limit the flow of capital from the United States to Germany, which was putting upward pressure on the Deutsch Mark as it put downward pressure on the dollar. The other reason behind the imposition of such controls was that in the fixed exchange rate world of Bretton Woods, foreign capital inflow could result in the possible loss of control of the money supply, because if a large volume of foreign reserves flowed in, the central bank of the capital-receiving country might not be able to counter the effects on the money supply, which could lead to inflation.

Since then, and especially since the 2008 financial crisis, Micossi (2009), Gallagher (2010), Ocampo (2014), Stiglitz (2010b), and The Pardee Center (2012), to name a few, have advocated for various policies to reform the International Monetary System, notably the expansion of vehicles to facilitate capital controls, even for those countries that are somewhat restrained from doing so (unless sanctioned by the IMF) by virtue of their signing on to sections of the General Agreement on Trade in Services, which liberalizes certain financial services affecting inflows of capital (see Section 11.1.2 in Chapter 11).

Bordo (2017) maintains that, although the par system ended in 1973, the dollar standard without gold is still with us as both private entities and official agencies keep holding dollars because of their superior attributes as money. After the Federal Reserve's inflationary policy in the 1970s led to a speculative attack on the dollar in 1978, a vigorous disinflationary policy followed in the 1980s and, since then, the Fed has kept a policy to maintain credibility for low inflation, fully restoring the dollar's international stature. According to Bordo, the likelihood that the dollar will be replaced as the dominant international reserve currency in the foreseeable future seems remote, with the euro still in crisis and China not yet financially developed and still lacking the rule of law necessary to backstop a true international reserve currency. Therefore, in Bordo's view, the dollar standard and the legacy of the Bretton Woods system will still continue for a long time.

4.6.2 The benefits and perils of increased capital mobility

In general, in a rapidly growing economy with a high return to domestic capital, investment can be financed more cheaply by borrowing from abroad than from domestic savings alone. This is perhaps the most significant argument for financial integration and increased capital mobility. Symmetrically, investors in wealthier countries can sometimes earn higher rates of return (for a variety of reasons) by investing in emerging markets rather than investing domestically. Arguably, this process of openness can further lead to everyone benefiting from the opportunity to diversify risks and dampen volatility.

An additional argument in favor of capital inflows is that letting foreign financial institutions into a country with an underdeveloped financial system improves the efficiency of

* See also the discussion in Section 11.1.2 in Chapter 11 on the limits of countries to use capital controls to restrict capital inflows if they have signed on to certain sections of the WTO's Agreement on Trade in Services (GATS) relating to financial services.

domestic financial markets. Internationalized financial markets foster a competitive environment, making it more difficult for overregulated and potentially inefficient domestic institutions to operate as they did previously. Finally, governments face the discipline of international capital markets in the event they make substantial policy missteps in their domestic regulatory duties.

Nevertheless, recent crises underline that financial markets do not work as perfectly as economic theorists seem to believe.* Practice does not corroborate the argument that investors have punished countries only when governments are following mistaken macroeconomic policies. In many cases, large capital inflows are succeeded by large capital outflows, with no significant reasons appearing in the interim that could justify such a shift (Caves et al. 2006). In addition, if international capital controls are removed prematurely, massive capital inflows might occur internally. For instance, liberalization in Chile resulted in a large trade deficit financed by a large increase in domestic borrowing, thus leaving the country with an excessive level of debt throughout the 1980s.

As with free trade, capital mobility has clear winners and losers. Investors are generally better off because they are offered an expanded portfolio of investment options. On the other hand, increasing options for capital reduce those of labor, making it less costly for capital to move than to comply with labor demands (Frieden 1991). Furthermore, according to Heckscher and Ohlin, increased capital mobility will benefit capital where it is abundant and hurt capital where it is scarce. It is argued that, as a rule, capital flows out of capital-rich countries, raising the return to (now-scarcer) local capital, and flows toward capital-poor countries, lowering the return to local capital there. Hence capitalists in capital-rich countries in the developed world arguably have gained from increased capital mobility, while the opposite probably holds true for capitalists in capital-poor countries.

However, despite the theoretical prediction that capital will move from more to less developed countries, empirical observation suggests the opposite. According to Raja (2008, p. 1, emphasis added):

The capital-poor developing world is lately exporting more capital to developed countries than it receives. [. . .] In its Trade and Development Report 2008 [. . .], UNCTAD said that the puzzle is all the more intriguing because many of these capital-exporting countries have been achieving higher rates of investment and growth than those that rely on the standard economic model of net capital imports. [. . .] The beginning of the millennium saw the shift of developing countries as a group from net capital importers to net capital exporters. Indeed, since the Asian financial crisis in 1997–1998, capital has increasingly been flowing “uphill” – from poor to rich countries. The magnitude of this new phenomenon has caused some observers to conclude that some developing countries have been creating a global savings glut. The emergence of developing countries as net capital exporters contrasts with expectations derived from standard growth theories. These theories postulate that with open capital markets, capital will flow from rich to poor countries in order to exploit the higher expected rates of return on capital and bridge the “savings gap” in capital-scarce countries. The theories also predict that capital inflows will spur economic growth. However, [. . .] these predictions are not supported by developments over the past few years. **Not only is capital flowing “uphill,” but net capital-exporting developing countries also tend to grow faster and invest**

* Ayres (2014), Galbraith (2014), Stiglitz (2011), and Varoufakis (2013) have been particularly vocal in pointing out the flaws in the current economics profession and its intellectual foundation. See the additional discussion in Section 4.6.4.

more than those developing countries that receive net capital inflows. Thus, higher rates of investment for diversification and structural change do not always require current-account deficits or net capital inflows, as suggested by standard economic models. Indeed, many developing countries, particularly in Latin America, failed to achieve higher productive investment under the mainstream approach **because the monetary and financial policies that attracted waves of capital inflows also led to high domestic financing costs and to currency appreciation.** [Finally. . .], these developments also call into question another hypothesis of standard economic theory, namely that there is a close and positive relationship between capital account liberalization and economic growth.

These findings are consistent with Varoufakis's (2013) analysis. According to him, following the unravelling of the Bretton Woods system (see Section 4.6.1), the U.S. decided to replace its "Global Plan" with the "Global Minotaur," a new global surplus recycling mechanism that would operate (and attain hegemony) thanks to, rather than despite, the expansion of its deficits. In other words,

instead of reducing the twin deficits that had been building up in the late 1960s (the budget deficit of the U.S. government and the trade deficit of the American economy), America's top policy makers decided to increase both deficits liberally and intentionally,

and have the rest of the world* finance them (Varoufakis 2013, p. 22). Concretely,

powered by America's twin deficits, the world's leading surplus economies (e.g. Germany, Japan and, later, China) kept churning out goods that Americans gobbled up. Almost 70 per cent of the profits made globally by these countries were then transferred back to the United States, in the form of capital flows to Wall Street.

(*ibid.*, p. 23)

This transfer back, and thus the establishment of the U.S. as the Global Minotaur, was made possible because of the Minotaur's unique "four charismas" (*ibid.*, p. 101): a reserve currency status, rising energy costs, cheapened labor, and geopolitical might. This explains, in part, how capital-poor countries ended up exporting capital to the U.S.

Consistent with this analysis, in a provocative essay, Rodrik and Subramanian (2008) argue that:

Financial globalization has not generated increased investment or higher growth in emerging markets.

(*ibid.*, p. 16)

[. . . countries] that grow more rapidly are those that rely less and not more on foreign capital; and in turn foreign capital tends to go to countries that experience not high, but low productivity growth.

(*ibid.*, p. 2)

* In this way, the U.S. could avoid cutting spending or raising taxes while finding support for expanding deficits.

While some nations may be severely constrained by inadequate access to finance, others – and perhaps a majority – are constrained primarily by **inadequate investment demand**, due either to low social returns or to low private appropriability.

(*ibid.*, pp. 2, emphasis added)

In this case, the effect of financial liberalization is to boost consumption, not investment (or at least not local investment). If the goal of aid is to boost consumption of essential goods, like food, drugs, and shelter, that is all well and good, but financial flows are not thereby likely to boost self-reliance or transform the domestic economic system.

Furthermore, Rodrik and Subramanian (2008, p. 16, emphasis added) observe:

there is a crucial difference between domestic and foreign finance: improvements in the former depreciate the real exchange rate [making export-oriented activities more profitable], **while improvements in the latter appreciate it** [placing domestic producers of tradable goods at more of a disadvantage relative to imports of tradable goods, thus dampening domestic growth].

Although FDI generally involves the transfer of skills and technology, it “may or may not be accompanied by a capital inflow” (*ibid.*, p. 16). In fact, depending on the extent of constraints on expatriation of capital by MNCs, capital outflows may well occur, giving rise to the criticism that foreign investment causes money to flow from the South to the North rather than fulfilling the promise of the reverse.

In a hard-hitting essay on global financial capitalism consistent with the views of Varoufakis, Galbraith, and Stiglitz, Robinson (2017) warns of the impending polarization of the haves and the have-nots in all countries as a result of the emergence of the transnational capitalist class, made up of the owners and managers of transnational corporations, aided by transnational state apparatuses. He cites Greece as the preeminent example of the destruction that austerity measures bring when targeted towards vulnerable nations.

Over two decades ago, Frieden (1991) identified a different conceptual model for analyzing the winners and losers of financial integration. His model follows a sectoral approach to political economy rather than a class-based approach like that of Heckscher and Ohlin. The model predicts that in the developed world, winners (and thus supporters) of financial openness include the owners and managers of financial assets and multinational firms with internationally diversified investments. On the other hand, participants in “specific” industries, especially those tied to a particular national market, are among the losers from increased capital mobility. **In broad terms, the model indeed predicts the patterns of political activity on the issues in question.** In the United States, for instance, the country’s financial centers and its internationally oriented nonfinancial corporations were among the major proponents of financial deregulation. On the contrary, domestic manufacturing and farm interests have either been ambivalent or even hostile (Frieden 1991).

It is not only the outflow of capital from developing economies, lowering available capital there for investment, that causes concern. High volatility of capital flows makes it difficult, if not impossible, to engage in longer-term industrial planning and investment (Gallagher 2010). While it created “a semblance of stability and steady growth,” the system that prevailed under the “Global Minotaur” (1971–2008) was characterized by “rapidly accelerating asymmetrical financial and trade flows,” which increased global imbalance (Varoufakis 2013, p. 22). Since the system crashed in 2008 (see Box 4.1 for a brief description of the 2008 financial meltdown), short-termism, due to high uncertainty and volatility, has become even more of an issue, encouraging economists like Ayres (2014), Ocampo (2014), Stiglitz (2010b), the Pardee Center (2012), and Varoufakis (2013) to put capital controls back on top of the economic and financial reform agenda. Indeed, capital

controls have been found to stabilize short-term volatility and give government a chance to use other policies to improve the investment picture and discourage capital outflows (Ostry et al. 2010).

Box 4.1 The 2008 financial meltdown

Since a lot has been written about the 2008 global financial crisis, it is assumed that the reader has some basic knowledge of the topic. Nevertheless, the 2010 CEPS Report by Brender and Pisani (Chapter VII) and Varoufakis's *The Global Minotaur* (2013) may be referred to for easily accessible and comprehensive explanations of the architecture of modern globalized finance and the phenomena that unraveled in 2008.

Briefly put, by 2008, the imbalances of the global trading and financial systems (as described in Section 4.6.2) had become unmanageable. Tipping points were reached and the system collapsed. Consider the following description of a generic boom–bust cycle by the Pardee Center (2012, p. 2):

there is a consistent concern that during periods of growth, expectations can become extremely optimistic, leading to a reduction in risk aversion, a rapid expansion in credit and a rise in asset prices. Imbalances associated with excessive risk taking build up, and if there are changes in expectations, possibly unleashed by facts that lead to a loss in asset values, the unwinding of positions may lead to instability, panics, and crises. Boom is then followed by bust.

This is exactly what happened in 2008. The U.S. housing market – and the associated subprime mortgage loans – had been expanding since the end of the 1990s and booming since the mid-2000s thanks to a “continuous relaxation of the prudential standards” (Brender and Pisani 2010, p. 118). Nevertheless, “permitting the securitization of loans whose quality was continually deteriorating fed risk-taking chains with securities that would turn out to be all the more ‘toxic’ in that the purchasers were in many cases also takers of a liquidity risk” (ibid., p. 120).

The stability of the system depended on an extremely lenient attitude to risk that was to be radically changed in the space of a few weeks by the subprime shock [in 2007]. *The perceived risk on the securities held, like the aversion to risk on the part of all the links in the risk-taking chains, rose steeply and abruptly, forcing down the leverage of the system. By this route, the subprime shock spread rapidly to the whole Western financial system [and subsequently to the global system].* (ibid., p. 121)

Indeed, while in a “typical year before the Crash of 2008 [. . .] the Minotaur was devouring more than 70 per cent of global capital outflows” (Varoufakis 2013, p. 115), with the Crash, it became “too unwell to keep consuming enough of the surplus outputs of Europe, Japan, China and South-East Asia to prevent their economies from stalling” (ibid., p. 183). The liquidity and credit crises quickly evolved into an economic and macroeconomic crisis. In multiple regions of the world, the U.S. and the EU in particular, mechanisms were put in place to try to contain the shock and inject liquidity in the system.* “The authorities [effectively] bypassed

the damaged private financial system [to maintain the economy]. Everything went indeed as if the Fed was borrowing excess reserves from banks in order to buy the assets the risk-takers could no longer carry” (Brender and Pisani 2010, p. 134). Unfortunately, most of these relief mechanisms arrived too late or in insufficient proportions: the Western economies plunged into a deep recession. Even more important, instead of taking equity stakes and possibly nationalizing the banks they were rescuing, Western states granted them loans. Essentially, banks were “bailed out” and their books were cleaned at the expense of state deficits, which surged. Losses were socialized – taxpayers ended up footing the bill, and a new social system, which Varoufakis (2013, p. 167) calls “bankruptocracy – the rule of bankrupt banks” was established. Indeed, “by strengthening the hand of the bankrupt banks, [politicians] deprived themselves of any serious room for effective policy making” for the years to come (ibid., p. 174).

* For instance, in the U.S., in the fall of 2008, \$350 billion of the Troubled Assets Relief Program (TARP) were used to recapitalize American banks and prevent AIG, the world’s largest insurer, from going under. A few weeks later, the Fed decided to extend \$600 billion (quickly increasing to \$1,450 billion) to clean the books of banks from toxic securities and ensure the availability of mortgage credit at lower cost and risk (Brender and Pisani 2010, p. 134). The Term Securities Lending Facility (TSLF), the Asset Backed Commercial Paper Money Market Mutual Fund Liquidity Facility (AMLF), the Commercial Paper Funding Facility (CPFF), and the Geitner–Summers Plan are just other examples of similar rescue mechanisms that were put in place. Similarly, in Europe, the European Central Bank (ECB) was called to the rescue and the temporary European Financial Stability Facility (EFSF) was established to a similar end.

4.6.3 *Toward a new Bretton Woods?*

The mainstream belief in financial integration/liberalization seems to have been shaken by recent events. The 2008 financial crisis has led to an increasing number of voices demanding a more “fair” and “stable” international financial system. We have reached a point where, as Wolf (2008a) emphasizes, ambitious leaders are calling for a new Bretton Woods. However, is a new Bretton Woods attainable? Perhaps it is, but probably not under the fierce urgency of now. The original Bretton Woods agreement, despite having been achieved during a period when the outcome of World War II was far from certain, was a product of two years of extensive preparation. A decade after the 2008 crash, it still is not clear that an agreement could actually be reached on the exact nature of a novel financial architecture. The Europeans, through the statements of their national governments, are pushing for the creation of new global regulators for the international financial system, while the Americans and the Chinese are more cautious about such a development. It is particularly striking that “developed countries blocked and obstructed most of the innovative proposals [of the 2010 *Stiglitz Commission Report*]” (Arner and Buckley 2010, p. 53) and that “the proposals that would have been an immediate help to developing countries or would have significantly reshaped global economic relations going forward were not taken up” (ibid., p. 53).

In addition, it is very unclear whether a country like China would accept changing its reserve accumulation policy to fit the needs of the United States or the United Kingdom. Hence, the call for a return to the spirit of Bretton Woods (Rodrik 2012, p. 404). Brender and Pisani (2010, p. 169) notably emphasize the point that savings-exporting countries

“have to accept the need, as and when necessary, to attenuate the pressure exerted by their surpluses on the world macroeconomic equilibrium.” If they cannot take into account the limits of the rest of the world’s capacity to use their surplus savings by themselves, then capital controls need to be imposed (The Pardee Center 2012). In any case, one lesson from the 2008 financial crisis is clear: “making financial globalization work calls not only for more public action but also for more international coordinated public action” (Brender and Pisani 2010, p. 166). This is politically (and even intellectually) challenging as it means that authorities need to act against the dominant laissez-faire ideology and accept an more involved role in the functioning of financial systems (Brender and Pisani 2010, p. 163).

With a heightened focus on public intervention and international coordination, the discussion on global governance and global institutions has regained attention (see Section 4.6.4.4). While Stiglitz (2010b) and others suggest establishing new governance bodies, like a Global Economic Coordination Council, a Global Financial Regulator, and a Global Competition Regulator, others, like Frieden (2012), the SDR Working Party (2014), Vestergaard and Wade (2011), and Woods (2010), advance recommendations to improve the governance of existing institutions, in particular the G20, the IMF, and the World Bank.

Indeed, while developing countries and NGOs are happier with the responses of the UN (World Bank) institutions – which are regarded as advocating for their situation, but also still regarded as not sufficiently democratized – they are not at all satisfied with the IMF, which is regarded as having gained influence over the UN (World Bank) institutions (Gurtner 2010).

What could a Bretton Woods II agreement consist of? First, one needs to approach the subject with a certain degree of humility. As the *Economist* (2008) readily points out, “international finance cannot just be ‘fixed,’ because the system is a tug-of-war between the global capital markets and national sovereignty.” Consequently, Arner and Buckley (2010, p. 52) observe: “Given that we are living through the aftermath of the largest financial and economic crisis since the 1930s, what is remarkable about the changes enacted in response to it is that they have been so minor.” In general, the most “globalized” component of the international economy – finance – appears to be its weakest link. Some analysts have argued that **the crisis we are facing is essentially the outcome of the mismatch of international financial markets and national regulation and control measures** (Frieden 2006). **Hence, if a new comprehensive architecture were to be proposed, some version of a global financial regulator, or a global lender of last resort, would be vital.**

Today, non-coordinated national supervisors, in some cases even state-based, oversee regulated financial firms, while the large “shadow” financial system* is mostly unregulated. International differences in regulation led to what the *Economist* (2008) calls “regulatory arbitrage.” **The big lesson of the crisis is that policy makers did not understand the nature of the financial system when they were engaging in extensive deregulation.** Hence, instead of just re-regulating domestically, reforms of the financial structure and the development of new regulations at both the domestic and international level are needed, with less speculation and more real investment.

* This is a term coined by Krugman (2009, p. 158). The shadow banking system consists of non-depository banks and other financial entities (such as investment banks and hedge funds) that provide finance/credit to the business sector. In 2007, the credit provided by the traditional depository banking system (~\$12 trillion) was less than that provided by market-based institutions (~\$16 trillion) (Tobias and Shin 2009, p. 1). In 2008, the shadow banking system experienced a collapse in its lending activities, primarily due to the subprime mortgage crisis (ibid.).

4.6.4 *Steps toward a new financial architecture*

Since 2008, a wide variety of solutions have been formulated to fix part of the global financial system. As Brender and Pisani (2010, p. 158) put it: the system needs not only more solid “plumbing” (i.e., designing the “pipes” of the global financial architecture), but also better regulation of the “pressure” or “flow” of what circulates in the plumbing. While we do not get into the technical details of each and every solution that has been formulated, in the following sections we discuss five essential areas of reform that could address many of the challenges discussed previously:

- 1 Rebuilding the financial and economics intellectual foundation;
- 2 Setting the reduction of imbalances as the global imperative;
- 3 Floating a new monetary system;
- 4 Establishing new institutions and/or at least new governance mechanisms; and
- 5 Passing micro and macro-prudential regulations.

4.6.4.1 *Rebuilding the intellectual foundation*

Ayres (2014), Galbraith (2014), Lothian (2011), Stiglitz (2010a, 2011), and Varoufakis (2013), to name just a few, have been particularly vocal critics of the current economics and financial profession. Collectively, these authors have pointed out the flaws in the assumptions, and thus the conclusions, that neoclassical theory – the bases for the economic and financial models used at all major institutions – draws. In particular, Galbraith (2014) is reported to have criticized the

dogmatic commitment to a sense of “normal” economic performance and the belief by “freshwater economists” (i.e., pro-market economists, many of whom are located around the U.S. great lakes region) that “normality” is achieved by market adjustment of prices, or “saltwater economists” (i.e. pro-market Keynesian-inspired economists, many of whom are located on the ocean coasts of the U.S.) who believe “normality” is achieved with economic management, market adjustment, and proper public policy. (Despain 2014)

For Galbraith, both beliefs are illusionary. Growth can no longer be considered “normal, perpetual, and expected” (Galbraith 2014, p. 21) – nor should it have ever been considered as such.* Instead, the collapse of 2007–2008 was “a capital ‘C’ crisis” (Varoufakis 2013) and led to a definitive institutional shift. In other words, “there have been systemic changes to the structure of the economy that make the economy more vulnerable to crisis, contrary to what the standard models argue” (Stiglitz 2011, p. 591). **As such, we are required to review all our theories and models.** This is absolutely fundamental because the theories and models in question permeate the education of each and every decision-maker – in academics, politics, the corporate world, etc. – tainting their very conceptions of how the world can/should work.

* See also Stiglitz (2011), who reexamines in detail the “Standard Models” and shows their incapacity to predict crises (p. 630). According to him, the main issue with the models is that they make the wrong trade-offs: they focus “on explaining better the small and relatively unimportant fluctuations that occur ‘normally,’ ignoring the large fluctuations that have episodically afflicted countries all over the world” (p. 607).

The task ahead is challenging, both intellectually and politically. Intellectually, because the realities to be grasped are complex. For instance, Stiglitz (2011) explains that

the New Macroeconomics will need to incorporate an analysis of risk, information, and institutions set in a context of inequality, globalization, and structural transformation, with greater sensitivity to assumptions (including mathematical assumptions) that effectively assume what was to be proved.

(*ibid.*, pp. 636–637)

And politically, because change is difficult to effect: even when facts are scientifically advanced, the power of habits may be stronger. The following excerpts from Kollatz-Ahnen's article and Galbraith's book illustrate how deeply ingrained models may be.

Despite the prevailing situation in Europe, with many countries simultaneously following austerity programs, the IMF published empirical data on October 2012 that contradicted the traditional assumptions [. . .] With this publication, the IMF admitted officially that the negative effect of the austerity programs on GDP had been significantly underestimated. Even though the data of the IMF analysis were specifically about the E.U., the E.U. Commission has continued so far to follow the mainstream models.

(Kollatz-Ahnen 2013, p. 44)

In the face of such events [the 2008 financial crisis and subsequent years], one might think that economists [at the U.S. Congressional Budget Office, CBO] responsible for official forecasting would be moved to review their models. Yet there is no sign that any such review took place [. . .] The CBO (and every other modeler using this approach) [is] stuck in the gilded cage of statistical history [. . .] If the news brought word of a 10 percent unemployment rate instead of 8 percent, the model would project a more rapid rebound, so as to bring the economy back to the natural rate. In other words, whatever the current conditions, the natural rate of unemployment would reassert itself over the forecast horizon. The worse the slump, the faster the rebound.

(Galbraith 2014, pp. 172–173)

Overall, on top of the abandonment of the notion of “normality,” the main intellectual re-conception that needs to occur concerns the role of (global) finance in our economy and society: from end to means, from master to servant. The finance industry has diverged from its initial vocation that is to “make money available for productive uses” (Stiglitz 2015, p. 32). On the contrary, the pursuit of predatory rent-seeking activities and short-term investments have prevailed and resulted in weakening the positive externalities attached to the allocation of capital (*ibid.*, p. 39). In addition, the competition in the financial sector has progressively decreased since the 1970s, with the share of corporate assets managed by the top five banks growing from 17 to 52 percent (*ibid.*, p. 41). Lothian (2011, p. 410) proposes an institutional reshaping with regulation of finance as one of the central pillars to put finance back in its role as “servant” of the real economy. She recommends distinguishing between a desirable financial deepening [i.e., multiplication of the links between finance and the real economy, to channel long-term savings into long-term productive investments] and an undesirable financial hypertrophy [i.e., expansion of the financial sector without regards to the services extended to the real economy] (*ibid.*). Similarly, the 2010 *Stiglitz Commission Report* presented to the UN outlines the principles for a new architecture for financial markets, which are viewed not as an end, but as a

means (Arner and Buckley 2010). From this perspective, financial markets should support the “real economy” by “(a) mobilizing savings, (b) allocating capital, and (c) managing risk, transferring it from those less able to bear it to those more able” (ibid., p. 54).

4.6.4.2 *Setting the reduction of imbalances as the global imperative*

As mentioned earlier (see Sections 4.6.1 to 4.6.3 and Box 4.1), global imbalances under both the “Global Plan” (1944–1971) and the “Global Minotaur” (1971–2008), to use Varoufakis’s (2013) terms, were a fundamental cause of the crises that terminated these eras. **Beyond the accumulation of imbalances in capital accounts** (the increase in some countries’ surpluses coupled with the increase in others’ deficits), **the volatility of capital accounts is also problematic** as it “plays a major role in determining boom–bust financial cycles, and therefore macroeconomic risks and fluctuations” (Ocampo 2014, p. 4). The magnitude and volatility of global capital accounts imbalances played a role in sparking the 2008 financial crisis,* but also in spreading it. While imbalances initially fell with the outbreak of the crisis, they soon surged again. The adjustments made in the U.S. and in the EU – to reduce deficits and even maintain surpluses, respectively – came at the cost of emerging and developing countries (e.g., China’s surpluses fell and non-oil, non-East Asian emerging and developing countries saw a massive increase in their deficits) (ibid., p. 12). Within the EU itself, Germany’s determination to maintain its surpluses came at the cost of a massive increase in the deficits of “peripheral” countries (i.e., Spain, Portugal, Italy, Greece, and Ireland). Ocampo (2014, p. 12) describes this outcome as a great example of Keynes’s argument

that the major problem of the International Monetary System is the asymmetry between the need for deficit countries to adjust during crises and the lack of any pressure for surplus countries to do so, which generates a deflationary (recessionary) bias.

According to the aforementioned analyses – Varoufakis’s in particular – the 2008 (and still current) financial crisis is, to some extent, a by-product of increasing current-account deficits on behalf of the United States. Hence, this significant imbalance will need to be alleviated in some way in order to avert further global financial turmoil. Unfortunately, the probability that a country like the United States will significantly rebalance its current account does not seem particularly realistic. Hence, attention needs to shift to the other side of the equation. In normal times, current-account surpluses of countries that follow mercantilist policies (for example, China, which keeps its currency artificially low through foreign-currency intervention policies) or that are structurally mercantilist (for example, Germany and Japan, which have a chronic excess of output overspending) can perhaps even be useful (Wolf 2008a). However, in times of recession and insufficient aggregate demand, these policies are perilous and contractionary, as Keynes already warned.

It becomes more obvious, therefore, that surplus countries must expand domestic demand relative to potential output, or, in other words, spend more at home in order to

* In 2009, the aggregate excess of savings over investment in surplus countries was over \$1.2 trillion (IMF 2010b). The countries with the highest savings were China (\$297 billion), Germany (\$163 billion), and Japan (\$142 billion) (ibid.), consistent with Varoufakis’s “Global Minotaur” thesis. These three countries have one-half of the world’s savings. At the same time, the big current-account deficit countries were the United States (–\$378 billion), Spain (–\$81 billion), Italy (–\$67 billion), France (–\$51 billion), Australia (–\$43 billion), Canada (–\$38 billion), Greece (–\$37 billion), and India (–\$35 billion) (ibid.). These seven countries represent around three-quarters of the world’s deficits (ibid.).

stabilize the global economy.* Global imbalances are hurting the international financial system, and it is in the interest of the surplus countries to be accommodating in their policy approach. After all, if the surplus countries do not act, they should not be surprised if the deficit countries resort to protectionist measures in order to alleviate their troubles. The expansion program announced by the Chinese government in early November 2008 was exactly in that spirit (Wolf 2008c).

The point here is not that all capital flows are bad. Not at all. The freedom of capital movements allows savings to flow from one place to another where they can be usefully invested, potentially for purposes consistent with a sustainable development agenda. However, freedom of capital movements in itself is not sufficient to ensure that this takes place. **The global financial system needs both better “pipes” (architecture) but also a better regulation of the “pressure” (flows) of what circulates in the plumbing** (Brender and Pisani 2010, p. 158) **to ensure the stability and viability of the system.**

This is the idea behind capital account regulations (or capital controls), or behind Varoufakis’s (2013, p. 62) call for the establishment of a new “Global Surplus Recycling Mechanism (GSRM)” – a set of institutions and policies to direct investments toward “productive and profitable” activities in key (deficit) regions in order to restore growth of the world economy as a whole (ibid., p. 61).

There are several dimensions to consider when talking about capital account regulations. First, one needs to distinguish between **private and public money flows**. After a crash, the world seems to run out of creditworthy private borrowers. In this case, governments have a role to play in the short run, replacing private-sector borrowers through increased fiscal deficits. This prevents the economy from coming to a complete stop. However, this does not constitute a sustainable policy prescription. As Wolf (2008b, p. 3) notes, “if [current-account] surplus countries do not expand domestic demand relative to potential output, the open world economy may even break down.”

It is important to keep in mind that financial flows should first be carefully analyzed and distinguished before being regulated. Second, it is important to consider what measures and policies could/should be formulated at the **domestic and international levels**. While financial flows are global, financial policy-making, implementation, and monitoring is still more effectively performed at the domestic level (due to the lack of a legitimate Global Financial Regulator). However, the system cannot continue to consist of a diverse set of loosely connected national systems (Brender and Pisani 2010, p. 157). If monetary policy is essentially non-coordinated, then investors and speculators can move their capital to the countries with the highest interest rates for a given level of risk. **Hence, a certain level of coordination, especially during times of crisis, needs to characterize both fiscal and monetary policies to avoid arbitrage opportunities for investors and retaliation among countries.**[†] It is also crucial to note that many trade agreements currently in place, like the WTO rules, forbid countries from restraining capital flows. International cooperation will be necessary to overcome these barriers and rewrite the trading rules. **Finally, timing is important as well.** Capital account regulations are not just reactive measures to be implemented once a bubble has burst. They should be proactively used at all times. That is, they should not only aim to regulate outflows during the bust phase of the cycle (in order to

* In line with Varoufakis’s concern about recycling surpluses and large trade deficits, the *Economist* (2017b) drew attention to the problems of Germany’s increasing surplus, exports, and wage dispersion, rather than increasing wages and domestic spending, as a source of global financial destabilization.

† Interestingly, Brender and Pisani (2010, p. 170) notes that there is a need for international cooperation between oil-producers and oil-consumers in order to avoid the excessively rapid rises in the price of oil, as this impacts the different countries’ levels of savings and hence the capital flows that they are likely to generate.

retain money within borders), but also, and perhaps more importantly, inflows during the boom phase (Ocampo 2014, p. 9). This will require that savings-exporting countries reduce the pressure their surpluses may be placing on world macroeconomic equilibrium, as and when required (Brender and Pisani 2010, p. 169).

An interesting report on this topic was prepared by the Pardee Center (2012). The report explains the importance of capital account regulations and provides interesting examples of what forms such regulations could take, and how they could be used in both developed and developing countries. Examples of measures aimed at regulating *inflows* include: unremunerated reserve requirements, taxes on new debt inflows, limits on net liability position in foreign currency of financial intermediaries, end-use limitations (borrowing abroad only allowed for investment and foreign trade), minimum stay requirements, etc. Examples of measures aimed at regulating *outflows* include: prohibition or limits on sectors in which foreigners can invest, limits or approvals on how much non-residents can invest, restrictions on amounts of principal or capital income that foreign investors can send abroad, taxes on capital outflows, etc. (Pardee Center 2012, p. 4). An important point that the report makes is that

the stigma attached to capital account regulations (CARs) should be removed, so nations have ample confidence that they will not be rebuked for taking action. The IMF could play a valuable role in taking away the stigma of CARs, as well as doing comparative analysis of which CARs are most effective.

(*ibid.*, p. 6, emphasis added)

4.6.4.3 *Floating a new monetary system: the Special Drawing Rights (SDR) proposal*

According to the SDR Working Party (2014), there exists a “built-in destabilizer” in the current International Monetary System (IMS). This is the use of national currencies, mainly the U.S. dollar,* as reserve currencies. The existence of national reserve currencies gives rise to what has been called **the Triffin Dilemma**. This refers to

the difficult choice, for the country or monetary area issuing the reserve currency, between going ever deeper into debt in order to satisfy the growing world demand for liquidity, with the danger that this will undermine its creditworthiness on the one hand, or failing to satisfy this demand by giving priority to preserving its creditworthiness on the other hand.

(SDR Working Party 2014, p. 3)

In other words, the problem is that the international use of a national currency relaxes the external constraints on the issuing country, which may then follow macroeconomic policies that negatively impact the rest of the world (*ibid.*, p. 4), for instance in the form of increasing global imbalances and financial instability. The issuing country may also ultimately suffer as the relaxation of external constraints allows it to depart from solid

* At Bretton Woods, Keynes had already advocated in favor of the establishment of an International Currency Union (ICU) both “to avert systematic trade imbalances and to endow the commonwealth of capitalist nations with the flexibility necessary to deal with future catastrophic crashes (like that of 1929)” (Varoufakis 2013, p. 66). Nevertheless, this plan was not in tune with American priorities. See the second footnote in Section 4.6.1. Through its global plan to dominate global finance, the U.S. dollar became *de facto* the global currency. For instance, today, the USD is around 87 percent of all foreign exchange transactions (SDR Working Party 2014, p. 6).

economic fundamentals (e.g., lowering its savings rate, increasing its consumption and indebtedness).

Assuming that the need for a national Central Bank is well understood at the domestic level, the same rationale can be used to call for a single global reserve currency that is issued by a single multilateral development bank (SDR Working Party 2014). This bank would then be responsible for regulating global liquidity – i.e., preventing the creation of both global excesses and shortages of reserves (*ibid.*, p. 5). While it would be tempting to propose that an existing multilateral entity (such as the IMF) perform the role of global monetary authority, in today's political reality, this seems unlikely to happen. Political forces, regulations, voting, and decision-making processes remain mostly national and are often influenced by vested interests.

Instead, it might be worth exploring what an extended Special Drawing Rights (SDR) regime could look like. The SDR is an interest-bearing financial instrument valued as a basket of four currencies (euro, dollar, yen, and pound). As such, it performs much better in terms of short-term stability and long-term value than any single national currency. And, theoretically, the more inclusive the basket, the more stable the SDR.* SDRs were introduced by the IMF in the 1970s as an international reserve asset for its members to serve both as a unit of account and as a means of payment. However, adoption was limited, and until recently, SDRs made up only 4 percent of total foreign reserves (against 62 percent for the USD, 24 percent for the EUR, and 10 percent for other currencies) (SDR Working Party 2014, p. 6). SDRs also have limited effects. "This is primarily due to the limited share – less than a third – going to developing countries, which are the most active users of this instrument" and to their use "as an unconditional overdraft facility rather than a full reserve asset" (Ocampo 2014, p. 15).

Nevertheless, the 2008 financial crisis, and the realization that national monetary policies should not be left to get out of control,[†] have renewed the interest in SDR, which Ocampo (2014, p. 7) describes as "the only element of global liquidity that, in practice, can be subject to collective decision-making."

There is now a consensus that the most important action immediately taken in response to the 2008 financial crisis was the issuance of SDRs for the equivalent of USD 250 billion, the largest issuance ever made (Ocampo 2014, p. 14). Ocampo (2014), the SDR Working Party (2014), and Stiglitz (2010b), among others, have formulated various proposals and recommendations that would help SDR play a much larger financial role than today. These include, but are not limited to,

- (i) the transformation of SDRs into a full reserve asset; (ii) a more active use of this instrument, by using it in particular to finance IMF lending; (iii) the inclusion of a "development dimension" in the allocation, by increasing the share of emerging and developing countries[. . .];[‡] (iv) using SDRs for development programs, or to help finance the provision of global public goods, particularly to combat climate

* Including more currencies in the SDR basket would also probably increase its adoption rate. The inclusion of the Chinese RMB is currently under debate (SDR Working Party 2014, p. 8).

† For example, consider the destabilizing effects of the tendency to accumulate large amounts of foreign exchange reserves (e.g., in USD) as "self-insurance" (Ocampo 2014, p. 13).

‡ See Soros's (2002) SDR proposal. The proposal is for developed countries to donate the SDRs they are allocated by the IMF, in accordance with certain rules, for the purpose of providing international development assistance. Less developed countries would benefit from such a mechanism in two important ways: directly, because the SDR donations would increase their monetary reserves, and indirectly, from the increases in international development aid (Soros 2002, p. 181). Moreover, because SDR allocations are roughly based on the economic strength of a country, the use of SDRs as development aid would also ensure that each country contributes its share, eliminating the possibility of free-riding.

change;[*] (v) the creation of a “substitution account” to manage shifts in the currency composition of reserves, to avoid their effects on foreign exchange markets [. . .]; and (vi) allowing the private use of this instrument to transform it into a global currency.

(Ocampo 2014, p. 15)

Allowing central banks to use their official SDRs directly in interventions would also be key (SDR Working Party report 2014, p. 13). While the most ambitious of these proposals would require a limited number of amendments to the IMF’s Articles of Agreement, much could be accomplished by using existing official and private SDRs without changing them (ibid., p. 15).

In conclusion, while there are some technical and political challenges to be overcome, SDRs represent a good (perhaps the best currently available) opportunity to disconnect the global reserve currency from a nation’s monetary and financial policies (Lothian 2011, p. 18). As such, they deserve further attention.

4.6.4.4 Establishing new institutions and governance mechanisms

As mentioned earlier, the post-WWII Bretton Woods system did not establish a global financial watchdog or global financial regulation, since cross-border financial flows were to be largely constrained. In 1971, when the system collapsed, there was a missed opportunity to develop a new, coherent system that had sufficiently proactive adjustment mechanisms (Ocampo 2014, p. 11). This allowed the rise of global imbalances. The 2008 crisis shed light on the failures of the “non-system” and put reform of global financial institutions, governance, and regulation at the heart of the discussion.

One proposal that was offered was to establish new global governance bodies or international watchdogs. For instance, Stiglitz (2010b) suggested establishing a Global Economic Coordination Council, a Global Financial Regulator, and a Global Competition Regulator. The rationale behind these proposals is that making financial globalization work calls for internationally coordinated public action and oversight (Arner and Buckley 2010; Brender and Pisani 2010). So there is a need for a global authority able to: (1) impose a common set of rules and norms on those operating in the system and on the products circulating in it; (2) assess the extent to which practices of offshore centers conform to the rules; and (3) monitor the solidity of the system’s infrastructures, both public and private (Stiglitz 2010b). Arner and Buckley (2010, p. 38) add to the potential responsibilities of the global financial authority the (re)negotiation of trade arrangements with special provisions for cross-border financial flows, and the affirmation of sustainable development as a global imperative. Stiglitz (2010b) also emphasizes that the global financial body should be able to act as **lender of last resort**, providing credit facilities (in local currencies) without conditions attached, in order to contain emerging crises more quickly and effectively.

* Soros proposes that the developed nations would be able to donate their SDRs only to a portfolio of pre-approved programs that would be established by an international advisory board of experts operating under the aegis of the IMF. This board, however, would not have any authority over spending the funds; the developed nations would retain the right to make their own selections from the portfolio of projects recommended. This mechanism ensures a market-like interaction between donors and programs – supply and demand. In the initial stage, this portfolio would be confined to four specific priority areas: public health, education, information and communication technology, and judicial reform. Also, it must be noted that government-sponsored projects would not be eligible because they can be left to the existing multilateral development banks and bilateral donor programs. An independent audit commission would supervise and evaluate the chosen programs (Soros 2002, p. 182).

Indeed, some of the main issues with the response to the 2008 financial crisis were that **the stimuli were too small** (compared to the magnitude of the initial contraction of private sector finance), **too late** (authorities should have realized earlier that “the time for education had passed and preventing collapse [was] the only priority” (Brender and Pisani 2010, p. 162)), **and not fairly distributed** (to a large extent, the crisis response benefited high- and middle-income countries, rather than low-income ones (Ocampo 2014, p. 6)). Stiglitz also suggests the establishment of an international panel on economic policy comprised of government representatives, leading academics, etc., similar to the IPCC on the topic of Climate Change (see Arner and Buckley 2010, p. 53).

On paper, new global governance institutions and mechanisms may seem like the solution to all evils. In practice, however, it may be very difficult – if not impossible – to achieve, given today’s geopolitical realities. In a very interesting article, Frieden (2012) describes the normative and practical challenges that stand in the way of establishing global governance. Normatively, he reminds us that “to justify international governance,[*] there has to be something that national governments will not adequately supply” (ibid., p. 3).

The existence of bad policies is in itself not a justification for greater, more centralized, international authority over economic (or other) policy; it should, first and foremost, prompt us to try to get governments to pursue better policies at the national level.

(ibid., p. 6)

Then, at the practical level, Frieden (2012, p. 12) warns us about **the risks of agenda-capture associated with global governance**. As he explains, the mere provision (implementation and enforcement) of global governance will often only be possible with the support of powerful, concentrated interests. As such, global governance structures will likely be biased in favor of their strongest supporters. In conclusion, it appears that global governance alone “cannot eliminate disagreements among countries, or within countries” and is “no panacea” for the creation of a system, more adequate and fairer, than the one we currently have (ibid., p. 11). Consequently, many authors like the SDR Working Party (2014), Vestergaard and Wade (2011), and Woods (2010) instead focus on recommendations to **improve the governance of existing institutions, in particular the G20, the IMF, and the World Bank**.

Woods (2010, p. 56) provides an interesting account of the historic (post-WWII) “capture” of the IMF and the World Bank by the U.S. and EU – the designers of the Bretton Woods system – both in terms of funding and in terms of governance (e.g., heads of the IMF have always been either American or European). The G7/G8, which regroups the Heads of State of the seven or eight wealthiest countries on the planet,[†] is another illustration of the concentration of power in the hands of “Western” countries. Initially, it was argued that effectiveness could only come at the cost of inclusiveness (i.e., a small number of countries allowed for faster decision-making). However, in response to the global nature of the 2008 financial crisis, the G7/G8 was extended to the G20, and subsequently to the “G20+5” to include representatives from the African Union and ASEAN. This represented a promising step in “translating rising economic multipolarity into rising

* “What is typically meant by ‘governance’ is the provision of government like functions [e.g., the supply of public goods and services], either by systematic institutionalized inter-governmental cooperation or by supranational institutions such as the IMF, the BIS, and (within Europe) the ECB” (Frieden 2012, p. 3).

† The Group of Seven (G7) includes the United States, Canada, France, Germany, Italy, the United Kingdom, and Japan. Russia, which was invited in the G8, was suspended in 2014 and replaced by the European Union.

multilateralism in global governance” (Vestergaard and Wade 2011, p. 8). In a similar vein, new governance reforms and financing rules were also designed for the IMF.

Despite these initiatives, very little has changed. The G20 lacks legitimacy and credibility: with 173 UN members excluded, its “selection process could scarcely have been more ad hoc” (Vestergaard and Wade 2011, pp. 10–11), and it has been unable to induce cooperation beyond the 2008 crisis context. Even the G20+5 presents some constituency issues, with nineteen representatives representing only their own country and the six other seats looking after the interests of all 173 remaining countries. Similarly, some major emerging economies are still not being heard at the IMF. And **whereas there had been promising reforms immediately after the crisis,[†] the ones proposed since 2010 have been very insignificant in terms of both changing the funding and the governance model of the IMF** (Woods 2010, pp. 55–56). Indeed, when the IMF received an extra \$1 trillion from the G20, its “management and staff [were quick] to use their available resources [. . .] to avoid financial crises in European area countries” (ibid., p. 59). The IMF claimed that its mandate was to focus on middle-income countries, while low-income ones fell under the scope of the World Bank (which, interestingly, did not receive extra funds from the G20; ibid., pp. 59–60). Woods interprets this as “the last gasp of the great powers” (ibid., p. 1) and instead contends that “a new order may emerge in which multilateral institutions – such as the IMF – end up with only a limited role to play alongside emerging national and regional strategies” (ibid., p. 54). Indeed, **the next era may witness the continuing rise of regional and national development banks**, such as the Inter-American Development Bank (IADB), the Asian Development Bank (ADB), etc. (Ocampo 2014; Woods 2010).

In conclusion, we agree with Ocampo (2014, p. 1) that three elements are needed for international monetary reform:

[i] the design of an apex organization more representative than the G20, [ii] advanced participation of developing countries in the Bretton Woods Institutions and on the Financial Stability Board, and [iii] the design of a multi-layered financial architecture, with active participation of regional and sub-regional institutions.

As top-down global governance approaches have mostly failed so far, it may be interesting to take a closer look at **bottom-up approaches**, relying on local initiatives, in which civic actors play a major role (Schmitz 2015, p. 175), to identify solutions worth emulating. In doing so, it will also be of utmost importance to **keep an eye on the political windows of opportunity** to place institutional and governance reforms on top of the agenda. While the post-2008 window seems to have closed at the end of 2009, the current Eurozone crisis could potentially be seized to launch a new reform wave.

4.6.4.5 *Passing micro- and macro-prudential regulation*

In addition to the aforementioned remedies, the fundamental reform of additional elements that made this crisis possible is essential. Krugman (2008, p. 1) notes that

* In their article, Vestergaard and Wade (2011, pp. 16–21) present a very interesting set of rules to reallocate **both seats and voting rights** in the New Global Economic Council in a more balanced way.

† Ocampo (2014, p. 7) explains that in 2009 and 2010, there was a major redesign of IMF’s credit facilities. The modalities (terms and sizes) of the loans were reviewed in favor of the borrowers and precautionary facilities were established and improved (e.g., the Flexible Credit Line, the Precautionary Credit Line). For some preventive credit lines, the link between disbursement and fulfillment of structural conditions (one of the major stigma associated with IMF loans) even got eliminated.

the growth of the shadow banking system, without any corresponding extension of regulation,[*] set the stage for latter-day bank runs on a massive scale. These runs involved frantic mouse clicks rather than frantic mobs outside locked bank doors, but they were no less devastating.

This is in line with the official statement by the Financial Stability Board (FSB), which acknowledges that

the major challenges that persist [to regulate the global financial system] include: [i] how to reduce dependence on credit rating agencies, [ii] resolution mechanisms for “too-big-to-fail” institutions, [iii] still inadequate regulation of shadow banking, [iv] the insufficient expansion of derivatives exchanges, [v] the limited advance of supervisory colleges, and [vi] the lack of agreement on unique accounting standards. (Ocampo 2014, p. 4)

A higher level of transparency and oversight in the financial sector, and specifically in the shadow banking sector (see Ocampo’s points [i], [iii], [v] and [vi] above), **should be on top of the regulation reform agenda.** Transparency should be understood as the better provision of financial information in a manner similar to the requirement that corporations in the United States provide accurate public reports of their financial positions. Increased transparency has the potential to reduce the tendency of very elevated levels of capital rushing into a country or asset under favorable financial conditions and flowing out in times of stress.

Increasing transparency will require agreeing on unique accounting and reporting standards ([vi]) – the Global Reporting Initiative (GRI) and the Sustainability Accounting Standards Board (SASB) initiatives are particularly worth noting in this respect. **It will also require better implementation and monitoring agents and mechanisms** ([i] and [v]). While today, credit rating agencies (CRAs)[†] are supposed to act as a force for monitoring the financial transparency of thousands of companies and governments, Eccles and Youmans (2015, p. 8) reveal that CRAs’ “issuer pays model” (i.e., the company being rated pays for its rating) is the source of significant corruption and failure. Examining the three largest agencies’ annual reports, the authors remark that

for unexplained reasons, over the past ten years, McGraw Hill (S&P) appears to be continuously diminishing, especially since 2012, the strength of its claims regarding the independent and unbiased nature of the credit ratings it gives to the debt issues of thousands of companies.

(*ibid.*, p. 13)

Similarly, they observe that “Moody’s has taken a very clear position, starting in 2008, that the independence of its credit ratings is no longer a material disclosure” (*ibid.*, p. 13). Given this available information, one may think that CRAs would have experienced stringent regulation post 2008, but this has not yet been the case. While investigations and

* Ocampo (2014, p. 3) reminds us that Basel II (2006) established the “adoption of self-evaluation as the [main] mechanism to evaluate risks by major financial institutions.” This, unsurprisingly, led to the growth of non-banking financial institutions and the creation of new asset categories (e.g., derivatives, securitization) – the so-called shadow banking system, accompanied by a rise in the lack of transparency and information, and increasingly inadequate regulation of these alternative markets and instruments.

† The three largest credit rating agencies, Standard and Poor’s (S&P), Moody’s, and Fitch, deliver 96.6 percent of all ratings (Eccles and Youmans 2015, p. 5 and p. 18). So, “clearly, the quality of [their] ratings work [...] is critical for protecting the integrity of [...] markets” (*ibid.*, p. 6)

lawsuits were filed, they have not significantly impacted the three major CRAs, whose revenues have now exceeded their pre-crisis levels (*ibid.*, p. 15). **Coming to terms with this system and increasing public surveillance of rating agencies so they become reliable monitoring agents is extremely urgent and necessary, especially as prudential regulation refers to the grades they issue** (Brender and Pisani 2010, p. 160).

Stronger banking systems are also essential. The severity of the Asian financial crisis of the 1990s was due to the fact that the currency crisis was associated with bank runs (Krugman and Obstfeld 2003). Had the banking institutions been stronger, it is quite possible that the situation would have been milder. **A stronger banking system denotes a more closely regulated banking system with increased capital requirements in order to alleviate moral hazard on behalf of the bank owners.** As Gao Xiqing, president of the China Investment Corporation, underlines, “thirty years ago, the leverage of investment banks was like 4-to-1, 5-to-1. Today it’s 30-to-1. This is not just a change of numbers. It’s a change of fundamental thinking” (Fallows 2008, p. 27). Since the 1930s, commercial banks in the United States have been required to possess adequate capital, hold reserves of liquid assets that can be quickly converted into cash, and limit the types of investments they make, all in return for federal guarantees in case of a crisis (Krugman 2008). **Comparable regulation will need to be put in place for the shadow banking system as well.** In the existing system, the risk is put on the party least able to bear it, i.e., the borrower (Arner and Buckley 2010, p. 54). This needs to change. So far, attempts in the U.S. have included the 2010 Dodd–Frank Act to strengthen prudential regulation and the 2013 Volcker rule to limit the core capital that banks can place in investment funds to 3 percent. While the EU has undertaken similar initiatives, its fiscal and banking disintegration (as compared to the U.S.) are still major obstacles to overcome. The regulations in the U.S. have now created a situation where U.S. banks have a stronger capital base than those in Europe (Ocampo 2014, p. 4). This diverging evolution in U.S. and EU regulation should raise concern as **the lack of international coordination and homogeneity could constitute a threat to successful reform of the International Monetary System.**

Soros (2008) also makes the case that variable margin requirements and minimal capital requirements that are meant to control the amount of leverage market participants can employ should be instituted. He notes,

Central banks even used to issue guidance to banks about how they should allocate loans to specific sectors of the economy. Such directives may be preferable to the blunt instruments of monetary policy in combating “irrational exuberance” in particular sectors, such as information technology or real estate.

(*ibid.*)

However, in order to employ such requirements, financial engineering should also be regulated,* and new products should be registered and approved by the appropriate authorities before they can be used.

Finally, **enhanced credit lines** that nations could draw from in the event of a credit crisis, adding to their foreign-exchange reserves, would also help moderate the likelihood of having a credit crisis, along with diminishing its potential effects in case such a crisis becomes unavoidable. Similarly, but more preventively, it may be worth putting in place “specialized public risk-takers to take, when deemed necessary, the risks that private agents [would] have every reason not to be able to assess correctly and hence, unless they act[ed] imprudently, not to take” (Brender and Pisani 2010, p. 168).

* Financial engineering refers to the creation of new financial instruments, such as derivatives.

Returning to a world of low capital mobility neither constitutes a political reality nor is a development that nations should seek. The most realistic and effective option would be the adoption of coordinated policies that would **modify the composition of capital inflows rather than completely discouraging them** (see Section 4.6.4.2 and our discussion of the Pardee Center Report 2012). In general, the higher the reliance on foreign-currency borrowing that is short term or intermediated through banks, the higher the probability of having a crisis, because short-term flows are prone to moral hazard and asset mismatch (Krugman and Obstfeld 2003). On the other hand, policies that would seek to shift the composition of capital inflows, instead of affecting their total level, would be significantly beneficial. **These policies would include taxes or restrictions on short-term inflows, along with a set of measures that would create incentives for foreign direct investment and longer maturities. In that respect, a tax would not only generate extra revenue, but also “penalize short-term traders [. . .] encouraging longer-term productive investment” (Stiglitz 2015, p. 68).**

A success story in this regard is Chile. Chile imposed a tax on inflows in 1991. This tax took the form of a requirement that a percentage of any foreign borrowing be left in a non-interest-bearing deposit maintained at the central bank for up to one year. Additionally, a requirement was put in place that all FDI must remain in the country for at least one year. These controls were successful in changing the composition of the capital inflows to Chile in the 1990s in the direction of longer-term maturities while having a minimal effect on the total magnitude of capital inflows (Edwards 2000). Hence, countries should aim for increased foreign direct investment and long-term inflows relative to debt and portfolio capital inflows. **Nevertheless, if such a policy is implemented on a country-by-country basis, this will do little to avert a future crisis – it will only better protect the set of countries that adopt such measures, and only up to a certain degree. Policy coordination again appears to be at the epicenter.**

Another possibility that should be explored is the adoption of a measure similar to what is now called the **Tobin tax**. The Tobin tax, which was proposed by the late Nobel laureate James Tobin, essentially entailed a very low tax imposed on each individual foreign currency transaction.* This measure would have two fundamental effects: first, it would reduce currency speculation by “throwing sand in the wheels” of the financial system and perhaps make it easier for governments to pursue their own monetary and fiscal policies without excessive concern about the exchange rate; second, it would also raise significant amounts of revenue, which could be used for activities such as financing development assistance or alleviating the debt of the developing world (Wolf 2004). Another use of the tax revenue could be to provide insurance in the form of, for example, a resolution fund that could be drawn upon in the time of a future financial crisis (IMF 2010a). Alternatively, a financial transaction tax could be dedicated to the funding of green technologies and sustainable projects in accordance with Paris Agreement commitments. Whether a

* In August 2009, the President of the British Financial Services Authority, Adair Turner, proposed to the G20 the introduction of a financial transactions tax that was not limited to *foreign* financial transactions. It was not seriously considered (cited in Gurtner 2010, paragraph 75). However, a year later, sixty nations proposed a tax on international currency transactions during the UN MDG Summit (September 20–22, 2010) (source: The Leading Group on Innovative Financing for Development, www.leadinggroup.org, accessed 01/08/11). While the merits and structure of a financial transactions tax (FTT) continues to be debated by the international community, the idea is gaining traction within the EU where the European Commission has supported the idea of a financial transactions and a financial activities tax (source: Europa Commission Outlines Vision for Taxing the Financial Sector, IP/10/1298, Brussels, October 7, 2010). Some argue, however, that an international FTT system is necessary since a regional system would be inefficient and may force trading outside of the covered area (Crouse 2009; UN Advisory Group on Finance 2010).

form of Tobin tax would indeed be beneficial is still under debate (Crouse 2009). Economists such as Martin Wolf think that it would actually be a bad idea because, in his view, the tax would not prevent big jumps in exchange rates and, by reducing hedging activity, might eventually increase volatility (Wolf 2004). Others, such as investor George Soros, do not share this view and believe that some variation of tax would actually be significantly beneficial (Soros 2001). In any case, “throwing sand in the wheels” is exactly one of the things that the financial system seems to need right now, so any measure that proposes to do so should be thoroughly examined.

The list below provides a summary of the recommendations to regulate and stabilize the financial system:

- Increase the level of transparency in the financial sector and in the shadow banking sector by agreeing on unique accounting and reporting standards and establishing reliable implementation and monitoring agencies (e.g., reforming existing credit rating agencies);
- Establish stronger banking systems by increasing the stringency of regulation and increasing capital requirements (going back to the spirit of the 1933 Glass–Steagall Act and in particular the separation between deposit banks and investment banks);
- Regulate the shadow banking system, to end regulatory dualism and reduce investors’ opportunities for arbitrage;
- Regulate financial engineering by having appropriate authorities examine and approve (or not) new products;
- Set up enhanced credit lines to moderate the likelihood and the magnitude of a credit crisis;
- Delineate clearly private vs. public risk and rewards. Define the extent to which risk and rewards associated with specific transactions belong to private vs. public agents. Unlike what happened post 2008, capital made available by the state for turnaround (bailout) should normally take the form of an equity stake rather than a loan to avoid “the privatization of benefits and socialization of losses”;
- Establish capital account regulations (various forms available) to change the nature of cross-border financial flows, i.e., restricting destabilizing short-term flows and incentivizing more stable FDIs and longer-maturity flows. For instance, a “Tobin-like tax” could contribute to reducing the volatility of cross-border financial transactions; and
- Obtain international cooperation and agreement in all the above initiatives.

4.7 The case of the EU

The Eurozone Crisis, which started in 2010 and reached a new peak during the summer of 2015 with threats of “Grexit” (i.e., exit of Greece from the EU) coming close to reality, is a highly visible symptom of the structural weaknesses of the global (financial) system. Our goal here is not to provide an exhaustive historical account of the crisis’s unfolding, but rather to use this case study to conclude this chapter by looking at the evolution of global financial institutions and the need to reconstruct them post-2008.

The EU, as mentioned before, suffers from imbalances – both within and beyond its boundaries. It is involved in global imbalances vis-à-vis non-EU countries, but also suffers from internal destabilizing movements (with Germany being a chronic surplus country, for example). While at a global level, prior to 2008, it was at least part of a global surplus recycling mechanism (GSRM) – the “Global Plan” and the “Global Minotaur” (see Box 4.1) – internally, it did not have any stabilizing scheme.

As Varoufakis (2013, p. 61) explains:

The problem with currency unions, as Argentina was to discover in the late 1990s and Europe in the aftermath of the Crash of 2008, is the simple fact of life that trade and capital flows can remain systematically unbalanced for decades, if not centuries.

When the entities involved have their own currencies, they can adapt their exchange rate to absorb the strain caused by the imbalances. However, as Varoufakis (2013, p. 61) explains:

Once these economic regions are bound together by the same currency (as in the United States or the Eurozone), something else is required to release the tension caused by unbalanced trade and capital flows – some mechanism for recycling surpluses from the surplus regions (e.g. London or California) to the deficit regions (e.g. Wales and Delaware). Such recycling might be in the shape of simple transfers (e.g. paying unemployment benefits in Yorkshire through taxes raised in Sussex). Or – and this is much more desirable for both the surplus and the deficit regions – it might be in the form of productive and profitable investments in the deficit regions (e.g. directing business to build factories in the north of England or Ohio).

The reason why the dollar-zone is a successful currency union whereas the euro-zone is plagued with crises is that America features at least two surplus recycling mechanisms (a global and a domestic one), whereas Europe has none (*ibid.*, p. 61). Rodrik (2012, p. 399) adds that the political integration and cultural and linguistic homogeneity in the U.S. also support the domestic redistribution of imbalances. **In contrast, the EU is a collection of individualities, in which national sovereignties, preferences, cultures, and languages prevent the economic union from being accompanied by a coherent political, fiscal, and monetary union.***

Today, the EU is indisputably mired in its most acute crisis since its founding in the 1950s. From an economic point of view, the Eurozone suffers from three sub-crises (Varoufakis et al. 2013, pp. 1–2): a banking crisis; a public debt crisis; and a crisis of underinvestment. From a social and political point perspective, the current situation is marked by unemployment and poverty rates skyrocketing, extremist attacks, unchecked immigration, a rising military threat from Russia, and political upheaval (Katz 2016), of which Brexit is the most visible sign – but certainly not the only one. For instance, increased social stress has led to the rise of populism, not particularly in Portugal, Ireland, Italy, Greece, and Spain, but rather in the largest countries (Germany and France) and also in the Netherlands, Hungary, and Poland, where extreme parties (both left and right) are gaining traction,[†] but whose influence has diminished in recent Dutch and French elections.

At the economic and financial level, the EU requires structural, fiscal, and monetary reforms, starting with the adoption of a new intellectual foundation (see Section 4.6.4 and the *Economist* 2014). Indeed, one of the main obstacles to solving the Eurozone crisis is

* Both Rodrik (2012) and Wren-Lewis (2013) point out the gaps of the EU architecture versus that of the U.S. and UK. Importantly, in the current architecture, the E.U. is not able to adopt and coordinate fiscal stimulus programs (because of the lack of fiscal homogeneity across the different member states) and thus the European Central Bank (ECB) cannot undertake substantial quantitative easing (Wren-Lewis 2013, pp. 68–69). As a result, the crisis is still dragging on in the EU.

† For example, the Front National in France (far-right), Podemos in Spain (left), Party for Freedom in the Netherlands (far-right), the People's Party in Denmark (far-right), Alternative for Germany (far-right), and Syriza in Greece (far-left), to name just a few.

that current decision-makers and processes restrict the policy space to the pursuit of austerity. The *Economist* (2014) argues that instead, we should encourage a dramatic increase in infrastructure spending* [coupled] with bond-buying by the ECB [. . . and] redefine EU's deficit rules to exclude investment spending, which would allow governments to run bigger deficits, again with the ECB providing a backstop." In other words, the Eurozone should get rid of its Stability and Growth Pact (SPG) – a pillar of the EU architecture, focused on placing limits on the size of official deficits, that is, on national fiscal discipline (i.e., spending and taxes) rather than on national macroeconomic stabilization (i.e., output, inflation, countercyclical fiscal policy, etc.) (Wren-Lewis 2013, p. 67).

Even though "the idea that cutting government deficits would increase demand by adding to confidence has proved illusory" (Wren-Lewis 2013, p. 70), **since 2010, the architecture has been reinforced rather than altered.** This – along with the set of conditions attached to the most recent Greek bailout (summer 2015) – illustrates how difficult it is to move away from the existing economic dogma and its obsession with union-wide control of national fiscal deficits. **However, this is not just a matter of ideology. One must also look closer at who is making the decisions and how.** The fact that not all states or members of the union are equal is perhaps more visible in the EU than in the U.S. Similarly, it is debatable whether for the members of the EU Council, the EU Commission, the EU Parliament, and the different financial institutions at the regional level, the interests of the EU will prevail over domestic ones.

For all these reasons, while some union-wide cooperation is necessary (especially on monetary, institutional, governance, and regulatory initiatives), authors like Rodrik (2012) and Wren-Lewis (2013, p. 66, emphasis added) argue that a **"more feasible and desirable path" for the Eurozone is to move "towards greater subsidiarity and not greater fiscal union."** Although this arrangement may come at the cost of economic globalization, it would enhance national sovereignty and democratic politics, a much better trade-off in Rodrik's (2012, p. 398) mind, who analyzes the problem of the Eurozone as "having policy without politics at the Union [level] and politics without policy at the level of nation states." The EU would still need to formulate fiscal rules, but at the national level "to combine long-term debt control with aggressive use of countercyclical policy to prevent the repeat of post-2000 bubbles" (Wren-Lewis 2013, p. 70). Such action would protect national interests and lower the risk of contagion associated with uncertainty about the Eurozone and the ECB behavior.

Other authors have contrasting views. James K. Galbraith (2016), the son of the Keynesian economist John Kenneth Galbraith, agrees that the EU erred egregiously in making austerity policies the price of Greece's rescue. The IMF actually apologized for its influence (or lack of influence) in fashioning Greece's bailout (Evans-Pritchard 2016). Deep budget cuts and high taxes have cost Greece a quarter of its pre-crisis wealth, rendering a recovery impossible, according to Galbraith, perhaps forever, and the only way out would be a multipronged approach that includes a spending program like the postwar Marshall Plan. He insists, however, that deeper political and economic integration is the answer to the current situation. This opinion is shared by Giles Merritt (2016), another economist who claims that since Europe's political spectrum is fractured as never before, the lesser evil at the moment may be smaller, tactical interventions to complete the single market and to invest in research and the modernization of infrastructures.

Stiglitz (2016b) offers the most thorough evaluation of the possible options. The first and most desirable would be reforming the fundamental structure of the euro system so that it generates growth and distributes the benefits fairly (Moravcsik 2016). To do so, national policies must be made to converge – which means that the German economy

* To be performed by the European Investment Bank, EIB.

would also have to be forced into line. To do so, the EU should discourage trade surpluses (for example, by imposing a tax on them) and the German government should unilaterally engineer a rise in wages and increase deficit spending. In theory, deep structural reforms represent the optimal choice (as the phrase “monetary union requires fiscal union” summarizes).

However, Stiglitz (2016b) continues, if major structural reform is unrealistic, then member states would have to “muddle through” and strengthen the EU’s ability to manage the crisis: the EU created in 2012 the European Stability Mechanism, an institution responsible for bailing out member states, and the European Central Bank has engaged in monetary easing. But further changes would be necessary to make the EU’s single currency system work properly. The burden of the current system on deficit countries must also be eliminated, and eventually Europe would have to restructure its debt. And, if neither of the two options to save the single currency and restart growth is viable, this leaves only a third option: abolishing the euro, although almost all European politicians, and majorities in every member state, reject this course.

Moravcsik (2016) notes that governments have little incentive to make charitable and risky concessions, even in a united Europe with economic prosperity on the line. As Varoufakis writes,

all talk of gradual moves toward political union and toward “more Europe” are not first steps toward a European democratic federation but, rather, and ominously, a leap into an iron cage that prolongs the crisis and wrecks any prospect of a genuine federal European democracy.

(as quoted in Moravcsik 2016)

In conclusion, the Eurozone provides an interesting illustration of the post-2008 evolution of political and financial institutions in a region prey to both internal and external imbalances. In both the U.S. and EU cases, the “bankruptocracy” (Varoufakis 2013, p. 167) weakened the ability of governments to address the consequences of the crisis. Similarly, many proposals to reform the multiple facets of the International Monetary System never fully entered into the G20 and IMF debates – see Section 4.6.4, Arner and Buckley (2010), and Ocampo (2014) – revealing a **fundamental and “bottleneck”* issue of agenda capture or “corruption” at domestic, regional, and global levels**. In other words, “with ‘light-green’ transformations, the obstacle is not finance, but the incumbents who benefit from the status quo, as well as collective action problems operating at the international level” (Spratt 2015, p. 101). What may come as a ray of light in this dull picture is that the aftermath of the 2008 crisis has witnessed **the acceleration of the global power shift from West to East** (Schmitz 2015, p. 180): “The *rising powers* have become the default movers and shakers in the green transformation, in both the negative and positive sense. While responsible for the continuing growth of carbon emissions, they are also the biggest investors in mitigation” (ibid., p. 176). **While changing power dynamics will result in a whole new set of challenges, it may also open up opportunities to recraft the global system – intellectually, politically, financially, and economically, etc.** Finally, no single actor (government, civil society, or business) will have the resources to bring about the green transformation. **The coming era will thus have to focus on building multidimensional cooperative alliances to find a more satisfying outcome in Rodrik’s (2012, p. 398) trilemma between hyper-globalization, national sovereignty, and democracy, and transform**

* “Bottleneck” in the sense that as long as corruption prevails (i.e., decision-making processes at the highest levels only respond to vested interests), no drastic reform of the International Monetary and Financial Systems can take place.

trade and globalization into a real force for economic and sustainable development – see Varoufakis (2017).

As this book goes to press, two developments have emerged that attempt to address the needed reforms in the Eurozone and in Greece specifically. In January 2018, nineteen EU and U.S. economists from the European Centre for Economic Policy Research, a network of about 1,200 research economists based mostly in Europe, undertook a detailed analysis of possible reforms for the Eurozone. The following excerpt outlines their main findings (Bénassy-Quéré et al. 2018, pp. 20–21):

Conclusion

Building a monetary union of sovereign states is an ambitious endeavour, even when these states are closely integrated and already share common institutions. The crisis has simultaneously revealed the weaknesses of the euro area's initial architecture, the strength of the member states' and citizens' commitment to its integrity, and the depth of disagreements over its reform. The task ahead is to embed the revealed collective preference for integration in institutional arrangements that are both robust and acceptable for all participating members. We think that this is a feasible task.

Our proposal should be regarded as a package comprising six main elements:

First, breaking the vicious circle between banks and sovereigns through the coordinated introduction of sovereign concentration charges for banks and a common deposit insurance. The former would incentivise the diversification of banks' portfolios of government securities, while the latter would protect all insured euro area depositors equally. Incentives for prudent policies at the national level would be maintained by pricing country-specific risk in the calculation of insurance premiums, and through a reinsurance approach: common funds could be tapped only after "national compartments" have been exhausted. Together, these measures would decisively reduce the remaining correlation between bank and sovereign risk, paving the way for the cross-border integration of banking and capital markets. In addition, mechanisms to bail in creditors of failing banks should be strengthened, the reduction of existing non-performing loans needs to accelerate, and bank regulatory standards should be tightened and further harmonised.

Second, replacing the current system of fiscal rules focused on the "structural deficit" by a simple expenditure rule guided by a long-term debt-reduction target. A rule of this type is both less error-prone than the present rules and more effective in stabilising economic cycles, since cyclical changes in revenue do not need to be offset by changes in expenditure. Monitoring compliance with the fiscal rule should be devolved to national fiscal watchdogs supervised by an independent euro area-level institution. In case of no compliance, a government should be compelled to finance excess spending through the issuance of junior sovereign bonds, whose maturities would be automatically extended should the country be subject to an ESM programme.

Third, allowing orderly sovereign debt restructuring of countries whose solvency cannot be restored through conditional crisis lending – and hence a more credible no bailout rule. This requires lowering the economic and financial disruptions of a restructuring, adopting legal mechanisms that protect sovereigns from creditors that attempt to "hold out" for full repayment, and developing ESM policies and procedures that provide an effective commitment not to bail out countries with unsustainable debts. To prevent any instability in sovereign debt markets, such policies need to be phased in gradually and combined with other reforms that reduce sovereign risk, such as common deposit insurance and fiscal risk-sharing mechanisms.

Fourth, creating a euro area fund, financed by national contributions, that helps participating member countries absorb large economic disruptions. Payouts would be triggered if employment falls below (or unemployment rises above) a pre-set threshold. To ensure that the system does not lead to permanent transfers, national contributions would be higher for countries that are more likely to draw on the fund, and revised based on ongoing experience. This system would maintain good incentives through three mechanisms: “first losses” would continue to be borne at national level, participation in the scheme would depend on compliance with fiscal rules and the European semester, and higher drawings would lead to higher national contributions.

Fifth, an initiative to create a synthetic euro area safe asset that would offer investors an alternative to national sovereign bonds. Safety could be created through a combination of diversification and seniority – for example, financial intermediaries would purchase a standardised diversified portfolio of sovereign bonds and use this as collateral for a security issued in several tranches. Introducing such assets in parallel with a regulation on limiting sovereign concentration risk would help smooth the transition away from excessive concentration on home-country government bonds.

Sixth, reform of the euro area institutional architecture. The role of the watchdog (“prosecutor”) should be separated from that of the political decision-maker (“judge”) by creating an independent fiscal watchdog within the European Commission (for example, a special Commissioner) or, alternatively, by moving the fiscal watchdog role outside the Commission. At the same time, the Eurogroup presidency role (the judge) could be assigned to the Commission. The policy responsibility for conditional crisis lending should be fully assigned to a crisis management institution built on the current ESM, with an appropriate accountability structure.

Implementing these reforms would be a game changer for the euro area, significantly improving its financial stability, political cohesion and potential for delivering prosperity to its citizens, all while addressing the priorities and concerns of the participating countries. Our leaders should not settle for less.

Alternatively, the Pan-European political movement DiEM25* created in 2015 on Varoufakis’s initiative suggests the implementation of a European New Deal (reminiscent of Roosevelt’s New Deal) to bring economic stabilization within and between member states, decrease rampant unemployment, restore investment, regulate the banking system, restructure public debt, and contain nationalism. Disapproving of both a “multi-speed” or “variable geometry” Europe and a federalization of the EU, they advocate for radical reforms within the existing institutional framework in keeping with national sovereignties. In that respect, the Diem25 Manifesto rests on four principles:

- Transforming wealth accumulation into green investment;
- Providing people with basic goods, namely food, energy, health, housing, and education;
- Sharing the returns from capital; and
- Democratizing macroeconomic management.

* DiEM25: Democracy in Europe Movement. The number “25” stands for 2025, the year by which the movement aims at establishing a constitution in the EU that would replace the current set of treaties. See www.thenation.com/article/why-europe-needs-a-new-deal-not-breakup/.

For that purpose, the movement proposes six strategies:

- Reordering finance via the regulation of the banking system and the establishment of a Public Digital Payments Platform (PDPP);
- Funding green investments via the setting up of a progressive tax carbon and tax credits;
- Funding basic goods via an Anti-Poverty, Housing, and Jobs Guarantee program;
- Creating a universal basic dividend (UBD) partly financed by (1) the income generated from the assets purchased via the quantitative easing programs by central banks, (2) the dividends from a percentage of capital stock shares from every Initial Public Offering (IPO) and capital increases of corporations, and (3) levies on the derived distribution of Intellectual Property rights and on common knowledge monopolies;
- Increasing the coordination of monetary, fiscal, and social policies between EU–non Eurozone, Eurozone, and non-EU countries; and
- Ending austerity, restoring national sovereignty, and minimizing the cost of the EU disintegration in case of such an event.

It is beyond the scope of this writing to delve into the strengths and weaknesses of these recommendations. Nevertheless, even though CEPR and DiEM25 contributions are grounded on different philosophical rationalities, their similarities are noteworthy:

- Reform of the banking system towards more regulation and accountability of the financial sector;
- Restructuration of sovereign debts;
- Creation of a European financial asset; and
- Increase the European coordination of monetary, fiscal, and social policies.

Beyond these points of convergence, CEPR contributors emphasize market discipline as a *sine qua non* condition to risk sharing, while the DiEM25 program focuses more on investments in social protection and the green transition. These two sets of viewpoints may nevertheless be compatible. The divergence may rather lie in the nature and the degree of the reforms necessary to reach the objectives mentioned above. In particular, the extent of debt sharing and the sources of funding to absorb economic shocks (CEPR) or finance public investment (Diem25) might constitute points of containment. Such disagreements stem from two different conceptions of the mission of the EU, namely either an economic free-trade area or a political union ensuring social protection and welfare for European citizens. These two conceptions have survived since the Treaty of Paris (1951)* that gave birth to the European cooperation. However, the aftermath of the 2008 financial crisis and the challenge of growing migration from conflict and climate change is limiting the space in which the EU can act. Yet, the recent political elections in France, the Netherlands, and Austria† give European citizens and political leaders the opportunity to overcome divergence and build an ambitious common future.

* Formally the Treaty establishing the European Coal and Steel Community.

† The election of President E. Macron in France in May 2017 against far-right candidate M. Le Pen, the defeat of the far-right party PVV (Party for Freedom) at the General Election in the Netherlands in March 2017, and the election of President A. Van der Bellen (Greens) against the far-right candidate Norbert Hofer in Austria in December 2016 provide some hope that the EU may have the capability to address the challenges it faces.

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5 Technological change, globalization, and sustainability

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We have argued that both technological change and globalization of commerce (i.e., trade and finance) are important drivers affecting sustainability. Chapter 3 was dedicated to describing the influence of technology in fostering economic growth without large contributions from globalization. Chapter 4 discussed the additional dynamics for economic growth for a nation involved in the global economy where knowledge/ideas, technology, and finance are shared and cross national boundaries. Here, we address how both technological change and globalization affect the three pillars of sustainable development: economic growth, the environment, and employment. What will be evident is that the following dynamics have had increasingly adverse impacts on economic welfare, employment, and earning capacity of ordinary citizens, and the environment:

- 1 The failure to internalize the costs of environmental damage and social exclusion/inequality in economic transactions in national policies – what is often referred to as “the pricing problem”;

- 2 The additional and complicating effects of the globalization of commerce through trade on those externalities – distinguishing local or national impacts from overall global economic efficiency and wealth maximization; and
- 3 The internationalization of the world financial system – where the ownership, control, and exploitation of financial capital drives investment, production, and profit-taking.

Part III of this book, which follows this chapter and consists of Chapters 6, 7, and 8, takes a detailed look at the impact of technological change on sustainability. Chapter 6 articulates the theories behind technological innovation, Chapter 7 explores technological change from the perspective of the business firm, and Chapter 8 considers the role of government in promoting technological change for sustainability.

We argue that a *technological perspective* can make a particular contribution to three aspects of the sustainability debate.

- **Technology is the medium through which an economy (the production of goods and services that satisfy needs and wants) interacts with the environment.** The scale, mix, and management of the technologies of production within an economy are significant determinants of anthropogenic environmental change.
- **Technology is the medium through which labor and capital are combined in production.** Technology is thus an important determinant of the nature of *work* (the provision of employment, the conditions under which individuals earn their livelihoods, and the distribution of remuneration).
- **Competitiveness* – in the long run, equivalent to an economy's ability to deliver an adequate level of material well-being to its citizens – is substantially dependent on technology.** Achieving and maintaining competitiveness (or, in a developing-economy context, succeeding at economic development) are, in an important sense, processes of technological change within the economy as a whole and within particular industries and firms.

More generally, we have argued that a sustainable society can be characterized by at least the following:

- *Economy* – The economy provides goods and services adequate to satisfy the basic material needs of all members of society and provides abundant and equitable opportunities for the realization of human potential;
- *Work* – Livelihoods are secure and available that provide satisfying engagement in work and equitable reward for labor, permit the maintenance of a decent standard of living, and are conducted in a safe working environment; and
- *Environment* – Long-run flows of environmental services are provided at a level sufficient to maintain a stable ecosystem and to support human health and welfare.

We contend that to move toward these goals on a worldwide basis, sustainability policy must be made in a dynamic environment in which economic linkages between nations are increasingly deep and pervasive, and changes in technology and these economic linkages are becoming more rapid and interconnected. The implication of attempting to pursue sustainable development in such an environment is the challenge to which we now turn. While the dynamics of globalization are the focus of this chapter, trade among nations does not always lead to mutual benefit. As a result, disengagement may sometimes appear to be a preferable pathway for some nations to take.

* Competitiveness is not to be confused with the term “competition.” In one sense, “competitiveness” is an unfortunate word to describe economic goals because it suggests winners and losers among nations.

The structure of this chapter follows Figure 5.1, which that was first introduced as Figure 0.2 in the Overview. The first three sections of the chapter move systematically through interactions that occur between *the economy and the environment* (Sector II on Figure 5.1; Section 5.1), between *the economy and work* (Sector IV on Figure 5.1; Section 5.2), and between *work and the environment* (Sector VI on Figure 5.1; Section 5.3). In each section, a version of Figure 5.1 is provided in which the relevant issues that will be discussed are highlighted. Note that to the extent possible, we exclude the analysis of policy responses and options, as well as a discussion of constraints on national policy options. We will explore these responses in Part III of the book and in Chapter 13.

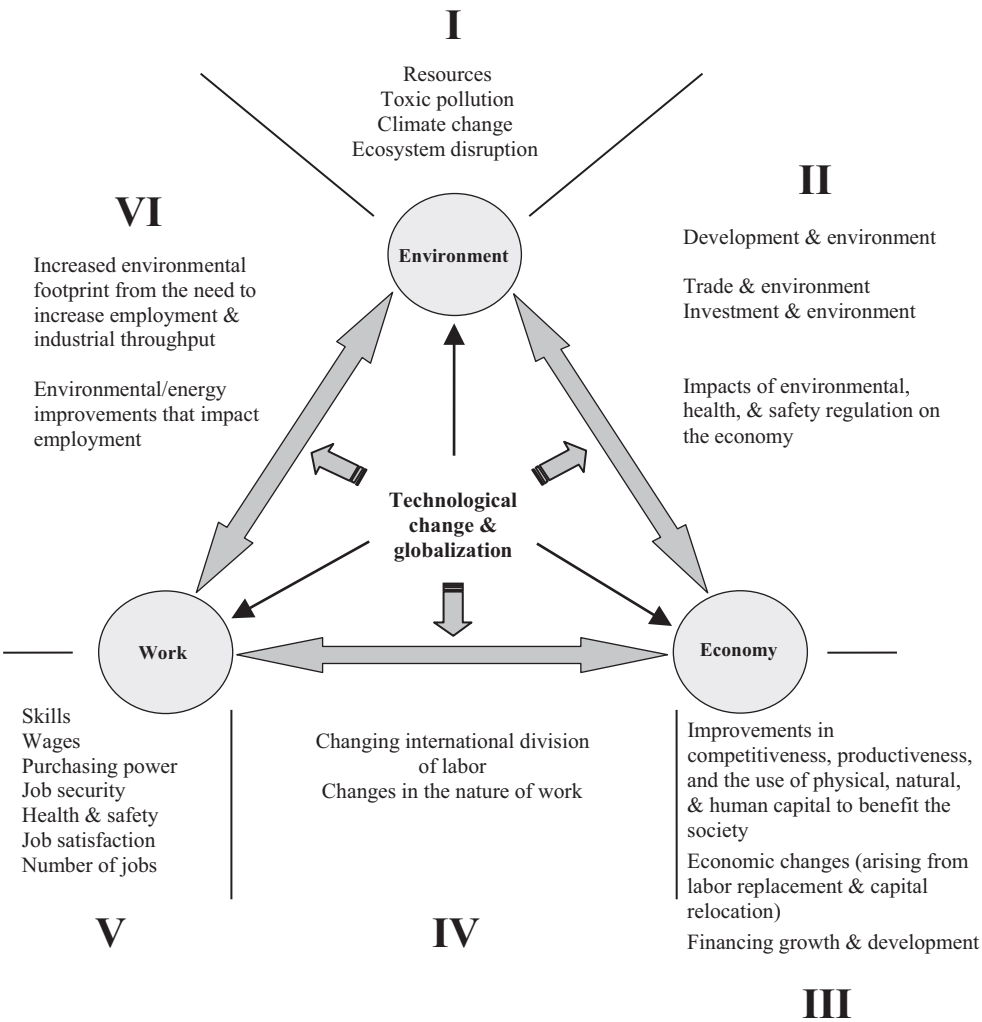


Figure 5.1 Technological change and globalization as drivers of change within and between three operationally important dimensions of sustainability

5.1 Effects of globalization on economy–environment interactions (sector II)

In this section, we analyze Sector II of Figure 5.2. (In Figure 5.2 and subsequent versions of Figure 5.1, the focus of each section is presented in bold text.) Sector II represents the interactions between the economy and the environment in a globalized and rapidly changing world. Thus, the following subsections will attempt to answer the following questions:

- How does globalization affect the environment?
- What is the effect of globalization on environmental regulation?
- How do environmental, health, and safety regulation affect the economy?

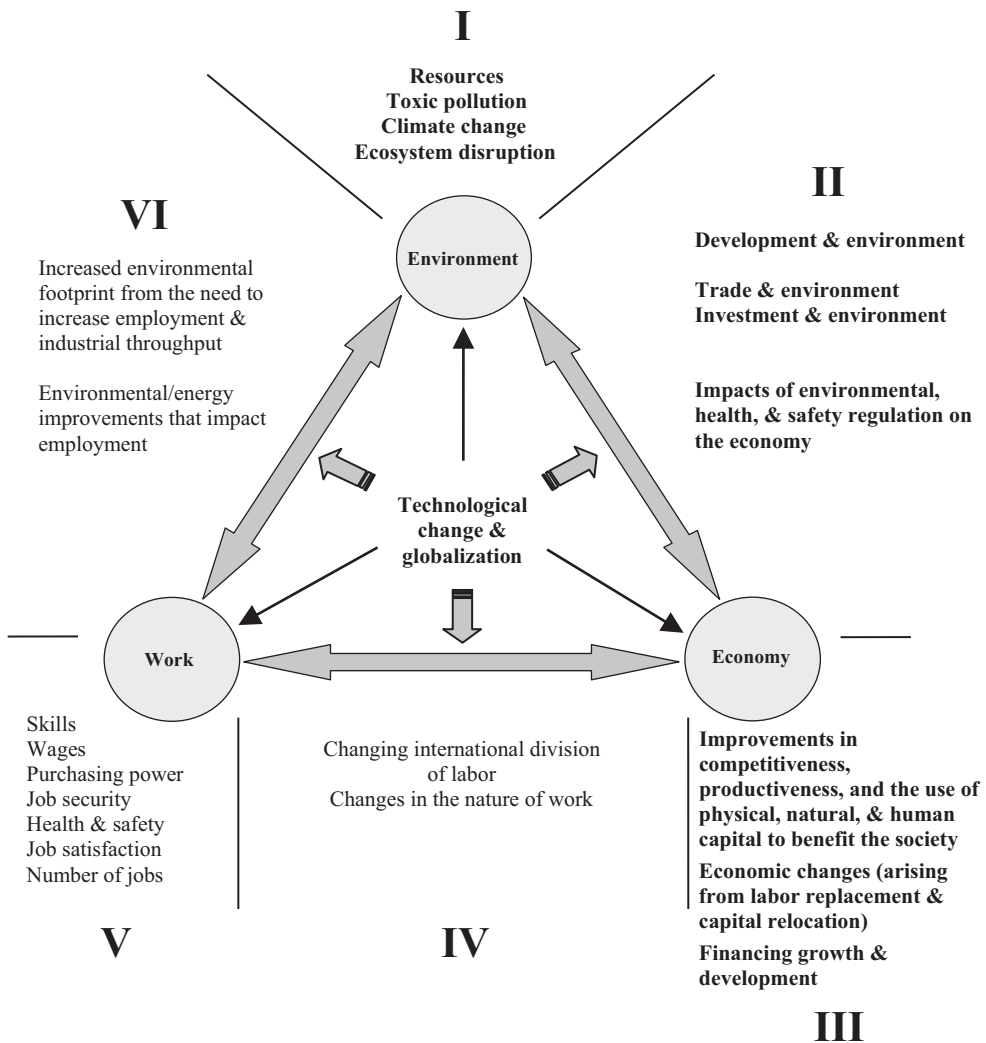


Figure 5.2 Technological change and globalization as drivers of change within and between three operationally important dimensions of sustainability (Sectors I, II, and III)

The first question addresses direct environmental impacts through changes in economic and industrial activity. The second question addresses instrumental impacts operating through the legal and political system. The third question addresses impacts in the opposite direction – the effects of regulation on economic activity.

As introduced in Section 1.3.4 in Chapter 1 and Section 2.1 in Chapter 2, the environmental consequences that underlie the concern for sustainable development (Sector I in Figure 5.1) incorporate what have been identified as **four different environmental concerns: (1) the disruption of ecosystems and the loss of biological diversity** (which relate to environmental degradation and the loss of wildlife and fauna) and the indirect effects these have on human health and well-being; **(2) resource depletion** (from the use of finite stocks of material resources and energy); **(3) toxic pollution** (and its impact on human health and other species); and **(4) global climate change** (the impacts of global air warming, climate disruption, and the rise of the sea level). Therefore, throughout the following subsections, we will focus on understanding the interactions between the economy and these four environmental concerns in a globalized world.

Three avenues of impacts on the environment (identified in Sector II) will be considered successively in assessing the effects of globalization on the environment: *development (industrialization) and the environment* (Section 5.1.1), *trade and the environment* (Section 5.1.2), and *investment and the environment* (Section 5.1.3). Because these aspects can be considered essential contributors to more globalization – and to loss of control over the national economy – they form the basic structure of this section.

Section 5.1.1, on development and the environment, focuses on the way the environment is transformed by technological change and industrialization. Section 5.1.2 addresses the trade and environment debate or, more precisely, the effects of trade liberalization or protectionism on the environment. Finally, Section 5.1.3 addresses the role of investment decisions and how they affect the environment. In addition, the impacts of environmental, health, and safety regulation on (1) economic development/growth, (2) trade and competitiveness, and (3) investment decisions will be addressed in each subsection.

5.1.1 Development (industrialization) and the environment

How is the environment transformed or affected as countries advance technologically or industrialize?

Economic development has traditionally been measured by growth of gross national product (GNP). Typically, a country is regarded as “developing” as long as its GNP grows at a rate of 5 percent to 7 percent a year and outpaces the population growth of the country, which implies that per capita income increases (Todaro and Smith 2015, p. 16). Development has also traditionally been associated with the alteration of the structures of production and employment so that the share of agriculture in the economy decreases as the manufacturing and service industries grow; such structural changes are typical outcomes of industrialization. Since the 1970s, the concept of development has evolved tremendously to incorporate not only dimensions of distributional equity but also changes in social structures and national institutions, the eradication of poverty, and the creation of opportunities (Todaro and Smith 2015).*

* For a detailed description of the evolution of the definition of development, see Todaro and Smith (2015, p. 16). See also Sections 1.1 and 1.2 in Chapter 1.

In this section, we explore the following two questions, which focus on how the industrialization process impacts the environment, but from different perspectives:

- What is the relationship between economic development/growth and the quality of the environment? (Section 5.1.1.1)
- What is the relationship between environmental regulation and economic growth? (Section 5.1.1.2)

5.1.1.1 The relationship between economic development/growth and environmental quality: an analytic approach

Various studies have attempted to analyze the relationship between economic growth and the environment (Grossman and Krueger 1993, 1995; Lopez 1994; S. Chua 1999; Antweiler et al. 2001; Feridun et al. 2006; Victor 2008; Kallis 2011. (See also Sections 3.7 and 3.8 in Chapter 3 on new economics and degrowth.) These studies typically focus on the following three factors, which help explain how economic development/growth, trade, and foreign direct investment (FDI) affect the environment: **(1) the scale of production/consumption; (2) the composition of production/consumption; and (3) the technique or method of production.**

The first of these studies (Grossman and Krueger 1993, 1995; Lopez 1994) evidence an **inverted-U-shaped curve (the so-called Kuznets curve) between the economy and the environment** (i.e., industrialization and the rise in incomes negatively impact the environment up to a certain point, beyond which populations have the willingness and (earning) capacity to become more concerned with the environment, and environmental impacts level off or decline as incomes rise further).*

Later studies, however (S. Chua 1999; Antweiler et al. 2001; Feridun et al. 2006), show that results from different analyses are ambiguous (sometimes even inconsistent) and far from presenting an inverted-U shape in all cases. For instance, Chua's (1999) results "suggest that interactions between economic growth and environmental quality are too complex to be satisfactorily captured by income differences alone" (pp. 395–396).† Instead, a closer look at the "composition" and "technique" effects is needed in order to understand these interactions better. In particular, "technological changes can outweigh the scale effects and are fundamental in determining the relation between growth and environmental quality" (ibid., p. 399). See also Everett (2010, p. 17) for the questionable relevance of the Kuznets curve hypothesis to policy-making.

* World-renowned economist Jagdish Bhagwati (1993) supports this view, stating that growth enables governments to raise tax money in order to protect the environment, and growth can increase the demand for high environmental quality. This is consistent with one of the explanations given for the inverted-U-shaped or environmental Kuznets curves: environmental quality is considered a luxury good, and therefore, once a certain level of income has been reached, the demand for a better environment increases. As part of his argument in favor of free trade, Bhagwati (1993) argues that rising income and freer trade enable countries to import pollution-fighting technologies. We will discuss Bhagwati's arguments in more detail in Section 5.1.2 when we analyze the impacts of trade on the environment.

† The limited amount of empirical data on the link between growth and the environment is primarily focused on developed nations. However, a study by Feridun et al. (2006) of Nigeria reached conclusions similar to those of S. Chua (1999). Feridun et al. (2006, p. 39) found evidence that "trade intensity, real GDP per square kilometer and GNP are positively related to environmental degradation indicating that the technique, scale, and total effects of liberalization are detrimental to the environment."

S. Chua's (1999) findings show that there is no reason to believe that growth will be the solution to environmental degradation, and that countries will naturally grow out of their environmental problems (Table 5.1).^{*} To the contrary, he suggests that **well-designed environmental policies, coordinated with economic policies, can encourage technological innovation in order for technical effects to outweigh the negative scale effects of economic growth on the environment.**

In agreement with S. Chua's (1999) expectations, Aslanidis and Xepapadeas (2008) demonstrate a "turning point" for SO₂ and smoke on the basis of a "regime-switching model" for countries that adopt more stringent environmental controls leading to decreases in emissions.

However, using material flows as a proxy for environmental degradation, Vehmas et al. (2007, p. 1162, emphasis added) find a "weak de-linking" of material flows and economic growth in the EU during the period 1980–2000 and conclude that while "the material intensity of the economy has generally decreased due to increased efficiency, **the absolute amount of material use has increased.**"

In general, the existing empirical studies point to an increasing level of environmental impact – when one considers types of pollution – from economic development/growth. This finding calls into question the adequacy of the present emphasis on dematerialization, efficiency improvements, and environmental regimes for decreasing environmental impacts as a whole (see the later discussions of environmental policy and technological changes in Chapters 7, 8, and 9). This is especially important if we add to the picture Ekins's (1995) claims that:

- 1 Economic growth creates more absolute environmental damage;
- 2 The resources that could be spent on environmental protection are not in fact allocated in this way;
- 3 Much environmental damage cannot be repaired; and
- 4 Countries with stringent environmental regulations are being increasingly pressured by competitiveness to relax them.

5.1.1.2 The relationship between environmental regulation and economic growth

Having considered the impacts of economic growth on environmental quality, we now reverse the question and discuss the potential impacts of environmental protection on economic growth. We are interested in answering this question: **how do activities that aim at preserving environmental quality (environmental regulation) affect economic growth?**[†]

The common perception of the factual basis for the antagonism between economists and environmentalists is that environmental regulation hurts the economy,[‡] affects productivity, and leads to a slowdown of economic growth. It is also traditionally believed that environmental regulation affects international competitiveness by increasing the costs of production. Therefore, in a world of free movement of capital, it is argued that

^{*} S. Chua (1999) suggests that the observation of inverted-U-shaped curves could lead to that conclusion. Nevertheless, it is worth remembering that previous authors who have shown such a relationship insisted that the leveling off was not an automatic process and necessitated a policy response.

[†] The corollary of this question is, does environmental regulation affect the employment outlook of a country? The debate on the interactions between the environment and employment will be our focus in Section 5.1.2.3.

[‡] This opinion is shared by Bhagwati (1993).

Table 5.1 Summary of the environmental–income relationship for different indicators^a

<i>Study (reference) (type)</i>	<i>Environmental Indicator^b</i>	<i>Shape</i>	<i>1st TP (U.S. \$)</i>	<i>2nd TP (U.S. \$)</i>
Sulfur dioxide				
Grossman & Krueger (6) (RE)	Urban concentration	R5	4,100	14,000
Grossman & Krueger (6) (FE)	Urban concentration	R5	~ 4,300	na
Shafik (5)	Urban concentration	R3	3,700	
Grossman (1)	Urban concentration	R5	4,100	14,000
Grossman (1)	Urban concentration (U.S.)	R5	13,400	24,000
Grossman & Krueger (7)	Urban concentration	R5	4,100	14,000
Selden & Song (4) (FE)	Emission per capita	R3	8,900 ^c	
Selden & Song (4) (RE)	Emission per capita	R3	10,700	
Panayotou (3)	Emission per capita	R3	3,000	
Suspended particulates				
Grossman & Krueger (6) (RE)	Urban concentration	R1	–	
Grossman & Krueger (6) (FE)	Urban concentration	R2	–	
Shafik (5)	Urban concentration	R3	3,300	
Grossman (1)	Urban concentration (U.S.)	R3	16,000	
Grossman & Krueger (7)	Urban concentration	R1	–	
Selden & Song (4) (FE)	Emission per capita	R3	9,800	
Selden & Song (4) (RE)	Emission per capita	R3	9,600	
Panayotou (3)	Emission per capita	R3	4,500	
Dark matter (smoke)				
Grossman & Krueger (6) (RE)	Urban concentration	R5	5,000	10,000
Grossman & Krueger (6) (FE)	Urban concentration	R5	~ 4,000	10,500
Grossman (1)	Urban concentration	R5	4,700	10,000
Grossman & Krueger (7)	Urban concentration	R5	6,200	na
Nitrogen oxide				
Grossman (1)	Urban concentration	R3	18,500	
Selden & Song (4) (FE)	Emission per capita	R3	12,000	
Selden & Song (4) (RE)	Emission per capita	R3	21,800	
Panayotou (3)	Emission per capita	R3	5,500	
Carbon monoxide				
Grossman (1)	Urban concentration	R3	22,800	
Selden & Song (4) (FE)	Emission per capita	R3	6,200	
Selden & Song (4) (RE)	Emission per capita	R3	19,100	
Carbon dioxide				
Shafik (5)	Emission per capita	R2	–	
Holtz-Eakin & Selden (2)				
Level of emissions per capita	Emission per capita	R3	35,400	
Log of emissions per capita		R3	> 8 million	
Dissolved oxygen (water pollution)				
Shafik (5)	Concentration	R1 ^d	–	
Grossman (1)	Concentration	R4 ^c	8,500	
Grossman & Krueger (7)	Concentration	R4 ^c	2,703	

(Continued)

Table 5.1 (Continued)

<i>Study (reference) (type)</i>	<i>Environmental Indicator^b</i>	<i>Shape</i>	<i>1st TP (U.S. \$)</i>	<i>2nd TP (U.S. \$)</i>
Fecal coliform (water pollution)				
Shafik (5)	Concentration	R5	1,400	11,400
Grossman (1)	Concentration	R3	8,500	
Grossman & Krueger (7)	Concentration	R3	8,000	
Total coliform (water pollution)				
Grossman (1)	Concentration	R5	No downturn ^c	
Grossman & Krueger (7)	Concentration	R5	3,043	8,000

a Table adapted from Ekins (10:808). Key; R1, linear, downward-sloping; R2, linear, upward-sloping; R3, quadratic, inverted-U; R4, quadratic, U; R5, cubic; TP, turning points for the quadratic and cubic functions; na, not available; RE, random-effects estimation; FE, fixed-effects estimation.

b Unless indicated, global data from different countries are used.

c The cubic function continuously rose with income.

d Because this is an indicator of environmental quality rather than degradation, this shape indicates continually worsening environmental quality with income.

e Because this is an indicator of environmental quality rather than degradation, this shape indicates continually improving environmental quality after the turning point income.

Source: S. Chua (1999, pp. 397–398). Reproduced with permission.

1 Grossman, G. (1993). *Pollution and Growth: What Do We Know?* CEPR DP-848. Cent. Econ. Policy Res., London.

2 Holtz-Eakin, D., and T. Selden (1992). *Stoking the Fires? CO₂ Emissions and Economic Growth*. WP-4248. Natl. Bur. Econ. Res., Cambridge, MA.

3 Panayotou, T. (1993). *Empirical Tests and Policy Analysis of Environmental Degradation at Different Stages of Development*. World Employment Programme Res. Work. Pap., WEP 2–22/WP 238. Int. Labour Off., Geneva.

4 Selden, T. M., and D. Song (1994). "Environmental Quality and Development: Is There a Kuznets Curve for Air Pollution Emissions?" *J. Environ. Econ. Manage.* 27: 147–162.

5 Shafik, N. (1994). "Economic Development and Environmental Quality: An Econometric Analysis." *Oxford Econ. Pap.* 46: 757–773.

6 Grossman, G. M., and A. B. Krueger (1993). "Environmental Impacts of a North American Free Trade Agreement." *The Mexico-U.S. Free Trade Agreement*. P. M. Garber. Cambridge, MA, MIT Press: 13–56.

7 Grossman, G. M., and A. B. Krueger (1995). "Economic Growth and the Environment." *Q. J. Econ.* 110: 353–378.

investments tend to relocate to regions with lax environmental regulation (the pollution-haven hypothesis).*

In his article on economic growth, liberalization, and the environment, S. Chua (1999) reviews the literature that attempts to answer this question. In particular, he analyzes the results of studies of the costs of abatement of carbon emissions, criticizes the methodologies used, and arrives at three important conclusions:

- 1 Most of the studies do not take into account the technique effect in their models, which neglect both the importance of technological innovation in reducing emissions and the fact that innovation can be enhanced by environmental policy.[†]

* The effects of stringent environmental regulation on trade, international competitiveness, and FDI will be analyzed in Section 5.1.2.3.

† As we will see in Section 5.1.2.3, Ashford et al. (1979), Ashford et al. (1985), and Porter and van den Linden (1995) argue that technological innovation is encouraged by environmental regulation, and this improves both sectoral and international competitiveness.

- 2 None of the studies integrates into their models the potential beneficial feedback of a better environment on the whole system. Examples of such benefits include better worker health, which in turn enhances productivity and better soil/water quality, which improves ecosystem health.
- 3 Most of the studies come up with relatively low costs of reductions in carbon emissions, with an average annual growth rate decline of the order of 0.1 percent.

Therefore, S. Chua (1999, p. 404, emphasis added) concludes “**that environmental control does not incur excessive economic costs nor significantly retard economic growth. Furthermore, the costs of pollution control are often offset by economic benefits from higher productivity of resources, including labor.**”

5.1.2 Trade (globalization) and the environment

Even more heated and passionate than the debate on economic development/growth and the environment is the debate on trade and the environment. As we have seen in the previous section and in Chapter 3, the mere concept of economic growth is somewhat contested by some scholars, nongovernmental organizations, and representatives from developing countries, but this opposition is relatively limited. In the political arena, almost everywhere, the centerpiece of concern focuses on economic growth. The belief that economic growth is the cure to all problems remains predominant. On the other hand, the opposition to free trade is embraced by a much larger audience, including not only nongovernmental organizations but also numerous politicians and representatives of the economic sector. Free trade is far from being considered by all actors and thinkers as something necessary to achieve (sustainable) development. It is often voiced that *free trade is not fair trade*. This view is enhanced by the perceived negative impacts of free trade on the environment by environmentalists, impacts that are strongly contested by free-trade advocates. More recently, concern has been increasingly voiced that free trade accelerates job losses in developed nations (Bivens 2017). Therefore, we start our discussion by asking: **what are the possible environmental impacts of trade liberalization or protectionism?**

At the center of the debate about the impacts of free trade on the environment lies the existence of negative *externalities*. As we defined them earlier, externalities are costs that arise from an activity but are not integrated into the total cost of the activity. For example, an unregulated factory that is polluting the air is creating an environmental and potentially public health externality. An advertising campaign to promote the use of video display screens in the driver’s field of vision in automobiles creates a social externality by increasing the risk of car accidents and pedestrian fatalities. These are examples of market failures: the environmental or social costs associated with the activity are externalized. When the externality is integrated into the total cost of the activity, it is said that the externality is internalized. For example, a factory can be forced by environmental regulation to bear the cost of polluting the air by having to comply with pollution standards or to pay a tax for the environmental harm caused by pollution. In this case, public intervention attempts to internalize externalities.

Some authors (Cole 2000) argue that trade by itself does not have a negative impact on the environment.* Through this lens, environmental harm is caused by the following failures:

- **Market failures:** the market fails to internalize externalities or “to properly value and allocate environmental goods, with the result that prices do not cover the full social costs of production” (ibid., p. 23). Cole recalls the three reasons for market failure

* This perspective reflects the view that some environmental harm is acceptable so long as the marginal benefits of an economic activity are equal to or greater than its environmental costs.

that were first outlined by the OECD (1994, pp. 23–24): (1) the costs of environmental harm are not being included in the price of goods and services; (2) the market fails to take into account the full value that society places on an environmental asset; and (3) there is a lack of property rights for certain environmental assets (the resource is considered “free of charge”).

- **Intervention failures and distortions:** these “occur when government policy creates, exacerbates or fails to remove market failures” (Cole 2000, p. 24).

5.1.2.1 *The positive impacts of free trade on environmental quality*

Free-trade advocates generally argue that the net effects of liberalized international exchange on the environment are positive. Their arguments are as follows:

- **Free trade favors economic growth, and the growth of income has positive effects on the environment because of the increased demands for a clean environment and the ability to pay for them.**
- **Free trade favors the international exchange of technology and environmentally sound products and services.**
- **Free trade induces the removal of trade-distorting and environment-harming policies.**

As we have seen in Section 5.1.1 on development and the environment, free-trade advocates oppose the argument that economic growth harms the environment. To the contrary, they believe in inverted-U-shaped relationships or environmental Kuznets curves.* Bhagwati (1993) argues that economic growth enables governments to raise taxes to protect the environment and increases the demand for higher environmental quality. Similarly, according to Cole (2000), the expansion of the scale of economic activity through liberalized trade increases the financial resources available to improve environmental quality. He states that in developing countries, growth in income is essential if they are to improve the quality of their environment. He recalls the example of Mexico, given by Voigt (1993), where the lack of financial resources has limited the ability of the government to control the environmental effects of development.

A second argument used by free-trade advocates to promote international liberalized exchange emphasizes the benefits of the free trade of environmentally cleaner technologies, products, and services. For Bhagwati (1993), freer trade and rising income enhance the exchange of pollution-fighting and resource-efficient technologies: trade liberalization plays a role in expanding the potential market for environmentally cleaner products, services, and technologies, and, in turn, this market expansion boosts technological innovation and trade (OECD 1994). Cole (2000) concurs that free trade can be beneficial to the environment through the technique effect: by allowing the expansion of markets, free trade increases access of countries to cleaner technologies, products, and services, but also to more efficient production methods. Therefore, output might be produced in a much cleaner and more efficient way following trade liberalization.

It appears that proponents of free trade consider a kind of “natural virtuous circle” between trade liberalization (market expansion) and technological innovation, so that environmental quality eventually benefits from increased international exchanges. However, environmental quality can suffer from the scale effects of trade, and the total burden for the environment could possibly be higher.

* For a discussion of the evidence against environmental Kuznets curves, see Sections 1.3.2 (in Chapter 1) and 5.1.2.1.

Finally, another advantage of trade liberalization is the removal of trade-distorting and environment-damaging policies. As Cole (2000, p. 27) states: "The very existence of such measures means that resources are not being allocated as efficiently as they could be, and thus both the location and intensity of technology, production and consumption are distorted." In particular, Cole (2000) gives the example of the Common Agricultural Policy (CAP) of the European Union. The CAP system, which guarantees prices to farmers, has resulted in production of food considerably in excess of the market's requirements. Besides not enhancing an effective allocation of resources, the CAP system has adverse impacts on the environment. Not only does it create an incentive for farmers to produce more using more intensive methods of production (and more artificial inputs), but the excess foodstuffs also represent a huge waste that needs to be disposed of. Similarly, Reijnders (2003) states that subsidies distort the efficient use of physical inputs. In particular, he argues that the removal of subsidies of energy and water would improve energy and water efficiency. He also adds that subsidies of pesticides and fertilizers, road and air transport, and raw materials have disfavored cleaner production programs.

One of the reasons for defending vehemently the environmental benefits of free trade is that above all, free-trade advocates fear "green protectionism," where environmental standards would be used as barriers to trade and limit the efficiency gains from world trade (Cole 2000). Bhagwati (1993) stresses that countries have the right to prioritize the environmental problems they want to tackle in their own way. Furthermore, he rejects what he recalls the "eco-imperialism" of countries that try to impose their values on other countries, when Northern countries have caused some of the most adverse environmental impacts (Bhagwati 1993, p. 45). According to Bhagwati (1993), the tuna-dolphin case (see Chapter 11 for a discussion of environment-related trade disputes) provides an example of eco-imperialism of the United States over Mexico. In his opinion, "the simultaneous pursuit of the two causes of free trade and a protected environment often raises problems [. . .]. But none of these conflicts is beyond resolution with goodwill and [. . .] imaginative institutional innovation" (Bhagwati 1993, p. 49).

Rather than restricting liberalized international exchanges, free-trade advocates believe that **externalities should be tackled directly**.^{*} They also urge environmentalists to use methods such as **lobbying countries with poor standards and boycotting certain commodities**, rather than attacking free trade (Bhagwati 1993). Finally, they believe in the potential of **voluntary approaches** to promote both free trade and the quality of the environment.

5.1.2.2 *The adverse effects of free trade on the environment*

The optimistic picture painted above is contested by many – for example, environmentalists, numerous scholars, opponents of globalization, some nongovernmental organizations, and many people in developing countries. In their opinion, Bhagwati's (1993) position that free trade favors the efficient allocation of resources and a better environment is purely theoretical. In the absence of internalization of externalities, it appears that trade is rather conducted on the "back of the environment" (as well as by exploiting workers). By encouraging trade with nations that do not internalize their externalities, free trade leads to inefficient allocation of resources and harms the environment (Daly 1993).

The prevalence of externalities, due in part to the difficulty of internalization, means that trade liberalization may exacerbate environmental damage. One reason for this

* Bhagwati (1993) sees nothing wrong with countries "trading on externalities," e.g., choosing to suffer environmental damage to gain economically.

is the scale effect associated with free trade. It was stated [. . .] that perfectly free trade will ensure that resources are utilized in the most efficient manner possible, thus minimising inputs per unit of output. Indeed, this is the case in a static framework. However, once we enter a dynamic framework then it is likely that liberalised trade will lead to an expansion of markets and hence economic growth. The increase in income associated with such growth may mean that nations now find themselves with greater resources to protect the environment, but the environmental impact of such an expansion in the scale of production may be considerable.

(Cole 2000, p. 27, emphasis added)

Similarly, Daly (1993) argues that the environmental costs of growth increase faster than its potential benefits, dampening the argument that growth generates wealth that can be used to protect the environment.

A second reason for questioning the supposedly more efficient allocation of resources and the better environment brought by free trade relates to the **different environmental (and labor) standards among nations**. First, comparative advantage can arise from differences in environmental standards. Countries are likely to specialize in those sectors where their country has the weakest environmental regulation, and, as a result, the production *composition* effect of trade liberalization will lead to a decrease of environmental quality (Cole 2000).^{*} Second, international competition arising from free trade can lower costs by keeping environmental standards low in developing countries and providing pressure to lower, or at least not to raise, those standards in the industrialized nations,[†] rather than through increasing efficiency (Daly 1993). Further, the ease with which capital can move between nations creates an additional force to lower standards in an effort to retain or attract capital (Daly 1999). The idea that free trade and increased competition among nations will lead to a lowering of environmental standards is usually referred to as the “race to the bottom.”

Some authors, and free-trade advocates in particular, contest the existence of the “**race to the bottom**.” Vogel (2000) defends the existence of the opposite effect: he believes that under certain circumstances, global economic integration can lead to the strengthening of consumer and environmental standards, resulting in a “race to the top.” However, even though he contends that the “race to the bottom” is not observed in practice, he mentions Esty and Geradin’s (2000) supposition that international competitiveness and

^{*} The rationale for trade is to exploit differences between nations; if there were no differences, trade would be worthless. Although the comparative advantage of nations is typically based on natural resource endowments and the skills and availability of labor, it can also be extended to include differences in national environmental and labor standards (Sinden 2008). From an economic perspective, it can be argued that if the standards in each nation were efficient – that is, they reflected the true preferences of citizens – then trade that exploits a comparative advantage in lower standards would actually be welfare enhancing for all trading parties. Such an argument that favors free trade without the need to raise/harmonize standards fails to acknowledge the reality that regulations in developing (and developed) regions are often inefficient – that is, the “wealth effect” lowers the stringency of standards because there is less willingness/ability to pay for better working/environmental conditions, and there are political/market failures that lower the actual standards beyond those differences and hence contribute to inefficient standards (Gitterman 2002; Sinden 2008). The result of inefficient standards is a welfare loss in the host nation. Therefore, increasing the volume of trade will further promote a loss of welfare. Sinden (2008) argues that the solution to this problem is the upward harmonization of standards. However, harmonizing standards to the most stringent existing standard may not be sufficient to address many critical environmental problems and ignores changes in technology that lead to new dynamic efficiency.

[†] This may also be true for employment standards.

differences in environmental regulation can have a “political drag” effect. This means that developed countries become reluctant to enforce higher environmental standards, while rapidly industrializing countries remain “stuck at the bottom” of environmental regulation (Porter 1990), “dragging down” standards in other poor countries.

Gitterman (2004) argues that the harmonization or convergence of standards is not driven by Vogel’s notion of internationally oriented producers, but by political and institutional factors. In particular, Gitterman (2004, pp. 340–341) contends that the stringency of standards depends on “the national *preferences* of the member states or trading partners (and political parties with control); the formal institutional and *decision rules* for aggregating policy preferences; and the *collective action* problem of joint decision making among many governments.” Gitterman (2004, p. 333) concludes that the expansion of trade has not resulted in a race to the top or bottom, and that “integration appears to result in an incremental march toward common regional and international minimum rules and norms.”

The **level of corruption** in a given country also has to be taken into account in evaluating the effects of trade liberalization on the stringency of environmental (and labor) regulation (Damania et al. 2003; Cole 2007). In particular, Damania et al. (2003) show that corruption reduces environmental policy stringency.

Besides claiming that free trade leads to the inefficient allocation of resources and environmental harm, Daly (1993, p. 53, emphasis added) adds that **free trade is problematic for the goal of a “sustainable scale of total resource use.”** As we have discussed in Section 1.3.1 in Chapter 1, Daly (1993, p. 56) advocates the steady-state economic paradigm, which means that “the economy is [. . . an] open subsystem in a finite, nongrowing and materially closed ecosystem.” He considers that there are limits to economic growth because there is an optimal level of throughput for an economy. Therefore, free trade, by favoring increases in growth and throughput and allowing countries to exceed their regenerative and absorptive capacities by “importing” these capacities, will result in economies overshooting their optimal scales (Daly 1993, p. 57). The fact that the benefits and the costs of environmental exploitation tend to be separated in time (that is, there are “divergent time horizons”) increases this tendency. In addition, the efficiency of modern transportation systems creates a “distancing effect,” whereby consumers are unable to know how their purchasing habits are affecting the environment in another country (Princen 2002).

Finally, the question of free trade and transportation deserves some attention. Daly (1993) states that the gains from free trade would be highly reduced if the subsidies of the energy-intensive transportation costs associated with increased global trade were to be deducted. Moreover, Cole (2000) argues that trade liberalization and the subsequent expanding volume of trade directly affect the environment by favoring increased transportation, because fuel prices do not fully internalize environmental costs associated with transportation. Thus, an unsustainable transportation system is linked to unsustainable consumption (Hall 2006).

It seems that environmentalists and some economists tend not to believe in the voluntary approaches and the “natural virtuous circle” that promote free trade and protect the environment simultaneously. But the opposition of economists and environmentalists in favor or disfavor of free trade is not the real issue, according to Daly (1993). What really matters is what regulations and goals are legitimate. For example, he argues that **countries that internalize their externalities should have the right to impose trade tariffs on those that do not.*** Similarly, he favors a **regionalization of trade among like partners.**

* Not all such tariffs comport with current WTO rules (see Chapter 11).

On the basis of the conflicting results of multiple studies, S. Chua (1999) concludes that **the effects of trade liberalization on the environment are relatively small compared with the effects of growth and the structural changes that would have taken place anyway.**

*5.1.2.3 The effects of stringent environmental regulation on trade and the environment**

The general perception of the relationship between environmental policy and international trade is that the international competitiveness of the countries that enforce stringent environmental regulation is affected. On the basis of this hypothesis, countries with a stringent environmental policy feel that they suffer from the unfair competition of their “dirtier” trade partners and call for the harmonization of environmental standards in international trade arrangements. Moreover, the harmonization of environmental standards is also advocated by those who fear the “race to the bottom” mentioned earlier. The following paragraphs will challenge this hypothesis and review the respective arguments of proponents and opponents of the harmonization of environmental standards.[†] However, it is important to commence by restating the distinction between the two categories of environmental problems that countries face – that is, **(1) domestic environmental problems and (2) global environmental problems** – because these problems call for different kinds of policy responses.

Both S. Chua (1999) and Cole (2000) dismiss the general perception that stringent environmental policy affects international competitiveness by arguing that research conducted on that topic shows mixed results.

Proponents of the harmonization of environmental (and health and safety) regulation – see Esty (1994) and Sinden (2008) – argue that while earlier history may not reveal a strong differential impact on trade or the existence of pollution havens, recent experience in Asia, particularly China, indicates that lax health, safety, and environmental regulation and enforcement do confer a comparative advantage in the trade of goods. However, a paper on the effects of regulation on the structure of bilateral trade between fourteen countries in the EU and China, and in eighteen manufacturing industries between 1996 and 2006, concludes that China does not enjoy a measurable comparative advantage over the fourteen EU countries (Marconi 2010).

According to Bhagwati (1993), the request for harmonization of environmental standards is unfair, and he defends the idea that each country has the right to prioritize the environmental problems it decides to tackle. In other words, this means that he recognizes that environmental regulation can affect the international competitiveness of countries, but he disapproves of the call for the introduction of environmental standards in trade terms. In his opinion, differences of standards between countries are legitimate (he calls them “Cross-Country Intra-Industry differences”), especially those that target domestic environmental problems: countries should have the right to value environmental goods differently and to trade off between pollution and income. Therefore, while the United States and Europe consider differences in environmental regulation ecodumping or unfair subsidies, Bhagwati (1997) treats the demands for so-called fair trade (and for inclusion of environmental and labor standards in the World Trade Organization) as “intrusionist” measures from powerful countries that “imagine” threats from elsewhere

* Here we discuss how environmental regulation affects decisions to invest in various economies. The possible positive effects of stringent regulation on technological change with resulting economic benefits that offer a competitive advantage to the innovator are discussed in Part III of this book.

† Chapter 11 on trade regimes will delve more deeply into this topic.

and wish to impose policy changes on the rest of the world. However, he recognizes that global solutions for global environmental problems are required.

Ashford et al. (1979), Ashford et al. (1985), Porter (1991), and Porter and van den Linden (1995) defend the opposite argument. On the basis of their research, conducted, respectively, in the late 1970s and early 1990s, they argue that stringent environmental regulation can improve the comparative advantage of the sector and country that adopt and enforce them, at least in developed societies. The rationale is that properly designed environmental policy will stimulate technological innovation and offset initial compliance costs through technology modernization.*

5.1.3 *Global investment and the environment*

A third subject of discussion in the debate over the economy and the environment relates to investments and the transfer of funds across countries. Funds can originate from either private or public sources. The following discussion outlines the relationships between the environment and both foreign direct investment (FDI), that is, private-sector investment, and official (government) development assistance (ODA). Regarding FDI, it is important to understand the nature of investment decisions and the determinant factors that govern the process. Thus, we will address the following questions: **(1) what is the effect of globalized investment on the environment?** and **(2) what is the effect of environmental regulation on investment decisions?** Because existing data do not appear to provide clear answers to these questions (S. Chua 1999; ECLAC and UNEP 2001; ECLAC 2002; Cohen and Tubb 2017), the following discussion will look more qualitatively at the potential links between the environment and private and public investments, respectively.†

Over the two decades before the financial crisis of 2008, **FDI** grew explosively (Figure 5.3). This growth in FDI has meant that private capital investment now outstrips public (government) investment in developing regions. In 2016, \$646 billion of global FDI flows were directed to developing countries after experiencing a decline of 14 percent from 2015 (\$752 billion in 2015, and \$704 billion in 2014) (UNCTAD 2017, p. 42). While ODA has also grown and did not deviate from its growth trajectory following the financial crisis (Figure 5.4), it is only around one-tenth of the FDI flows. In 2015, developing countries witnessed a decline in the net ODA to \$152 billion after having reached a peak of \$161 billion in 2014 (OECD 2017a). Thus, it is private investment, not government development assistance, that is the primary driver of growth in developing countries.

This surge in private capital can be of mutual benefit to the developed and the developing worlds. FDI not only injects money into the recipient's economy but also brings with it technology, managerial skills, and market access, thereby accelerating growth and development. It may even upgrade worker skills and create new jobs that might otherwise not have existed (Poole 2013; Gorodnichenko et al. 2014; Hausmann et al. 2016). Despite the positive spillovers, some researchers caution that FDI can lead to wage inequality, and there should be domestic policies in place to address wage polarization (Peluffo 2015; Davies and Desbordes 2015). To a certain extent, FDI investments are a vote of confidence. They flow into a country because investors are attracted by the country's policies and institutions and its long-term growth prospects.

* For a more detailed discussion of the weak and strong forms of the "regulation-induced-innovation hypothesis," see Section 8.3.5 in Chapter 8. See also the extensive European literature on the strengths and limitations of "ecological modernization" (Ashford 2002; Jänicke 2008).

† S. Chua (1999) argues that this lack of evidence is due to three factors that have not been considered in the analyses: environmental innovation, international diffusion of clean technologies, and the economic benefits of having a better environment.

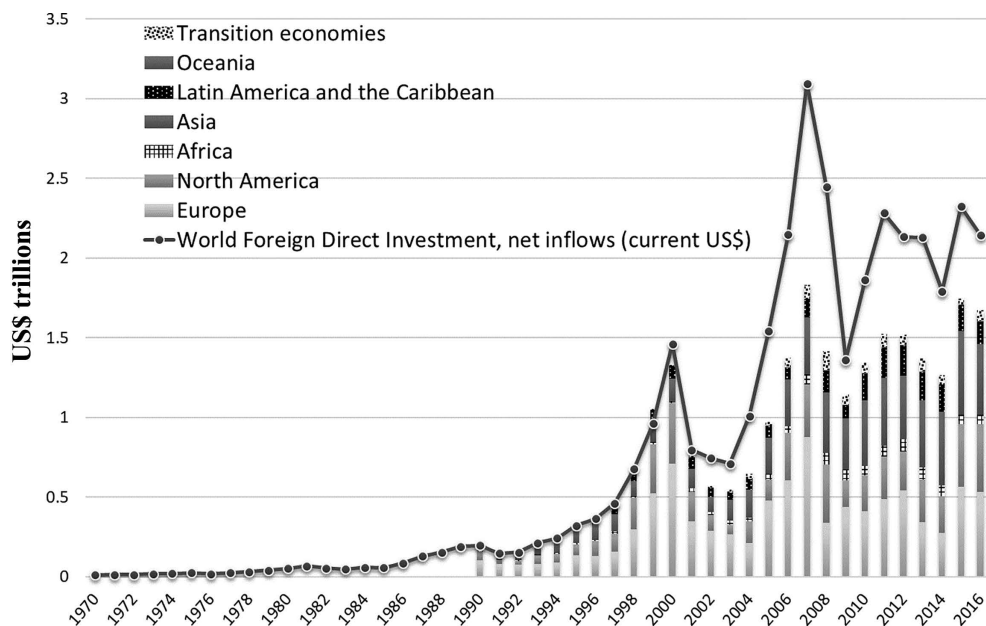


Figure 5.3 World Foreign Direct Investment (net inflows) and global distribution of FDI

Note: Foreign direct investment (FDI) is the net inflows of investment to acquire a lasting interest in or management control over an enterprise operating in an economy other than that of the investor.

Sources: For the World FDI net inflows: adapted from World Development Indicators. <http://databank.worldbank.org/data/home.aspx>. For the Global Distribution of FDI per region: adapted from UNCTAD. World Investment Report 2017: Annex Tables. <http://unctad.org/wir>.

Proponents of financial globalization point out that over the past decade, tens of thousands of companies have crossed their national boundaries in search of new markets, cheaper labor, and higher profits, resulting in a powerful transfer of advanced technologies, products, and managerial experience to the developing world, as well as a boost of wages, creation of jobs, and improvements in the quality of life for millions of people. Skeptics, on the other hand, point to the various adverse effects of this surge in international investment: the often terrible working conditions and low wages, the damage to the environment, and widespread corruption, as well as the exposure of weak economies to destructively high volatility shocks (Chesky 1998). All these issues have strong elements of truth in them, and the economic and environmental implications of financial globalization remain controversial (A. S. Miller 2000, p. 1230).

One significant challenge facing governments of developing nations is how to attract private capital while at the same time ensuring that this capital is invested in ways that promote – or at least do not prevent – *sustainable* progress. The problem is that many developing countries often bargain with foreign investors from the industrialized world from a position of weakness. This difference in power can result in developing countries bearing environmental and social costs in order to attract investors and acquire higher levels of private capital needed for economic growth (A. S. Miller 2000). For several decades now, developing countries have functioned as the main exporters of natural resources whose

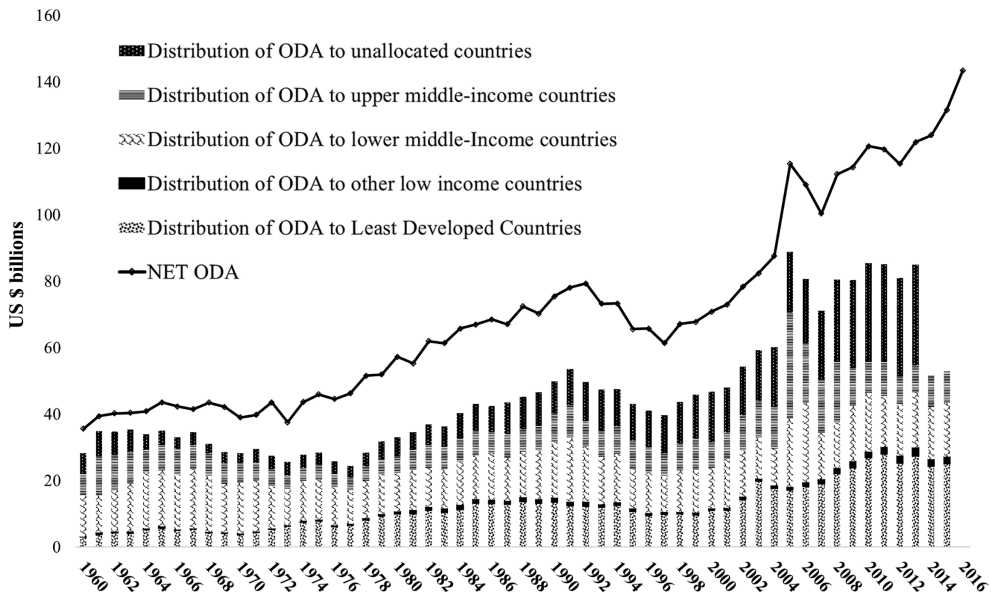


Figure 5.4 Net ODA and distribution of net ODA (USD)

Notes:

High-income economies are those in which 2013 GNI per capita was \$12,746 or more.

Upper middle-income countries are those in which 2013 GNI per capita was between \$4,126 and \$12,745.

Other low-income countries are those in which 2013 GNI per capita was \$1,045 or less.

Lower middle-income countries are those in which 2013 GNI per capita was between \$1,046 and \$4,125.

Source: OECD (2017a). Net ODA and Distribution of Net ODA (indicators). doi: 10.1787/33346549-en

extraction and preparation for export have a dramatic impact not only on their environment but also on levels of human health and the incidence of many illnesses.

In previous sections, we have discussed the pollution-haven hypothesis or “race to the bottom” (the “Delaware effect”) and the “California effect” or “race to the top” (see also Section 11.3.1 in Chapter 11). Interestingly, the presence of limited amounts of FDI could create a dynamic where environmental standards are strengthened in the developing nations and reduced in the developed nations to attract private capital, resulting in a “**race to the middle.**” The basic rationale is that developed nations, in an effort to remain competitive, face downward pressure on environmental standards, whereas developing nations, in response to international institutions and green consumers, face upward pressure on their environmental and health and safety standards. The special case of the European Union is said to exhibit “a race to Brussels” in which the regional environmental standards represent more stringency than those of the least aggressive EU members (Holzinger and Sommerer 2011).

The lack of any convincing evidence about the extent to which companies invest through FDI in nations on the basis of regulatory, tax, or wage arbitrage suggests that **the presence of a stable regulatory system might be just as important as a weak system in attracting FDI** (Rodrik 1996; Gitterman 2004). The ability of foreign firms to secure a return on their investments is linked to their ability to secure legal protection for their activities within a nation. Such legal protection pertains to well-defined property rights

and legal codes that are stable (or predictable) and not subject to frequent changes, permitting sound business planning. Thus, firms seeking to invest in foreign markets might also push for more stable and stringent regulations, reinforcing the idea of a “race to the middle” described above, or at least not a “race to the bottom.”

The **Global Sullivan Principles** provide a different mechanism through which foreign firms investing private capital in developing nations could create upward pressure, particularly on social regulations. High-standard firms that endorse the principles (see Box 5.1) agree to support far-reaching economic, social, and political justice objectives that have their roots in South Africa’s anti-Apartheid era. The Global Sullivan Principles require firms to extend their domestic standards and procedures to their overseas operations. In effect, the principles require a firm that is investing in a developing nation to extend its corporate social responsibilities to all of its operations and not to apply them only to regions where government and society have a watchful eye on their activities.

Box 5.1 The Global Sullivan Principles

The principles

As a company which endorses the Global Sullivan Principles we will respect the law, and as a responsible member of society we will apply these Principles with integrity consistent with the legitimate role of business. We will develop and implement company policies, procedures, training and internal reporting structures to ensure commitment to these Principles throughout our organization. We believe the application of these Principles will achieve greater tolerance and better understanding among peoples, and advance the culture of peace.

Accordingly, we will:

- Express our support for universal human rights and, particularly, those of our employees, the communities within which we operate and parties with whom we do business.
- Promote equal opportunity for our employees at all levels of the company with respect to issues such as color, race, gender, age, ethnicity or religious beliefs, and operate without unacceptable worker treatment such as the exploitation of children, physical punishment, female abuse, involuntary servitude or other forms of abuse.
- Respect our employees’ voluntary freedom of association.
- Compensate our employees to enable them to meet at least their basic needs and provide the opportunity to improve their skill and capability in order to raise their social and economic opportunities.
- Provide a safe and healthy workplace; protect human health and the environment; and promote sustainable development.
- Promote fair competition including respect for intellectual and other property rights, and not offer, pay or accept bribes.
- Work with governments and communities in which we do business to improve the quality of life in those communities – their educational, cultural, economic

and social well-being – and seek to provide training and opportunities for workers from disadvantaged backgrounds.

- Promote the application of these Principles by those with whom we do business.

We will be transparent in our implementation of these Principles and provide information which demonstrates publicly our commitment to them.

Source: University of Minnesota, Human Rights Library, *The Global Sullivan Principles of Social Responsibility*, <http://hrlibrary.umn.edu/links/sullivanprinciples.html> (accessed December 11, 2017).

One way to enhance the impact of the Global Sullivan Principles would be to require all firms that endorse the principles to extend their practices to their in-country suppliers and subcontractors. Although this extension is likely to be resisted by multinational corporations because of the implementation challenges, such an extended responsibility scheme could have a significant impact on enhancing the social, economic, and environmental performance of firms within a developing nation. For instance, it would potentially affect all firms within a manufacturing supply chain, from resource-extraction companies to the firms responsible for the disposal of consumer products.*

In addition to the Global Sullivan Principles, there are other less ambitious but nevertheless important industry-led initiatives designed to raise standards. For example, the Global Social Compliance Programme (GSCP) is a nonbinding effort that provides tools and practices to develop a common framework that aims to “generate improvement of working and environmental conditions at [the] supplier level” (Vazquez 2014).

With regard to public funding for development, it is important to consider the impacts of **official development assistance (ODA)**, **investments backed by export credit agencies (ECAs)**, and **investments/loans by multilateral development banks (MDBs)** on the environment.

The wider recognition of poverty alleviation, environmental protection, and development has expanded to questions of environmental financing, especially in the context of climate change (Eyckmans et al. 2016). A wide range of development organizations from multilateral institutions, to national governments, to NGOs, have reconsidered the goals of their programs and projects in order to respond to, and properly incorporate, the growing awareness of environmental concerns. A significant amount of climate-related finance is in the form of ODA (OECD 2015). From 2010 to 2012, 80 percent of climate-related finance was in the form of ODA (Kharas 2016), increasing to 84 percent from 2013 to 2014 (Griffiths 2017). Currently, merging climate-related finance with ODA budgets has become common practice, and it is driven by the fact that new and additional climate finance lacks both a clear definition and a method to record statistics on official development assistance (ODA) (UNCTAD 2015). Therefore, it has become difficult to separate “official climate finance from traditional ODA flows from climate finance, raising concerns” for double-counting (UNCTAD 2015). The lack of statistical methodologies for reporting climate financing is present in “multilateral agencies, bilateral export

* See the discussion in Chapter 10 of “extended producer responsibility” for electronic equipment, products, and waste under the EU’s WEEE Directive.

credit agencies, or the co-financing by private firms of associated climate-related projects” (Kharas 2016).

In the report “Climate Finance in 2013–14 and the USD 100 Billion Goal,” the OECD estimated that mobilized public and private climate finance from developed countries reached \$52 billion in 2013 and \$62 billion in 2014. This increase has been attributed to multilateral banks. In the 2009 Copenhagen meeting, developed countries committed to provide \$100 billion a year by 2020 to address the needs posed by climate change in developing countries (UNFCCC 2009). Further, even if ODA is considered as supporting/promoting “sustainable” development, it is likely that some sizable component of the funding aligns with the donor nation’s strategic development or security priorities (Gardner and Lugo 2009).

Notwithstanding the challenges, bringing environmental concerns into the realm of international development assistance has affected strategies for sustainable development in two important ways (Fairman and Ross 1996). First, it has led to **a new range of institutions, projects, and programs** devoted to the protection of the environment. Second, it has made **conventional development programs more environmentally aware** through, for instance, the promotion of environmental impact statements and the restriction of funds for environmentally harmful projects.

Although some progress has been made through ODA, there is concern that this might be undermined by the activities of publicly funded ECAs (ECA-Watch 2017a, Wiertsema 2008).^{*} **ECAs provide guaranteed loans/credits to private investors investing in projects that are usually not eligible for funding by international institutions because they have questionable effects on the environment or are otherwise not seen as sufficiently beneficial.** Wiertsema (2008, p. 2) also remarks that ECAs can “turn business risks of private companies of industrialised countries into public sector debt of developing country governments.”

ECAs are now among the largest public financiers of large-scale industrial and infrastructure projects (power generation, telecommunications, and transportation) in the developing and emerging economies (OECD, Klein, Sangare, and Semeraro 2014; ECA-Watch 2017b). These include large dams, coal and nuclear power plants, mining projects, roads, oil pipelines, chemical and other industrial facilities, logging, and plantation schemes. In contrast to ODA lenders, ECAs are not foreign assistance agencies but domestic assistance agencies, used to boost the sales of a country’s multinational corporations undertaking activities that some call the “new Mercantilism” (Rich 2000). ECAs are taxpayer supported but tend not to be politically accountable, having no or very little legislative oversight. In recent years, ECAs have come under increasing scrutiny by civil society and policy makers because of their backing of investments that have had negative environmental, social, and human rights impacts. Of the wide range of projects that ECAs have supported in sectors such as oil, gas, coal, and mining, but also nuclear energy, hydropower, and pulp and paper, many have had detrimental effects on the environment, social structures, and human rights (Norlen 2002).

With limited social and environmental guidelines informing their investment decisions, there is concern that the actions of ECAs are fueling a “race to the bottom” – that is, investments flow to those regions with the lowest overheads and standards (Norlen et al. 2002). Further, the lack of public disclosure of their activities is seen to be at odds with the tenets of democracy to which their parent governments aspire (ibid.). In response to such concerns and to the unfair competition that ECAs posed to national import–export banks, in 2001 the OECD agreed to nonbinding guidelines that asked ECAs of member

^{*} ECAs are government or quasi-governmental institutions that provide government-backed loans, guarantees, and insurance to MNEs based in their home country with the purpose of promoting international trade and investment. The loans guarantees are often given where no other capital is available.

states to incorporate environmental and social considerations into their lending practices (Evans and Oye 2001; Evans 2005; Nakhooda et al. 2009).^{*} In 2004, the recommendations – known as “common approaches” – were accepted as binding standards for project support and requirements for ex ante transparency. However, countries could choose between World Bank/International Finance Corporation (IFC) standards and more lax regional bank rules, and thus the goal of harmonization was not achieved. In addition, transparency could be thwarted by a country’s ECA invoking confidentiality or proprietary concerns (Schaper 2009). The OECD Export Credit Group (ECG) was also criticized for weakening the environmental policy for ECAs (ECA-Watch 2007). In countries such as the United Kingdom, which is considered to be proactive on addressing the shortcomings of ECAs,[†] there continues to be concern about the role of ECAs in promoting environmentally destructive projects (Appleyard 2008). Despite national commitments to reduce greenhouse gas emissions, ECAs from G20 countries remain a significant source of funding for fossil fuel investments, including highly polluting coal projects (Chen 2017). A report by Friends of the Earth (2017) sheds some light on how between 2013 and 2015, ECA’s provided “\$32 billion [. . .] to support oil and gas projects” and an average of \$5.6 billion to coal per year. It seems, therefore, that there is much to be done to green the investment activities of ECAs.

In contrast to ECAs, the investment actions of multilateral development banks (MDBs) – such as the World Bank, the African Development Bank, the Asian Development Bank, the European Bank for Reconstruction and Development, and the Inter-American Development Bank Group – can have a significant impact on furthering sustainable development objectives in developing regions. Guided by the Sustainable Development Goals and other international agreements, the investment decisions of MDBs have the potential to limit social and environmental burdens related to large-scale projects (Nakhooda et al. 2009). **The actions of MDBs also influence the private banking sector.** For example, the Equator Principles – modeled on the World Bank’s environmental principles and the IFC’s social policies – shape the investment decisions of some ninety-one private banks in thirty-seven countries that have adopted the principles (as of June 2018). The Equator Principles try to ensure that the adopting financial institutions support only projects where measures have been taken to mitigate, monitor, and manage any significant social and environmental risks.

In conclusion, the link between global investment activities and the environment is complex. Both private and public investment in developing countries can advance or hinder important social and environmental objectives. With regard to private investment, no clear evidence exists whether FDI harms the environment or whether environmental regulation impedes investment. A dynamic situation exists in which pressure on firms to invest in regions with low wages and standards to reduce costs is countered by pressure from consumers and international organizations to act responsibly. The situation is somewhat different with regard to public investments in development. Because ODA is subject to the rules and regulations of national and international institutions, there are mechanisms that can prevent investments that have significant negative environmental and social impacts. In contrast, because ECAs are not publicly accountable and existing ECA investment principles (or “common approaches”) can be circumvented, ECA-backed investments can lead to significant social and environmental impacts. One way to reduce the destructive investment activities of ECAs would be to make them publicly accountable. However, such action is likely to reveal uncomfortable

^{*} OECD, Recommendations on Common Approaches on Environment and Officially Supported Export Credits, www.oecd.org/dataoecd/26/33/21684464.pdf (accessed December 10, 2017).

[†] See the ECA-Watch commentary on the ECA-Watch reform efforts occurring in several developed nations, www.eca-watch.org/issues (accessed December 10, 2017).

tensions between the need to grow a national economy and protecting the environment and society of foreign regions. Finally, placing sustainable development objectives at the center of MDB investment decisions would raise the profile of social and environmental outcomes in relation to the traditional economic indicators of success. Such progressive actions would set an important precedent for other public and private financial institutions to follow.

5.2 Effects of globalization on economy-work interactions: sector IV

The purpose of this section is to explore how technological change and globalization – or technological change in the context of globalization – might affect development in industrialized and developing regions, and the implications of that development on employment. Technological change and globalization are considered as drivers of change *within* and *between* three operationally important dimensions of sustainable development (Figure 5.5). Although the “sustainability triangle” is often defined as the economy, the environment, and equity (the three Es of sustainability), here we argue that equity is not a separate concern; rather, considerations of “equity” occur in each corner of the triangle. Thus, equity is replaced with employment because technological change and globalization have direct implications for employment in both developed and developing nations, and labor-market policies share importance with government policies focusing on improving economic competitiveness and environmental quality. In addition, if we are to meet the basic human needs for such items as food, clothing, and shelter, a major pathway to do this is to satisfy the basic need for a sustainable livelihood by creating employment opportunities with adequate purchasing power. “There is no point to a globalization that reduces the price of a child’s shoe, but costs the father his job” (anonymous, from WCSDG 2004, p. 13). Other pathways may also be important. Spreading ownership of the means of production, i.e., capital ownership advocated by binary economics (see Section 3.6.1 in Chapter 3) is one alternative. Community-financed investment is another (see Section 3.6.2 in Chapter 3).

The following subsections will attempt to provide some insight into how the forces of technological change and globalization can shape development and affect employment opportunities. The challenge in considering these two forces of change is that their impacts on nations and societies depend on a wide range of factors, such as a nation’s level of industrialization, its administrative environment, and its openness to trade.

For example, beyond the investment decisions of MNEs and ECAs, the ease with which short-term portfolio capital can flow across borders is placing many nations at the mercy of international market forces. A potential solution offered by Daly (1994) is for governments to focus on growing internal markets and then look to expand trade once these have matured sufficiently to be competitive internationally. Although this strategy runs against the Washington Consensus and, indeed, trade theory, it seems that there is sufficient merit in Daly’s ideas for them to receive serious consideration before fully opening the markets of developing nations to speculative international investors. With regard to technology, advances in transportation and information and communication systems, combined with declining user costs, have had profound impacts on the structure of industries, trade, labor, wages/incomes, societies, and the environment.

Even if technological innovations in products, industrial processes, and services can enhance our quality of life, these innovations can also bring social and environmental consequences. **It is possible to consider the impact of rapid technological change and**

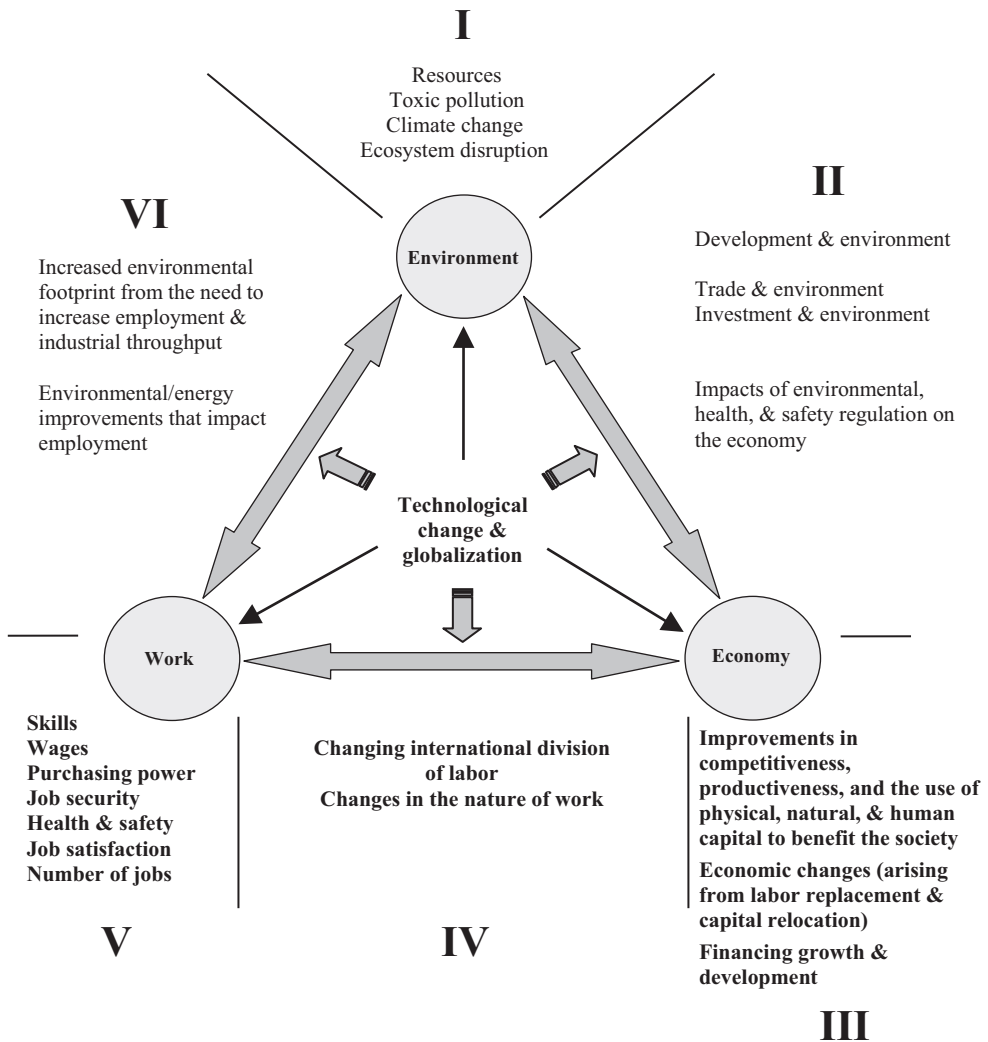


Figure 5.5 Technological change and globalization as drivers of change within and between three operationally important dimensions of sustainability (Sectors III, IV, and V)

globalization on employment through four broad lenses: (1) income inequality and technological displacement, (2) the international division of labor, (3) the creation of purchasing power, and (4) technology-enabled capital mobility. Although the following sections address these four issues separately in an effort to explore specific trends/concerns, it is evident that they are all highly interconnected, and changes in one will most likely affect the others.

5.2.1 *Income inequality and technological displacement*

The term “**technological unemployment**” was coined by John Maynard Keynes in 1930. In his essay “Economic Possibilities for Our Grandchildren,” Keynes warned of

a new disease of which some readers may not yet have heard the name, but of which they will hear a great deal in the years to come – namely, technological unemployment. This means unemployment due to our discovery of means of economizing the use of labor outrunning the pace at which we can find new uses for labor.

(Keynes 2010, p. 325)

This was not, however, the first time that such a concern was expressed – and certainly it would not be the last. During the Industrial Revolution some textile workers known as the Luddites had protested against machines and engines that would make human labor redundant, and automation anxiety only increased during the twentieth century. In 1964, a group of academics, Nobel Prize winners, and activists self-denominated the Ad Hoc Committee on the Triple Revolution prepared a memorandum for President Lyndon Johnson alerting him of the cybernation revolution

brought about by the combination of the computer and the automated self-regulating machine. This results in a system of almost unlimited productive capacity which requires progressively less human labor. Cybernation is already reorganizing the economic and social system to meet its own needs.

(Agger et al. 1964)

The advent of the personal computer in the 1980s and the perfecting of digital technologies – those with hardware, software, and networks at their core – in the following decades further fueled the debate. The questions at stake today concern the **type of jobs** that are more susceptible to be displaced by automation, what the **impact on wages** will be, whether the **number of jobs** created by technological progress will offset or not the number of jobs destroyed, and which **accompanying measures** will more adequately allow workers to prepare for the digital age and help them to cope with the consequences.

When it comes to **the type of jobs that are most vulnerable** to technological displacement, Brynjolfsson and McAfee (2014) point out that technology may not affect all labor inputs equally, but rather may be “biased” toward some and against others. In particular, some technologies like payroll processing software or factory automation have been deployed for routine work, substituting for workers; by contrast, other technologies like big data and analytics have augmented the contributions made by people with the right data-driven reasoning or creative skills. The net effect has been to decrease demand for less skilled labor while increasing the demand for skilled labor. Economists have documented this trend in a number of studies – Autor et al. (2003); Levy and Murnane (2005); Autor (2010); Acemoglu and Autor (2010). They call this phenomenon *skill-biased technical change* and, by definition, it favors people with more human capital. The fact that some jobs are replaced with technology whereas other jobs are complemented by technology (therefore increasing their value) has an obvious impact on the wage distribution, as we will discuss later.

As new and more sophisticated technologies develop, one point on which most authors now agree is that, as Kaplan (2015, p. 145) puts it, automation is increasingly “blind to the color of your collar.” This is because what determines vulnerability to automation does not seem to be so much whether the job concerned is manual or white-collar but whether or not it is routine (The Economist 2016). MIT professor David Autor (2015a) uses Polanyi’s paradox to explain why non-routine tasks are less amenable to computerization. Michael

Polanyi, a Hungarian philosopher and scientist, published in 1966 a book called *The Tacit Dimension* in which he articulated the importance of tacit knowledge in human behavior and made the assertion “we know more than we can tell” (Polanyi 1966, p 4). Following Polanyi’s observation, Autor (2015a, p. 136) concludes that “the tasks that have proved more vexing to automate are those demanding flexibility, judgement and common sense – skills that we understand only tacitly.” At a practical level, Polanyi’s paradox means that many familiar but non-routine tasks cannot currently be computerized because we don’t know “the rules.”

Autor et al. (2003) draw a distinction between cognitive and manual tasks on the one hand and routine and non-routine tasks on the other. While the computer substitution for both cognitive and manual routine tasks is evident (giving ground to the assertion that “automation is blind to the color of your collar”), non-routine tasks, both manual and abstract, have proven challenging to computerize. These non-routine tasks for which computers do not substitute include tasks that require problem-solving capabilities, intuition, communication ability, and persuasion (Autor et al. 2003). These “abstract tasks” are characteristic of professional, technical, and managerial occupations and employ workers with a high level of education. Tasks for which computers do not substitute also include non-routine tasks that Autor et al. (2003) identify as those requiring situational adaptability, visual and language recognition, and in-person interactions. These “manual tasks” are characteristic of janitorial work, cleaning, maintenance, and home health aides, among others, and, while they are not highly skilled activities by human labor standards, they currently present daunting challenges for automation. However, since these jobs usually do not require formal education or extensive training beyond a high school degree, the potential supply of workers who can perform these jobs is very large. As a result, the fact that non-routine manual jobs are still in demand (because they are difficult to replace with machines) does not result in increasing wages.

Autor (2014) points out that, since jobs that are intensive in either abstract or manual tasks are generally found at opposite ends of the occupational skill spectrum – in professional, managerial, and technical occupations on one hand, and in service and laborer occupations on the other – a straightforward implication of this reasoning is that automation of routine job tasks may lead to the simultaneous growth of high-education, high-wage and low-education, low-wage jobs at the expense of middle-wage, middle-education jobs. This phenomenon was termed as **job polarization** by Goos and Manning (2003) and has important implications for wages that are discussed later. The association between computerization and job polarization has been widely documented in a variety of papers and studies, including Goos and Manning (2007), Autor et al. (2013), and Goos et al. (2014).

Figure 5.6 illustrates the pattern of job polarization in the United States and shows that between 1979 and 2012 employment growth in the three columns to the right (managerial, professional, and technical occupations, which are highly educated and highly paid) was robust throughout the three decades plotted. The four columns in the center display employment growth in middle-skill occupations (sales; office and administrative support; production, craft, and repair; and operator, fabricator, and laborer) and show that their rate lagged the average and slowed across decades. The leftmost three columns depict employment trends in service occupations (helping, caring for, or assisting others). Despite their low educational requirements and low pay, employment has grown relatively rapidly in service occupations over the last three decades. Cumulatively, these two trends of rapid employment growth in both high- and low-education jobs have substantially reduced the share of employment accounted for by “middle-skill” jobs (Autor 2014).

The polarization of employment across occupations is not unique to the United States. Figure 5.7 plots changes in the share of employment within different occupations between 1993 and 2010 in sixteen European Union countries, showing that in all of them

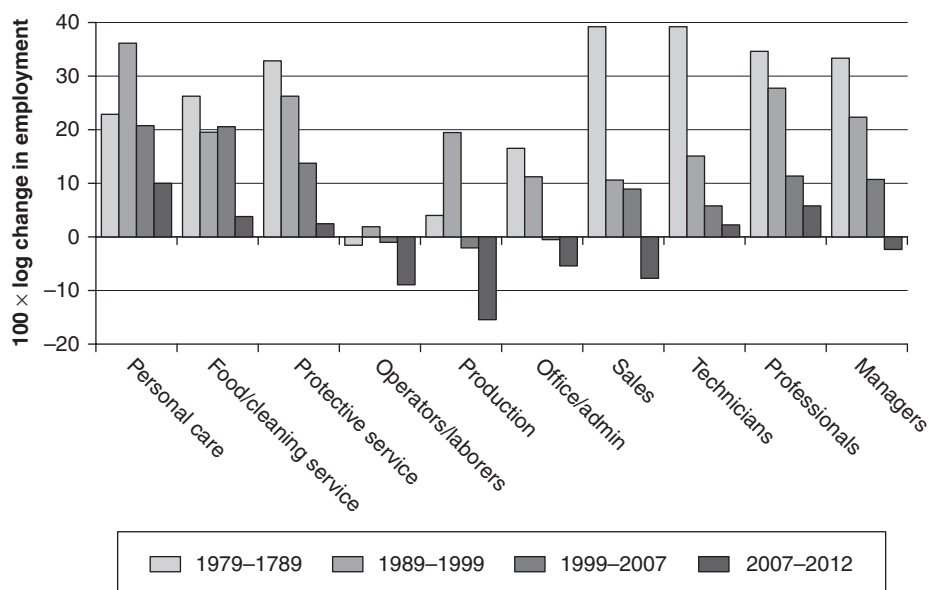


Figure 5.6 Change in employment by major occupational category, 1979–2012

Source: Adapted from Autor (2015b, p. 13).

middle-wage occupations declined as a share of employment, high-wage occupations increased as a share of employment, and low-wage occupations gained in size relative to middle-wage occupations over these two decades.

In their 2017 paper, Frey and Osborne examined the probability of computerization for 702 detailed occupations and concluded that about 47 percent of total U.S. employment is at risk. They also provide evidence that wages and educational attainment exhibit a strong negative relationship with an occupation's probability of computerization. However, they go one step further and forecast that, while computerization has been historically confined to routine tasks involving explicit rule-based activities, algorithms for big data are now rapidly entering domains reliant upon pattern recognition and can readily substitute for labor in a wide range of non-routine cognitive tasks. This forecast is in line with Brynjolfsson and McAfee's (2014) observations that computers are starting to win the race also in areas that were traditionally thought to be reserved for human beings. In a 2015 interview, Brynjolfsson and McAfee further develop this idea and acknowledge that, **whereas humans are still far superior in three skill areas – namely (1) high-end creativity, (2) emotions and interpersonal relations, and (3) dexterity and mobility – none of these is sacrosanct and machines are beginning to make inroads into each of them.** They break current technology development into three stages: in Stage 1, humans control all aspect of machines (such as through traditional software programming); in Stage 2, however, machines learn on their own, developing knowledge and skills (for example understanding speech); and finally, in Stage 3, machines might understand emotions and interpersonal reactions and may make progress in areas where humans still have the edge.

To summarize, our understanding of the kind of jobs that are more at risk of being technologically displaced has rapidly evolved during the last few years, following the perfecting and recombination of existing and new technologies that have made increasingly

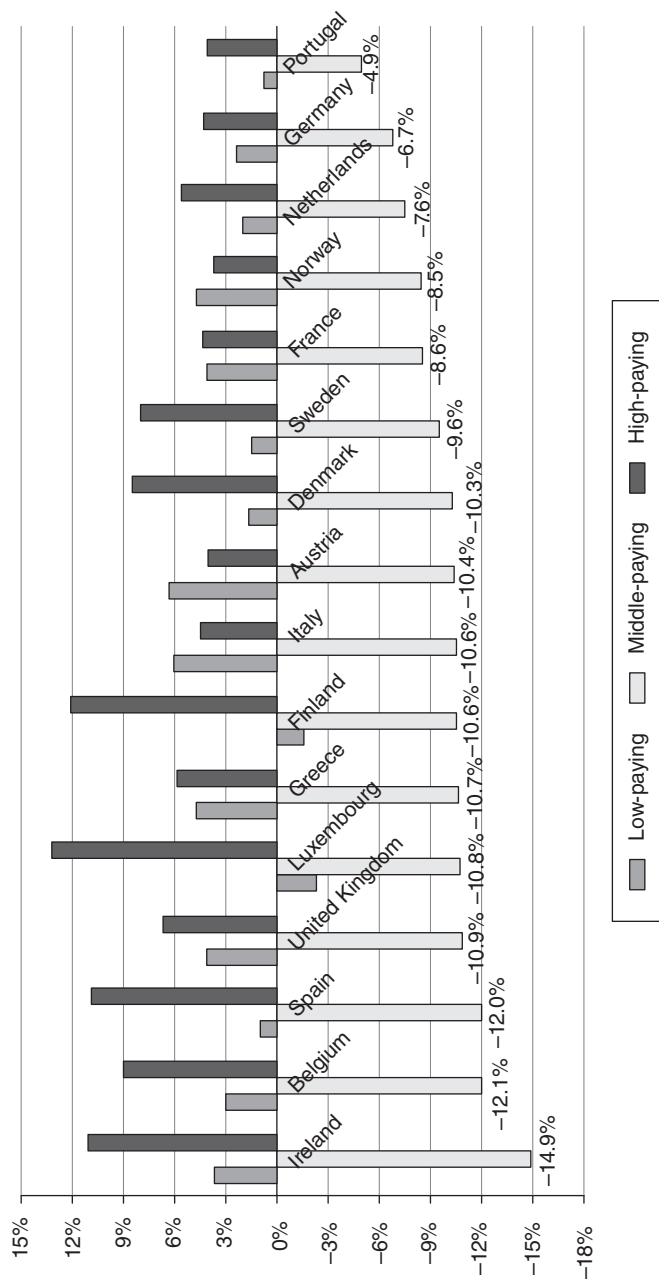


Figure 5.7 Change in occupational employment shares in low-, middle-, and high-wage occupations in sixteen EU countries, 1993–2010
Source: Adapted from Autor (2015b, p. 15).

different types of jobs susceptible to automation. During a first period it was thought that low-skilled jobs were at risk whereas high-skilled jobs were safe from automation. In a subsequent phase, however, it was widely accepted that what determined technology displacement was whether jobs were routine or non-routine. According to this explanation, routine jobs (both high-skilled/abstract and low-skilled/manual) could be performed by computers more easily, whereas non-routine jobs (both abstract and manual) were more difficult to computerize. We are now entering a third phase in which technology experts are starting to acknowledge that computers can perform non-routine cognitive tasks, too, and these jobs could also be at risk in the future.

As we have seen above, skill-biased technical change has provoked a polarization of employment. When assessing the **impact of technological displacement on wages**, however, the key question is whether employment polarization leads to wage polarization. Autor et al. (2013) consider that, while computerization has strongly contributed to employment polarization, these employment changes generally cannot be expected to culminate in wage polarization. In other words, employment polarization due to technological change will result in wage increases for abstract task-intensive activities – but not for manual task-intensive activities.

The explanation for this asymmetry is that abstract task-intensive activities benefit from strong complementarities with computerization (and thus technology increases the value of their output), relatively elastic final demand (a reduction in the production costs thanks to technology-driven gains in efficiency may increase demand for their work), and a low elasticity of labor supply (due to the high investment in terms of time and money necessary to achieve the required level of training, including MAs, MBAs, PhDs, etc.) (Autor 2014). For these reasons, computerization is expected to increase the wages in these occupations. Conversely, manual task-intensive activities are at best weakly complemented by computerization, do not benefit from elastic final demand (a reduction in the production cost thanks to technology will not increase demand for their work), and face elastic labor-supply that tempers any possible demand-induced wage increases (Autor et al. 2013). The authors document a structural shift in the labor market, with workers reallocating their labor supply from middle-income manufacturing to low-income service occupations, arguably because the manual tasks of service occupations are less susceptible to computerization, as they require a high degree of flexibility and physical adaptability.

As Brynjolfsson and McAfee put it, these findings challenge two of our common views, namely the idea that advances in technology always boost incomes and the assumption that automation hurts workers' wages as people are replaced by machines. Even if both of these have a kernel of truth, the reality is that rapid advances in our digital tools are creating unprecedented wealth, but there is no economic law that says all workers, or even a majority of workers, will benefit from these advances. On the contrary, what seems to be happening is what Brynjolfsson and McAfee (2014) call **the hollowing out of the middle class: as the labor market polarizes, people who were previously doing mid-skill knowledge work start looking for jobs lower on the skill and wage ladder**. For instance, after medical billing specialists have their work automated, they may start looking for jobs as home health aides. As explained above, this puts downward pressure on wages, because there are more job-seekers in this category, and this makes it harder to find a job in that profession. Even if home health aides remain largely immune to automation, in short, they won't necessarily be immune to all the effects of digitization. On the other side of the spectrum, pay at the very top pulls away from pay in the middle, resulting in **“winner-take-all” markets and raising income inequality**.

These trends show clearly when looking at four key measures of an economy's health: per capita GDP, labor productivity, the number of jobs, and median household income. Figure 5.8 shows that for more than four decades after World War II all four went up steadily with job growth and wage growth, keeping pace with gains in output and productivity.

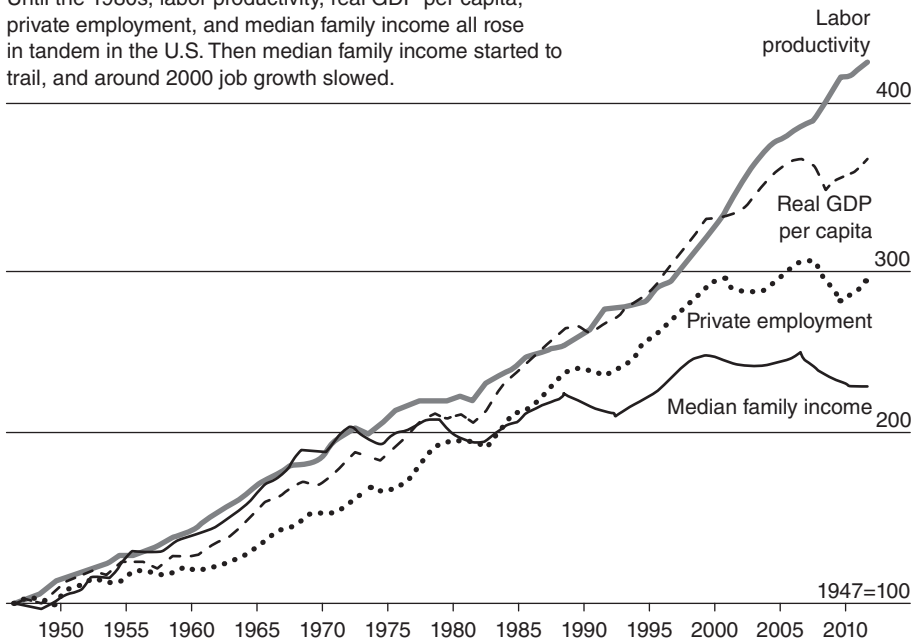
In other words, American workers not only created more wealth but also captured a proportional share of the gains. In the 1980s, however, the two halves of the cycle of prosperity began to take diverging paths, with economic abundance – as exemplified by GDP and productivity – remaining on an upward trajectory, whereas growth in median income and job gains have markedly slowed down. According to Brynjolfsson and McAfee, computerization is a prime force reshaping jobs and wages, and the hollowing out of the middle class is a major reason why median income has fallen (Bernstein and Raman 2015). In addition to these factors, the economic deregulation of the Reagan–Thatcher era, growing competition from international trade, and the decline in labor unions are also likely to have undermined the ability of labor to increase wages as a share of GDP.

This phenomenon, labeled as the **Great Decoupling** by Brynjolfsson and McAfee (Bernstein and Raman 2015), shows even more clearly when comparing the evolution of corporate profits with wages as a percentage of GDP over the last sixty years in Figure 5.9.

In the United States, corporate profits were rising before the 2008 recession and recovered very quickly. In contrast, wages as a percentage of GDP have been sharply falling since 2000. It is also noteworthy that China became a member of the World Trade Organization in 2001, after which it rapidly began to integrate into the world economy. It is estimated that the growth in the U.S. trade deficit with China – from \$83 billion in 2001 to \$367.2 billion in 2015 – resulted in the loss of 3.4 million jobs (Scott 2017).

When workers began falling behind

Until the 1980s, labor productivity, real GDP per capita, private employment, and median family income all rose in tandem in the U.S. Then median family income started to trail, and around 2000 job growth slowed.

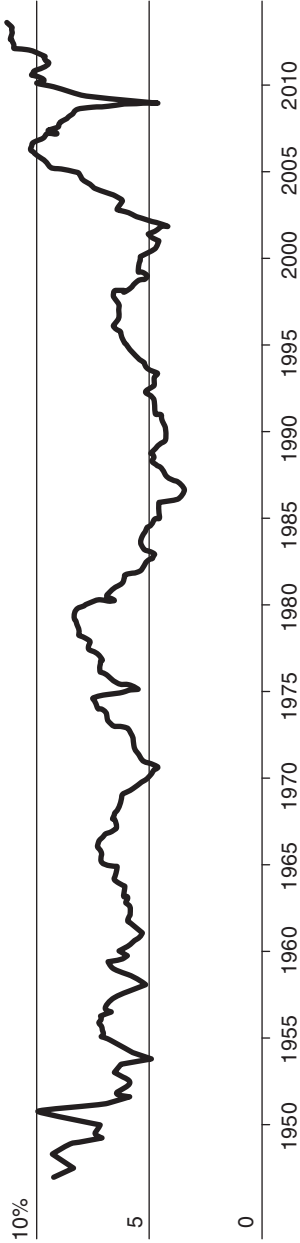


SOURCE FEDERAL RESERVE BANK OF ST. LOUIS; ERIK BRVNJOLFSSON AND ANDREW MCAFEE
FROM "THE GREAT DECOUPLING," JUNE 2015

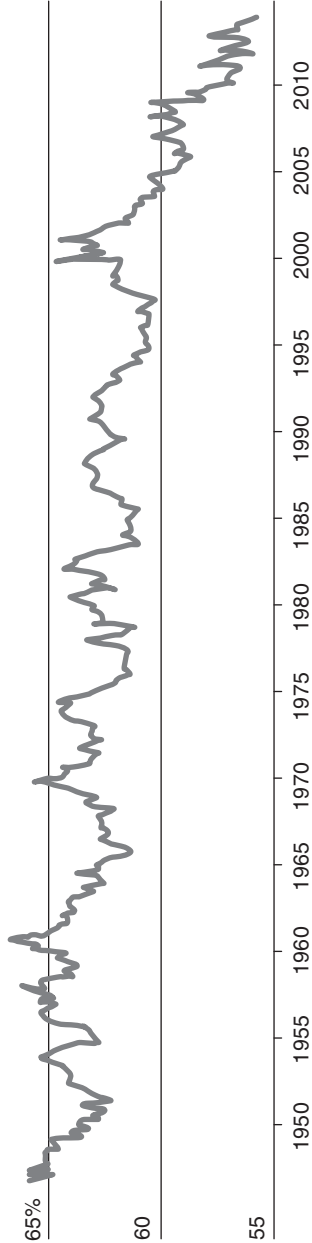
Figure 5.8 Key economic, productivity, and private employment trends, 1947–2012

Source: Adapted from Bernstein and Raman (2015).

CORPORATE PROFITS AS A PERCENTAGE OF GDP



WAGES AS A PERCENTAGE OF GDP



AS PROFITS CLIMB, WAGES PLUMMET

IN THE U.S., CORPORATE PROFITS WERE RISING BEFORE THE 2008 RECESSION AND QUICKLY RECOVERED FROM IT. IN CONTRAST, LABOR'S SHARE OF GDP, WHICH WAS HEALTHY FOR MANY DECADES, HAS FALLEN SHARPLY SINCE 2000.

Figure 5.9 Corporate profits as a percentage of GDP
Source: Bernstein and Raman (2015).

In the developing world, workers' prospects are deteriorating, too. Karabarbounis and Neiman (2014) document that the global labor share has significantly declined since the early 1980s, with the decline occurring within the large majority of countries and industries, and they show that the decrease in the relative price of investment goods, often attributed to advances in information technologies and the computer age, induced firms to shift away from labor and toward capital.

In assessing whether the *number of jobs* created by technological progress will offset or not the number of jobs destroyed, Autor et al. (2016) argues that the biggest change as new technologies emerge is not a reduction in the number of jobs created, but the types of jobs available and what those jobs pay. In other words, according to Autor, although automation does not generally reduce the quantity of jobs, it may greatly affect the quality of available jobs. Instead, Autor et al. (2013) point at international trade, and more specifically competition from China, as the factor explaining about a quarter of the contemporaneous aggregate decline in manufacturing employment in the United States (in addition, they argue that rising import exposure also lowers labor force participation and reduces wages in local labor markets). In contrast, globalization in Europe has fallen significantly with lower impacts on offshoring (Eurofound 2016).

In another paper, Autor et al. (2015) compare the effects of trade and technology on employment in local labor markets in the United States between 1990 and 2007 and conclude that labor markets whose industry composition exposes them to Chinese import competition experience falls in employment, particularly in manufacturing and among non-college workers. On the other hand, labor markets susceptible to automation (due to specialization in routine task-intensive activities) experience occupational polarization within both manufacturing and non-manufacturing, but no net employment decline.

In a later paper, Autor et al. (2017) show that the four to six dominant firms ("superstar" firms) in six important sectors in which industry concentration has increased in the U.S. have greatly reduced the share of wages going to labor from productivity advancements in both manufacturing and services. The trend occurs in Europe as well.

Brynjolfsson and McAfee (2014) have a different view. They argue that recent advances in technology have created both winners and losers via skill-biased technical change and the proliferation of winner-take-all markets, which have reduced the demand for some types of work and skills. In other words, just as technology can create inequality, it can create unemployment, even if the overall economic pie is growing. Indeed, technology has boosted productivity enormously, and the data show that employment grew alongside productivity up until the end of the twentieth century – however, as we have seen, job growth decoupled from productivity in the late 1990s, and this departure from the trend followed by employment during the previous two centuries might presage even greater disruptions.

The question of whether technology or trade is driving job polarization in labor markets was the focus of the WTO's 2017 *World Trade Report*. While country-specific factors were found to play an important role in the evolution of labor markets, the report concluded that "although interrelated, technology more than trade appears to be responsible for the decreasing share of manufacturing jobs and for the declining number of middle-skill jobs relative to low- and high-skill jobs" (WTO 2017, p. 190).

Which *accompanying measures* will more adequately allow workers to prepare for the digital age and help them to cope with the consequences? Brynjolfsson and McAfee worry that policy response to technological development has been inadequate so far and suggest focusing on five areas to create an economic environment that is conducive to innovation, new business formation, and economic growth and that can make the best use of the new digital technologies (Bernstein and Raman 2015):

- Primary and secondary *education* systems should be teaching skills related to creativity, interpersonal relations, and problem solving, which are things computers are not good at;

- Investment in *infrastructures* such as roads and networks, which are the foundations of growth;
- Facilitation of *immigration* procedures to attract talented and entrepreneurial people that can found companies and become job-creation engines;
- Policies to promote *entrepreneurship*, since young business – especially fast-growing ones – are a prime source of new jobs; and
- Basic *research*. According to Brynjolfsson and McAfee, companies tend to concentrate on applied research, meaning that the government has a role to play in supporting original early-stage research. Indeed, most of the technology we use daily, from smartphones to the internet, have a government program somewhere in their family tree; however, funding for basic research in the United States is on the decline. Support from the federal government has waned from nearly 2 percent of GDP during the 1960s to about 0.6 percent today, and this trend should be reversed.

To summarize, automation is playing a major role in reshaping jobs, wages, and wealth distribution through the polarization of the labor market, hollowing out of the middle class, stagnation of median income, and sharp decrease in labor's share of GDP, to name a few of the major impacts. This is due to the fact that there is no economic law ensuring that as technological progress makes the economic pie bigger, it benefits everyone equally (Brynjolfsson and McAfee 2014), and therefore public policies are needed to reverse any negative effects technology is having over employment.

As this work goes to press, the National Academy of Sciences (NAS 2017) released its report *Information Technology and the U.S. Workforce*, repeating the essential findings described above on income and wealth distributions in the United States. The committee, co-chaired by Eric Brynjolfsson and Tom Mitchell, observed:

Many factors are likely at work in this landscape of inequality; technological change, social biases, increased globalization and trade, the decline in labor union density and power, declines in the real minimum wage, changing norms regarding executive compensation, growing economic deregulation, changes in tax rates, and growing oligopoly – or in some cases, simple monopoly – are among the hypothesized causes of increased inequality of income and wealth over the past 40 years. However, for the purposes of this study, the committee focuses on the role of technology in income and wealth distributions.

(NAS 2017, p. 69; references omitted)

At the end of 2017, McKinsey issued a comprehensive report on the global future of work regarding jobs, skills, and wages (Manyika et al. 2017). The report presents a wide array of changes that are likely occur across many occupations and concludes that while there may be sufficient jobs available in 2030, the coming transition may match or exceed the challenges that were faced during the transition from agriculture to manufacturing.* These challenges are also likely to have significant implications for workforce skills and wages.

5.2.2 The international division of labor (resulting from multinationalization)

How can technology affect the international division of labor – that is, the distribution of manufacturing/assembly facilities and service centers among countries?

* See Section 3.3.1.2 in Chapter 3 for a discussion of the major changes that occurred in the structure of society from the early agricultural to the new knowledge-based societies.

The comparative advantage (Ricardo) model implies that countries endowed with high-skilled workers and capital should focus on the production of high-skill or capital-intensive commodities and export any surplus in exchange for imports of low-skill or labor-intensive commodities produced by countries with abundant low-skilled labor. This simple economic logic underlies much of the discussion surrounding international trade.

It is important to recognize that the composition of labor within nations varies considerably and continually evolves with development. For example, the transition of many developed nations from agricultural to industrial to service economies has been accompanied by technology-based shifts in the skills required of workers (Drucker 1994). Further, although countries such as the United States are described as having a postindustrial, service, or knowledge-based economy, it is important to recognize that the agricultural and industrial sectors have not been replaced (Bell 1999). Rather, the size of these sectors has declined with the growth of the service economy, but they still form an important component of the U.S. economy. Thus, **understanding a nation's "sectoral composition"** – that is, the proportion of an economy attributed to agriculture, manufacturing, services, and other sectors – **is important when one is considering the potential impact of technology and globalization on labor** (Coffey 1996). Further, unlike the manufacturing sector, which is somewhat homogeneous in character, the service sector varies considerably, from fast food to banking, dentistry, car repair, and teaching.

Three important factors that have historically shaped the international division of labor are the declining costs of freight transportation,* new process technologies that permit "the division, subdivision and standardization of specific tasks which could be easily learned and carried out by unskilled or semi-skilled labour" (Coffey 1996, p. 53), and the **continual growth of information and communication technologies (ICT)** that enable companies to outsource jobs, such as those of programmers and telephone operators, to firms in other nations with seemingly little difficulty.

The historical fall in freight transportation costs meant that distance became a less constraining factor to trade (Glaeser and Kohlhase 2003). Specifically, it has enabled manufacturing firms to rethink the location from which factors of production – such as labor and resources – are obtained and brought together. Further, advances in process technologies have effectively reduced the need for manufacturers to maintain low-skilled operations in industrialized nations where labor tends to be more expensive. The combination of these two factors meant that a nation's comparative advantages are likely to rest on its "administrative" conditions and the costs of its labor. In industrialized nations, these factors are often associated with *deindustrialization*, where labor-intensive and low-skilled parts of manufacturing processes are relocated (primarily) to developing nations, leaving behind the more highly skilled components in the home nation (Coffey 1996). In addition, as more production capacity is built in low-wage countries, manufacturing companies in industrialized nations employing unskilled and semi-skilled labor face growing competition, further promoting the displacement of manufacturing jobs (Kletzer 1998, 2000). Thus, although globalization holds the potential to enhance quality of life through economic development, processes such as multinationalization and deindustrialization are likely to feed the general perception that it can also reduce pay and undermine worker rights (Enviro-nics International 2002; Pew Research Center 2003).

The recent trends in outsourcing can also be seen as a new form of multinationalization, where the jobs of semi- and highly skilled workers in industrialized nations are being displaced by semi- and highly skilled workers in developing nations such as India. The fact

* See Lakshmanan and Anderson (2002) and WTO (2008) for a useful discussion of the factors behind the decline of freight transportation costs in the United States and across the world, respectively.

that distance is not really a consideration for ICT-based services means that multinational enterprises (MNEs) are likely to focus more on the price and availability of labor than on its location.* Although ICT has facilitated job displacement in developed nations, the broader impacts from such displacement may also have benefits for others. However, like the threat of capital flight, the specter of an employer outsourcing overseas may do much to dampen employee demand for wage and/or job benefit increases. The increased labor costs in Asia have given rise to “reshoring” whereby industries, such as GE and GM, are relocating production centers to the United States, although to the southern part of the country where wages are generally lower and unions are weaker. Because of automation, Brynjolfsson and McAfee (2014) observe the economic value of production is coming back, but not jobs.

On the financial side, there are several major forces also shaping the international division of labor: (1) the **FDI** investment decisions of MNEs; (2) the investment decisions of **ECAs and MDBs**; and (3) the **regulatory environments and financial incentives** created by governments to attract foreign investment in their home nations.

The transition of industrialized nations toward service or knowledge-based societies adds another dimension to the problems discussed above. A knowledge-based society reduces the need for unskilled or semi-skilled workers in developed nations – who form the largest proportion of the working population – and increases the importance of a well-trained and educated labor force (Drucker 1994; Levy and Murnane 2005; M. Miller 1995; WCDSDG 2004; WTO 2017). In effect, it is argued that in knowledge-based societies, unskilled labor is being replaced by (computer-powered) technology that requires a smaller amount of skilled labor to maintain and operate (Brynjolfsson and McAfee 2014; Rifkin 2004). These skilled laborers are what Drucker (1994) refers to as the “technologists.” The growing differential in wages between educated/skilled workers and unskilled workers and the higher unemployment rates in the latter group all point to the formation of a knowledge-based society and the reduction of manufacturing (and now servicing-producing) capacity (M. Miller 1995; Firebaugh 2003). In line with these findings, Brynjolfsson and McAfee (2014) explain the hollowing out of the middle class in *The Second Machine Age*.

In developing nations, the emergence of technology-enabled, knowledge-based societies is widening the educational/informational gap and extending **the digital divide**. In addition, the problem of high unemployment is worsened by the fact that over the next thirty years, “more than half of the anticipated [population] growth (1.3 billion) is predicted to occur in Africa” (UNDESA 2017 p 3). Additionally, as two-thirds of the world population are expected to live in urban areas by the middle of this century, Africa and Asia are projected to have the highest rates of urbanization compared to other regions of the world (UNDESA 2015). The constant flow of new entrants into the labor force in these countries is argued to result in “jobless growth,” meaning that the rise in unemployment is a structural phenomenon (M. Miller 1995). In this situation, it seems that the formation of high-tech industries in developing nations will be sustained only if a reliable stream of well-educated workers can be established. But the provision of basic education is a luxury for the vast majority who struggle daily against the poverty trap. Even if an adequate supply of educated workers could be provided, **there is concern that the sheer scale of technology-displaced workers is likely to overshadow any growth in high-tech industries** (Rifkin 2004; Brynjolfsson and McAfee 2014).

* Although manufacturing/assembly plants might be located abroad to be nearer to markets, services may be located abroad because location is not relevant. In both cases, jobs may be relocated.

Education aside, the impact that rapid technological change in industrialized (or information-based) nations is having on developing nations was put quite succinctly by M. Miller (1995, p. 128) over twenty years ago:

Rapid changes are stressful enough, but when the spearheading technologies are “high-tech,” labour-saving and involve extremely mobile intangible assets, the social impact is magnified. Unable to keep up with the rapidly and profoundly changing nature of technology, most developing countries are falling further and further behind the industrialized nations in the acquisition and deployment of these technologies that are opening the way to new modes of production, distribution and, in effect, new modes of economic and social life.

Given that reducing inequality is central to achieving sustainable development, understanding how rapid technological change and globalization can affect the international division of labor is of critical importance. Although it seems that workers with advanced technology-related (and transferable) skills and a high level of education are well positioned in the international economy, workers with a less flexible skill set and a lower level of education – who constitute the vast majority of people in the world – appear most at risk of unemployment with every move of the international economy’s invisible hand.

Daly (1994, p. 186, emphasis added) argues that one potential way to protect labor markets is to

move away from the ideology of global economic integration by free trade, free capital mobility, and export-led growth and toward **a more nationalist orientation that seeks to develop domestic production for internal markets as the first option, having recourse to international trade only when clearly much more efficient.***

This strategy would put the control of a country’s labor markets in the hands of the national government and industry, avoiding pressures to lower standards and wages and externalize environmental and social costs, which are some of the perils of global economic integration (Daly 1993). However, such an approach to protecting labor markets runs directly against the predominant economic view of trade and wage liberalization. Rather than establish anti-globalization measures, Brenton (2006) argues that **income-redistribution policies that preserve the gains from trade** are a more effective way to address problems of growing income inequality and social exclusion (that is, unemployment) caused by trade and investment liberalization. His basic argument is that although the process of globalization will inevitably create some losers, if these groups are compensated (by national governments and international institutions), the benefits from more rapid economic development are likely to outweigh the costs. The recent

* Similarly, J. E. Stiglitz (2002a, 2002b) promotes government intervention in situations where the pursuit of free trade is likely to undermine or destroy emerging domestic industries in developing nations that are unable to compete in the global market. **He also reminds us that today’s industrialized nations did not practice free trade when their industries were developing.** Indeed, one can argue that although many industrialized nations now promote trade liberalization (or the Washington Consensus), many still have policies in place that protect their agricultural sectors and domestic industries. To limit the potential negative impacts of free trade, J. E. Stiglitz (2002a, 2002b) promotes a range of government interventions that can stimulate and protect domestic economies; stabilize financial institutions; create, protect, and/or enhance existing employment opportunities; and shoulder some of the financial burdens during periods of unemployment that are caused by factors beyond an individual’s control.

resurgence of interest in providing a universal basic income (UBI) may generate some viable proposals that can be considered at the international level.

Regardless of one's view on the effects of globalization, the **importance of national governments in shaping the structure and dynamics of the international economy** should not be overlooked. As Castells (1999, p. 98) argues,

There is not, and there will not be in the foreseeable future, a fully integrated, open world market for labor, technology, goods, and services, as long as nation states (or associations of nation states, such as the European Union) exist, and as long as governments are there to foster the interests of their citizens and of firms in the territories under their jurisdiction, in the global competition.

It is interesting that while Daly (1994) argues for “renationalization,” Castells (1999) suggests that national policies already play a much more influential role in shaping a nation's competitiveness, productivity, and technology than they are often given credit for doing. To support his argument, Castells (1999, p. 89) documents cases where

some governments [or example, those of Japan, Taiwan, and South Korea or the “Asian tigers”] have restrained as much as possible the penetration of their markets by foreign competition, thus creating competitive advantage for specific industries in their period of nurturing.*

It is also apparent that those nations that resisted the advice of the Washington Consensus experienced some of the fastest growth since the early 1980s (Faux 2002). Beyond policies aimed at competitiveness, productivity, and technology, national governments also play a critical role in shaping employment opportunities.

In conclusion, it seems that a useful way to transition toward sustainable development would be to combine the inherent national desire to protect citizen, worker, and industry interests with the need to protect critical natural capital (that is, ecological systems and resources).† Such a strategy would make environmental protection and enhancement core objectives that shape national policies for employment, competitiveness, productivity, and technology development. However, the **trade-off between establishing an attractive investment environment** (with low taxes and a smaller role for government) **and protecting social welfare** (especially that of displaced or underemployed workers) is likely to continue to cause controversy and force government officials, industry, and civil society to think carefully about the delicate balance between competitiveness and social inclusion/cohesion.

* Although national governments have an incentive to craft policies to promote/protect the interests of their citizens and industries, the same is also true for economic regions such as the triad of Europe, Japan, and North America. Hirst and Thompson (2002, pp. 2–3, emphasis added) argue that “these major economic powers, the G3, [. . .] **have the capacity, especially if they coordinate policy, to exert powerful governance pressures over financial markets and other economic tendencies**. Global markets are thus by no means beyond regulation and control, even though the current scope and objectives of economic governance are limited by the divergent interests of the great powers and the economic doctrines prevalent among their elites.”

† Although protecting the environment is directly relevant to a nation's health and well-being, the growing trends of environmental destruction and the decline in global resources (WWF 2016) indicate that the desire to promote national competitiveness, productivity, and technological capacity has yet to be explicitly linked to the environment.

5.2.3 The creation of purchasing power

How does technology facilitate the creation of purchasing power throughout the world?

In Section 1.1.1 in Chapter 1, we introduced the Human Development Index (HDI), which measures the level of development achieved by a nation by using three indexes – health, education, and income. The HDI does not explicitly consider the impact of technology. However, it does provide a clear indication of the extent of the gap between the purchasing power of the rich and the poor. For example, almost all of the top twenty nations of the HDI have a GNI per capita (adjusted for purchasing power) that falls between \$31,215 and \$78,162, whereas the twenty nations ranked lowest have a GNI per capita between \$587 and \$3,216 (UNDP 2016). Therefore, even if developing nations experienced a significant rate of economic growth, their total relative amount of income would remain substantially lower than that of more developed nations. Today, 766 million people live in extreme poverty (UNDP 2016) and some 3 billion people live below the “ethical poverty line,” which is defined as the income needed for someone to achieve a normal life expectancy of 70 years (Edward 2006; Oxfam 2017). It is in this context that the implications of rapid technological change and globalization should be considered.

The transfer and diffusion of technology from industrialized to developing nations is a powerful mechanism that is creating a new working and purchasing class and reducing income inequality between these nations (Firebaugh 2003; WBG 2016). The impact of this mechanism on increasing purchasing power and reducing inequality depends on the **changing “technology–geography nexus.”** Firebaugh (2003) describes how the importance of (geographically fixed) natural resources can change dramatically as new technologies emerge. For example, the invention and diffusion of the internal combustion engine dramatically enhanced the real estate value of oil-rich regions of the world, leading to significant investment in these areas and job creation. In addition, he argues that technological change can also alter the “habitability” of those parts of the world that experience extreme temperatures and/or difficult living environments. For example, installing air-conditioning systems in factories and office buildings can enhance worker productivity by eliminating periods when it is simply too hot to work effectively. Firebaugh (2003, p. 181) captures these ideas in two simple models that indicate how new technologies can shape the continually evolving pattern of global income inequality:

- Changing technology → changing value of natural resources that vary geographically → changing global income inequality
- Changing technology → changing relative habitability of the world’s regions → changing productivity by region → changing global income inequality

A potential problem with these models is that there is **no explicit consideration of how changing technology is affecting the sustainability of development pathways.** A concern is that the transfer and diffusion of technology from developed to developing nations is fueled by an underlying desire to spread consumerism and expand markets for Westernized products and services (Benton and Redclift 1994). Further, it has been argued that the global agenda is dominated by the industrial globalization plans of the North (and now China), which are grounded on conventional economic development theory (Redclift 1992). This idea is perhaps best captured by Daly’s (1996, pp. 31–44) notion of “economic growthmania.”

Mehmet (1995, p. 7) provides a political critique of the mainstream Western (or European-centered) view of development economics (for example, trickle-down theory), which he argues is not “culture-friendly and has effectively denied the cultural diversity that exists in non-Western branches of humanity, where group and community rights are often held in higher esteem than individualism, and cooperation rather than competition

is prized.” Mehmet (1995) goes on to argue that international security will not be achieved without **sound population policies** in developing nations and **the correction of global inequality** generated by development economics that continually concentrate capital ownership in the North and support Northern consumerism. Although the alleviation of poverty in developing nations is clearly a desirable goal, Mehmet asks the fundamental question of whom the transfer of technology and the opening up of new markets is really benefiting.

In theory, the installation of production capacity in developing nations increases the purchasing power of those who are employed, enabling them to enjoy many of the products and services widely available in the North. The problem with this optimistic scenario of development is that the **world’s resources are insufficient to perpetuate a lifestyle of over-consumerism and increased inequality throughout the world** (Lorek and Vergragt 2015; WWF 2016; Toth and Szigeti 2016). Although technological innovation can extend the availability of resources, the new limits to growth appear to be not resource limits, but **limits on the ability of sinks** to absorb the externalities (that is, pollution and greenhouse gases) from economic growth (Meadows et al. 2004). Therefore, simply relocating manufacturing plants from developed to developing nations without any significant improvements in environmental performance is clearly not sustainable development.

Although considerations of whole life cycle impacts of products/services and the introduction of “factor X” technology can lead to more sustainable forms of development (see Section 1.3.3 in Chapter 1), they do not address the question of whether the developed-nation model is the one developing nations should be following. With such powerful economic and political forces behind industrial globalization, establishing a viable alternative seems extremely difficult. A more fruitful option might be to **search for radically different forms of industrial globalization that can operate within ecological limits and better suit the different needs of societies throughout the world**. Unfortunately, the formation of new forms of technology-enabled development is **likely to be hampered by technology-enabled financial capital mobility**.

5.2.4 *Technology-enabled capital mobility*

How does technology-enabled (financial) capital mobility affect government and industry efforts to promote sustainable development?

The ease with which **technology-enabled capital can flow** between markets – notably due to rapid global expansion of ICT and networks and the decline in capital controls since the 1980s – has led to a **shortening of investment horizons** as investors speculate on currencies, which can have **detrimental impacts on development**. For example, Block (1996) makes a convincing case that changes in the international financial regime following the breakdown of the Bretton Woods system in the 1970s led directly to higher unemployment and slower growth rates. The most important of these changes was the transition to a floating exchange rate system. Block (1996) argues that high real interest rates – which occurred in response to the new floating-rate system – make it difficult for governments to lower domestic rates to stimulate employment. Any attempt to do so would risk large outflows of capital that would move to regions with higher interest rates. As Block (1996, p. 27) explains,

high levels of capital mobility create a strong bias toward restrictive monetary policies in the world economy. Countries that fail to align their interest rates with those of the large economy with the highest interest rate risk substantial capital outflows and intense speculative pressures on their currencies.

Thus, with the advent of technology-enabled capital mobility, important segments of a nation’s tax base are able to invest their capital efficiently in locations where they can avoid or minimize tax payments and obtain a higher return on their investment. This has the effect

of increasing the “tax rates disproportionately on labor income” (Rodrik 1997, p. 6, emphasis added) and can lead to a number of “lowest-common-denominator socioeconomic and policy tendencies” (Paehkle 2003, p. 2). Think of the examples from Mexico and East Asian economies that have exposed themselves to large flows of potentially reversible short-term international capital. Thus, a major challenge facing governments is how to create an attractive and competitive market while providing an appropriate level of social welfare.*

Swank (2002, p. 4, emphasis added) explains that:

Politically, international capital mobility may constrain the social welfare policies of democratically elected governments through the routines of conventional politics [because] the **credible threat of exit may enhance the conventional political resources of mobile asset holders and their interest associations.**

However, **contrary to this economic logic, Rodrik (1997, 1998, 1999, 2007) argues that as national economies have become more open, their social spending has increased.** For example, in small and open economies such as the Netherlands and Belgium, government spending has increased to insulate society against external risks (such as the 1970s oil shocks). Rodrik (1997, 1999) argues, therefore, that the welfare state could be viewed as the other side of the coin to economic globalization. His point is that

the provision of social insurance is an important component of market reforms – it cushions the blow of liberalization among those most severely affected, it helps maintain the legitimacy of these reforms, and it averts backlashes against the distributional and social consequences of integration into the world economy.

(Rodrik 1999, p. 98)

In this regard, Rodrik (1997) identifies **two dangers that arise from complacency about the social consequences of globalization.** First, as indicated above, there is the **risk of a political backlash against trade.** For example, it is easier for a politician to defend protectionist policies if this action is likely to secure employment for his or her constituents and subdue anxiety about globalization. Second, and potentially more important, **globalization that is achieved at the cost of social disintegration would pay a very high price for development.** Both of these concerns point to the need for **well-conceived government intervention** that protects the environment and social stability and cohesion from the downsides of economic globalization (J. E. Stiglitz 2002a, 2002b).[†] In Rodrik’s (2007, p. 219) view, those regions and nations that have benefited the most from foreign trade and investment – such as East Asia, China, and India – were able to “combine the opportunities offered by world markets with a domestic investment and institution-building strategy to stimulate the animal spirits of domestic entrepreneurs.”

* This challenge is made even greater if one agrees with Soros (2002, p. 14) that “economic development, that is, the production of private goods, has taken precedence over social development, that is, the provision of public goods.” His main concern is that although international trade and financial markets are efficient at generating wealth, they are unable to take care of essential social needs “such as the preservation of peace, alleviation of poverty, protection of the environment, labor conditions, or human rights” (ibid., p. 14). Thus, governments have an important role in establishing regulatory frameworks that nurture both economic development and social welfare.

† It is important to recognize that the type of government intervention will vary between nations depending on existing labor-market institutions, corporate governance, social and environmental regulation, and other factors (Rodrik 1999, 2007). Further, such variation in legal and social structures makes the notion of a fully integrated global economy with common standards and regulations an unlikely prospect, at least in the foreseeable future (Rodrik 2005).

Although the benefits from liberalizing capital are clearly questionable, Rodrik and Subramanian (2008) do believe that real gains can be achieved from *domestic* financial liberalization that avoids the costs of external liberalization. On the basis of the work of Prasad et al. (2007), Rodrik and Subramanian (2008, p. 17, emphasis added) argue that “the evidence [. . .] suggests that for any given level of investment, **the more that is financed by domestic savings the greater the long-run growth.**” Similarly, those countries that relied on foreign capital grew less rapidly than those that did not (ibid.), indicating that governments that retain some control over capital flows are more likely to strengthen their economies and foster economic development.*

The shortening of investment horizons has also occurred within **corporations** at the potential expense of longer-term sustainable industrialization. The problem with shorter investment horizons is that they encourage **low-risk and lower-payoff R&D investments** that are seen as a considerable source of competitive disadvantage (NAE 1992; Tassey 2017). Firms focusing on short-term investment horizons tend to emphasize **incremental innovations and product-line extensions instead of more risky, long-term, and expensive next-generation (radical or disrupting) innovations** that are likely to be more profitable (Tassey 2003). The creation of international financial markets has made it possible for an individual (with access to a brokerage) to invest in any market. Therefore, the mobility of financial capital is creating a highly competitive capital market that is **reducing the time frames over which return on investment is demanded** to the detriment of more long-term and (perhaps) more sustainable industrialization. In addition, capital can easily be **expatriated rather than reinvested in countries** where production and services centers are located.

Hedge fund activism is another emerging issue that is resulting in “severe cut-backs in long-term investment (and particularly a reduction in investment in research and development) by both the targeted firms and other firms not targeted but still deterred from making such investments” (Coffee and Palia 2015, p. 1). Others have also raised concerns about how strategies used to maximize shareholder value and executive compensation – such as stock buyback programs and compensation packages linked to short-term equity gains – are reducing the long-term investments of publicly held firms (Galston and Kamarck 2015).

It is evident from the preceding discussion that the current international financial regime, combined with the drive for the liberalization of short-term capital flows, can (1) undermine the ability of governments to provide public goods and (2) focus corporations on short-term investments to the possible detriment of more sustainable forms of industrialization. The common factor underlying both of these concerns is the ease with which technology-enabled capital can flow across borders at the click of a button. As the international economy continues to expand by incorporating emerging economies, the nations that are likely to gain the most are those that have found ways to protect the welfare of their citizens while remaining attractive to international investors.

5.2.5 The effects of trade on the economy and employment

5.2.5.1 The effects of trade in the developed world

In general, the established consensus among most members of the economic profession appears to be that **trade constitutes “an important stimulus to economic growth”**

* The world continues to suffer from the consequences of the 2008 financial crisis, where the global mobility of financial instruments played a key role. Particularly adversely affected were Greece, Portugal, Spain, and Ireland, who purchased U.S. “toxic financial assets” that resulted in the proliferation of ultimately worthless financial assets that have threatened the stability of the euro (see Stiglitz 2010).

(Todaro and Smith 2015, p. 603, emphasis added). Trade increases a country's consumption capacities, expands world output, and provides access to scarce resources and global markets for products, without which poor countries would not have been able to develop (*ibid.*).

However, although agreements such as NAFTA are generally considered by economists to have been beneficial for the United States, the population of the United States appears to be particularly divided on the issue (Swift and GALLUP 2017). How can Americans be that divided when NAFTA has purportedly been beneficial for the majority of the population through lower consumer prices? One answer attractive to the proponents of the mainstream view has to do with the relative visibility of NAFTA's effects. In general, job losses are more obvious and concentrated than lower prices* and are more easily attributable. Therefore, even though one might have gained personally from free trade, the adverse effects of trade liberalization through the associated job losses in sectors like manufacturing can increase insecurity in the working population and create hostility toward free trade. This attitude was clearly captured by the results of an early 2016 Bloomberg poll where 65 percent of survey respondents opted for a U.S. trade policy with more restrictions on imported foreign goods to protect American jobs, against 22 percent that preferred fewer restrictions to enable U.S. consumers to have the most choices and the lowest prices.

Disagreeing with the "established" view that trade is beneficial, Scott (2014) states that NAFTA was eventually harmful for the U.S. economy, costing 851,700 jobs and job opportunities in the period 1993–2013 due to the increased trade deficit with Mexico. Scott (2013) also criticizes the claim made by the U.S. Chamber of Commerce that NAFTA trade has created millions of jobs because it only counts the jobs gained by increased exports and not the jobs lost to growing imports. The majority of job losses were in manufacturing, but imports do create U.S. jobs in transportation, distribution, and marketing (Public Citizen 2014).

In earlier commentary, Berger (2006, pp. 20–21) states

more than two million jobs disappeared from the U.S. workforce between 2001 and 2004. By one calculation, a half-million of them were in high-tech industries like electronics, components, and telecoms. The layoff rate has risen, and while many of those who lose jobs get hired again fairly soon, two-thirds of the jobs they get pay less than the jobs lost.

Hence, apart from the impact of trade on employment statistics, trade has also significantly affected wages. According to Lu and Hufbauer (2017), trade's indirect effects on wages through the elimination of good job opportunities and the possibility of relocation as a threat in wage negotiations have led to a series of effects on wages:

- A 5.4 percent decrease in real production worker wages between 1978 and 2000;
- Growing wage inequality since the late 1970s;
- Increasing income inequality since 1979; and
- Flat incomes for the bottom 60 percentile of workers despite a 7.6 percent increase in working hours.

The latest voice to weigh in on the effects of trade on employment in the United States is Josh Bivens (2017) of the Economic Policy Institute in a report on the effects of

* It is also not clear that the location of production abroad leads to benefits for domestic consumers. Monopoly wholesalers or retailers could very well retain saved costs and increase profits.

globalization. He is quite definite on his findings [the bold emphasis below is ours, not Bivens] and echoes similar critiques by Autor et al. (2013) and Stiglitz (2016):

Trade [...] leads to [...] so much upward redistribution that *most* workers are made worse off. Exchange rate misalignments [...] have amplified the regressive redistribution caused by trade [...], including] undercutting American workers' bargaining power [...] without compensating workers for their losses].

(p. 2)

[While] globalization remains "win-win" at the country level, [...] it has led to] *absolute* income losses as well [...] and] hit[s] *all* workers without college degrees [...] in both tradeable and non-tradeable sectors].

(pp. 5–6)

[A] key part of employment generation in the face of a negative relative demand shock is that wages must *decline* to support employment growth, so the downward wage pressure found by Autor, Dorn, and Hanson (2013) could (indeed likely *would*) just get worse as labor markets fully "adjust".

(p. 8)

The [...] fall in import prices [as a result of trade with lower-cost producers] that benefits consumers also leads to lower wages for most workers. Essentially, as growing imports lower prices of import-competing goods produced in the United States, domestic production of these import-competing goods becomes less profitable, and so this production shrinks. As this domestic production shrinks, resources displaced from this sector have to try to find employment in more capital-intensive sectors. This leads to a reduction in demand for labor (as well as bidding up the price of capital), and this in turn triggers adverse wage effects. The more imports drive down domestic prices for domestic goods, the worse the wage effect is. This wage effect, again, harms most workers, not just those located in particularly trade-exposed regions.

(p. 9)

It is clear that the decline in wages stemming from this process will be larger than the decline in prices [...]. This means that falling import prices are not a net benefit from trade for the majority of American workers on the wrong end of globalization's distributional conflict.

(p. 9)

This relatively recent manufacturing employment implosion is much more attributable to rising trade deficits than to productivity growth.

(p. 10)

From the perspective of the majority of American workers, expanded trade – amplified by trade agreements – has the primary effect of dragging on American wage growth. And wage growth for the typical American worker has lagged far behind overall productivity growth in recent decades. This growing wedge between productivity and pay is the root cause of the rise in income inequality over this time [...]. It is important to note that **globalization does not explain all, or even most, of this growing wedge between productivity and pay. But it does play some role.**

(p. 13)

Below are a few ways the international community can work together to forge solutions with widespread benefits:

Coordinate globally to enable countries to tax capital income and to clamp down on abusive tax havens. [. . .]

Institute a global financial transactions tax (FTT). [. . .]

Harmonize national policies aimed at combating global climate change. [. . .]

Coordinate internationally to address exchange rate misalignment. [. . .]

(pp. 17–18, bold emphasis from original text)

5.2.5.2 *The effects of trade in the developing world*

Although there appears to be a consensus among many economists that free trade produces net gains for developing societies, and that countries should unambiguously adopt trade-liberalization policies, reality paints a more complex picture. Rodrik (2007) cites the particularly elucidating case of two different countries, Vietnam and Haiti. Vietnam still engages in state trading, maintains import monopolies, retains quotas and tariffs (in the range of 30 to 50 percent) on imports of agricultural and industrial products, and is not a member of the WTO. On the other hand, Haiti undertook significant trade liberalization in 1994–1995, joined the WTO, diminished import tariffs to a maximum of 15 percent, and removed all quotas. The result? Vietnam experienced annual GDP growth rates in the area of 8 percent, reduced poverty, expanded trade significantly, and attracted significant foreign direct investment (WBG 2017a). On the other hand, Haiti has stagnated and suffered from significant poverty and unemployment rates, having made little progress in integrating into the world economy (WBG 2017b).

Rodrik (2007) is right that trade should not be viewed as a goal in itself but rather as a means toward the goal of increasing economic development. As he notes, “a leadership committed to development and standing behind a coherent growth strategy counts for a lot more than trade liberalization, even when the strategy departs sharply from the enlightened view of reform” (ibid., p. 217). His view is corroborated by the facts. **The cross-national evidence on the relationship between open trade policies and higher economic growth and poverty reduction has shown no systematic relationship between a country’s average level of tariff and non-tariff restrictions and its subsequent economic growth rate.** In fact, if anything, the evidence from the 1990s suggests a positive (but statistically insignificant) relationship between tariffs and economic growth, with the only systematic relationship being that as countries get richer, they tend to liberalize trade.

Hence, integration into the world economy through trade liberalization should be viewed as an outcome rather than a prerequisite of a successful growth strategy. As Stiglitz (2017a, 2017b) and Rodrik (2018) note, the fact that all of today’s advanced countries embarked on their growth under protectionist trade restrictions should be viewed as a lesson. Finally, almost all the outstanding success stories, such as China, India, and the East Asian countries, involved partial and gradual trade and capital liberalization. **A country’s trade policy should be eclectic and should take into account a series of national and external variables,** such as the industries that will be harmed from trade openness and the capacity of the domestic market to reallocate workers.

Although international trade has some positive effects on developing regions and can potentially help protect/enhance the environment, it is also seen to have negative environmental (OECD 1994) and social (welfare) impacts (Rees and Westra 2003). Among the main arguments against the international integration of economies are the following:

- Free trade is accompanied by environmental degradation and growing economic and gender inequality (Irwin 2015; Hassoun 2011; Juhn et al. 2014). In countries

with “suboptimal environmental policies in place, further trade liberalization is likely to exacerbate the environmental effects of negative externalities” (Neumayer 2017, p. 1).

- Free trade weakens the democratic accountability of governments through the prioritization of “economic and utilitarian group interests in order to” complete trade agreements that risk “undermining republican governance and rights of citizens” (Petersmann 2015, p. 579). This transfer of power is mirrored by “a corresponding shift in economic priorities from the production of goods and services to meet human needs to a wholly different agenda centered on extracting wealth from the larger society to increase the financial assets and power of the wealthiest among us.”*
- Free trade is not proceeding in a fair and equitable manner. A main contention is that industrialized nations have pressured developing nations to eliminate their trade barriers while keeping their own intact. This has the effect of opening up the markets of developing nations to capital-intensive products from developed nations, but has prevented them from exporting their labor-intensive products, depriving them of vital export income (Stiglitz 2017a, 2017b).
- Free trade encourages economically rational corporations to invest capital in countries with the lowest environmental and health and safety standards. Such action reduces the cost of producing commodities and might also lead countries to specialize in those sectors where regulations are weakest (Meltzer 2013). Alternatively, the pressure to produce commodities at or below the price dictated by the international market creates a perverse incentive to lower health and safety and environmental standards to improve the competitiveness of national sectors (Daly 1993).
- Free trade creates a situation in which capital from developed nations is invested only in nations that offer the potential for a high rate of return. This means that it is more profitable, and there is a comparative advantage, for polluting industries to invest in countries with laxer environmental regulations (Carvalho et al. 2013). Sapkota and Bastola’s (2017) study on the effects of FDI and income on pollution emissions validate the pollution haven hypothesis for fourteen Latin American countries. Hence, economic “logic” is reducing the already-limited financial flows reaching developing nations.
- Free trade leads to the “spatial and temporal separation of action and impact from responsibility” (Speth 2003, p. 13). The spatial and social distance between production and consumption is widened as commodity chains grow in length and become more complex and more international (Conca 2002; Princen 2002). Consumers lack the information and incentives to behave in a more sustainable manner even if they wished to do so as a result of this *distancing effect*. To put it another way, as trade increases and countries continue to specialize, the transaction costs (linked to externalities) become hidden by the distancing effect. Therefore, it becomes increasingly difficult for communities in different nations to communicate and agree on collective solutions to externality problems (Costanza et al. 1997). Further, the growing movement of resources between nations in response to *market demands* is reducing the effectiveness of traditional local controls over resource use (Speth 2003). This loss of indigenous control can lead to the exploitation of resources as a result of unsustainable rates of extraction.

* Source: People-Centered Development Forum, History, www.pcdf.org/About_PCDF/history.htm (accessed May 17, 2010).

The preceding concerns have led a series of scholars to move their point of reference, asking for trade to become part of a larger development scheme (Najam and Robins 2001; Najam 2007). It is noted that it is in the interest of the developing world to shift the terms of the debate from “trade and environment” to “trade and sustainable development.” Furthermore, in Najam and Robins’s view (2001, p. 68),

If sustainable development is to become the organizing focus of the international trade regime, then at some point, “sustainable trade” will have to replace “free trade” as the grand rationale for our efforts. For the early advocates of GATT, the ultimate and non-negotiable goal – to be reached through small steps – was to create a world in which all trade was “free.” The new goal, equally non-negotiable at its core, must be the creation of a world where all trade is seen as a part of the larger sustainable development enterprise.

5.2.6 MNEs: blessing or peril?

In Section 4.5.1 in Chapter 4, we noted that mainstream economists have mainly omitted MNEs from their analysis because of modeling difficulties and a different methodological focus. However, this has recently started to change, mainly because of advances in industrial organization and in strategic trade theory (Gilpin 2001). In this growing area in the economic literature, MNEs have increasingly been considered a means to reduce transaction costs, because vertical organization through FDI might be less costly than market transactions (Gilpin 2001).

Many critics of globalization consider the role of MNEs highly controversial, especially in the case of developing countries. Korten (2001) notes that the international integration of economies through free trade has weakened the democratic accountability of governments through a transfer of power from society to global financial institutions and corporations. Gilpin (2001, p. 286) cites Stephen Hymer’s radical theories, according to which “FDI was fundamentally different from portfolio investment and could be explained as part of a firm’s expansionist strategy and by its desire to control productive or other facilities in foreign countries.” Hymer considered what he called “monopoly capitalism” to be driven by two fundamental laws (Gilpin 2001):

- The law of increasing firm size: as firms grow in size and scope, they should be expected to expand within and across national borders, creating a hierarchical core/periphery structure and international division of labor around the world.
- The law of uneven development: because of their large size, mobility, and power, MNEs exercise control over and exploit the world to their own advantage.

Indeed, MNEs today appear to be richer than most countries in the developing world (OXFAM 2017). As Stiglitz (2006, pp. 187–188) notes, in 2004, the revenues of General Motors (\$191.4 billion) surpassed the GDP of more than 148 countries, while in 2005, the revenues of Wal-Mart (\$285.2 billion) surpassed the GDP of Sub-Saharan Africa. As their sizes suggest, these behemoths exert significant political power. If governments attempt to significantly regulate their activities or tax them, they threaten to relocate because “there is always another country that will welcome their tax revenues, jobs, and [FDI]” (Stiglitz 2006, p. 188). Furthermore, on many occasions, MNEs have acted in ways of disputed legality, undermining societal priorities in their quest for lower costs and higher profits. Stiglitz (2006) cites a series of such cases, such as Nestlé’s campaign to persuade third-world mothers to use infant formula instead of breast milk to feed their children, Bechtel’s attempt to privatize Bolivia’s water, and Monsanto’s development of seeds that grew

into plants that produced seeds that could not be replanted, thus forcing farmers to buy new seeds each year. While MNEs have accumulated significant wealth and power, Ruggie (2017, p. 4) argues that “the multinational enterprise barely exists under international law; indeed, some scholars have gone so far as to describe it as ‘invisible’.”

Coffey (1996, p. 58) notes that “the international division of labor has been largely regulated by the MNE through its decisions to invest or not invest in particular countries.” This assertion is debatable in the context of a series of countries, such as South Korea or Japan, for example, which permitted little equity ownership by foreign firms. However, **it does point to the fact that the evolution of the international economy is closely related to the changing nature of MNEs.**

While both of Hymer’s “laws” (above) raise important points, they seem exaggerated to some degree and disregard a series of positive effects emanating from FDI, which we discussed in Section 4.5.2 in Chapter 4. **Because of increasing scrutiny of the activities of MNEs by stakeholders, they are increasingly adopting “at-home” environmental and labor practices in their foreign locations.** For instance, Wallace (2017, p. 73) sees that there is

much the [MNEs] can do to contribute to sustainable patterns of industrialization in developing countries. In financial terms, direct investment in developing countries (generally) exceeds official development assistance. Investors can bring industry-specific and more general skills and can potentially have a profound influence on development. This potential can be realized if it becomes the norm for (MNEs) to transfer knowledge and skills, with an emphasis upon environmental issues, and to engage with wider society.

Along similar lines, Stiglitz (2006, p. 188), a famous critic of present-day globalization, notes:

[MNEs] have been at the center of bringing the benefits of globalization to the developing countries, helping to raise standards of living throughout much of the world. They have enabled the goods of developing countries to reach the markets of the advanced industrial countries; modern corporations’ ability to let producers know almost instantly what international consumers want has been of enormous benefit to both. Corporations have been the agents for the transfer of technology from advanced industrial countries to developing countries, helping to bridge the knowledge gap between the two. The almost \$200 billion they channel each year in [FDI] to developing countries has narrowed the resource gap. Corporations have brought jobs and economic growth to the developing nations, and inexpensive goods of increasingly high quality to the developed ones, lowering the cost of living and so contributing to an era of low inflation and low interest rates.

Ultimately, Gilpin (2001, p. 291) argues that

both extreme positions are exaggerations. Critics exaggerate the evils of the MNEs and their role in the world economy. Although some MNEs do exploit and damage the world, the MNE as an institution is beneficial to many peoples worldwide; it is, for example, a major source of capital and technology for economic development. On the other hand, the proponents of the MNEs exaggerate their importance and overstate the internationalization of services and production. The nation–state remains the predominant actor in international economic affairs, and domestic economies are still the most important feature of the world economy.

The financial crisis of 2008 brought new attention to the dominant position of MNEs in developing countries, especially in the least developed countries (LDCs) where local firms are at a competitive disadvantage as a result of MNEs' better access to advanced technologies, better technical flexibility and faster adaptive capacity to market changes, more available skilled labor and organizational capabilities and experience, operation at larger economies of scale, production sharing with their other subsidiaries, and additional features of modernization (South Centre 2010).

In spite of the mixed critiques, MNEs continue to come under great criticism for exploiting the environment and workers. Accidents such as the explosion at Bhopal, India, and the use of child labor in Asia are memorable examples. The effects of their great financial power have been recognized as being in need of oversight, and in the financial realm, codes of good practice for projects financed by MNEs have emerged to address this concern.

Beyond the harmful effects related to their investment activities, MNEs have come under direct scrutiny by the United Nations (Chen and Johnson 2015). More specifically, questions have been raised whether corporations have human rights obligations under national and international law (Cernic 2008). A 2003 attempt by the UN to adopt the UN Norms on the Responsibilities of Transnational Corporations and Other Business Enterprises with Regard to Human Rights* was not successful. In an interim report by John Ruggie, a special representative of the UN secretary general on the issue of human rights and transnational corporations and other business enterprises, it was concluded that "states have a duty to protect against human rights abuses by third parties," and "evidence suggests that corporations operating in only one country, and state-owned corporations, are often worse offenders than their highly visible private sector transnational counterparts" (Cernic 2008, pp. 4–5). The final report to the UN Human Rights Council concludes that "the corporate responsibility to respect [human rights] exists independently of States' duties," recommends "due diligence," and notes the commonplace inadequacy of judicial mechanisms and remedies to address human rights abuses (Ruggie 2008, p. 1).

5.3 Effects of globalization on environment-work interactions: sector VI

This section completes the discussion of the sustainability triad by focusing on the effects of globalization on interactions between the environment and work (Figure 5.10). Two effects are discussed: (1) the increased environmental footprint from increased output that results from population-led and/or economic-driven growth, or from an effort to employ more people; and (2) the employment effects of a greener and more energy-efficient economy.

5.3.1 Increasing the environmental footprint

One response to population and/or economic-driven growth is likely to be an increase in environmental footprint (Wackernagel, Monfreda, et al. 2002; Wackernagel, White et al. 2004; Thampapillai, Wu, et al. 2007).† Through a combination of new searches for

* See U.N. Doc. E/CN.4/Sub.2/2003/12/Rev.2 (2003).

† Today, the challenge of calculating our environmental footprint has been greatly reduced by online calculators such as the one provided by the Global Footprint Network (www.footprintnetwork.org/resources/footprint-calculator/) or the U.S. EPA's Carbon Footprint Calculator (<https://www3.epa.gov/carbon-footprint-calculator/>) (accessed December 12, 2017).

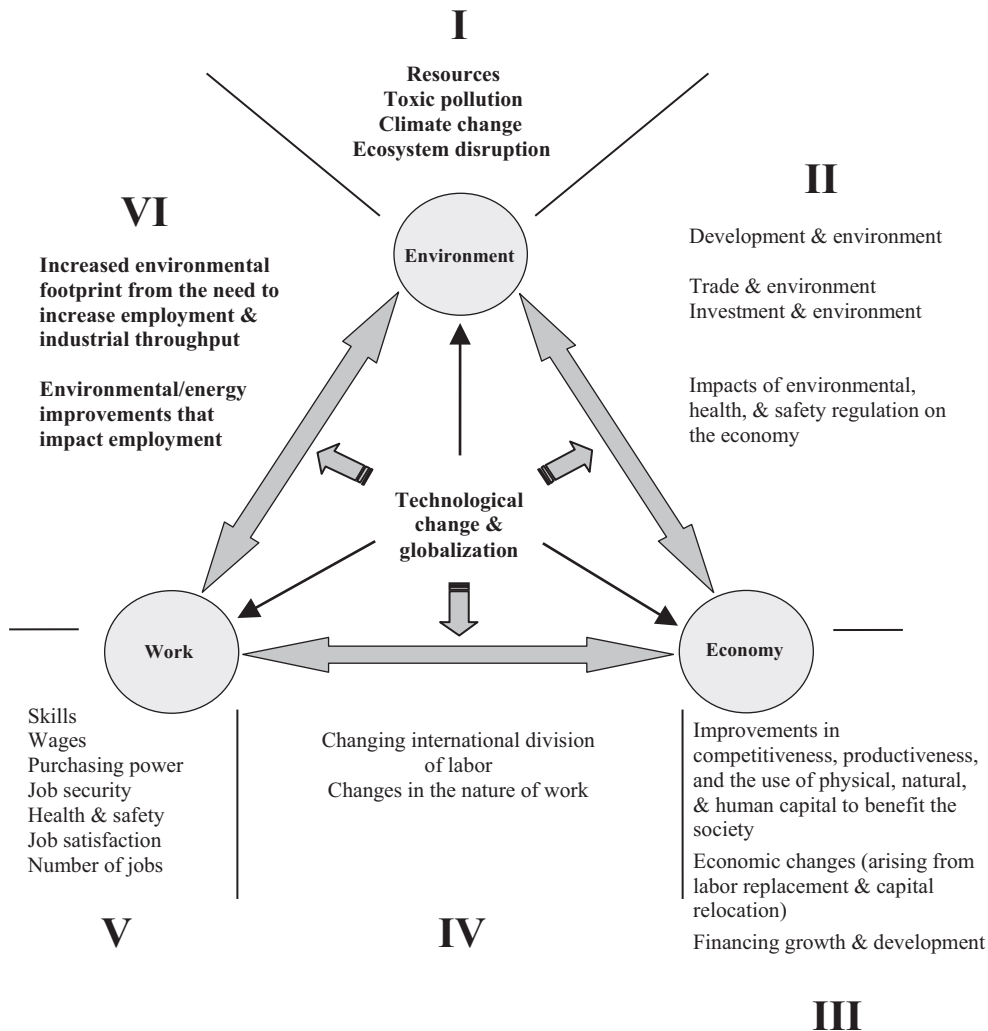


Figure 5.10 Technological change and globalization as drivers of change within and between three operationally important dimensions of sustainability (Sectors I, VI, and V)

trade revenues and increases in production/industrial throughput (and consumption) to accommodate the need to employ workers, the demand for resources and the environmental impacts are likely to increase. Although recommendations for advancing dematerialization (Schmidt-Bleek 1998; Ekins et al. 2015) and eco-efficiency have been offered, far more may be needed (McDonough and Braungart 1998). Hoffmann (2011) argues that “going green” is not enough to minimize global climate degradation sufficiently. Ashford (2016) has suggested that profit be delinked from consumption-led growth by judicious pricing schemes, which would minimize environmental degradation.

Ecological economists have long argued that growth in real GDP is ecologically unsustainable and that society, therefore, needs to transition toward a steady-state economy

(Daly 1991, 1996; Czech and Daly 2004).^{*} **The challenge, however, is that policies designed to keep economic activity within ecological limits raise difficult questions about how full employment is to be achieved** (Lawn 2004b). The current approach to creating employment is based on the assumption that increasing GDP will ultimately lead to job creation through the reinvestment of income/profits – “a rising tide lifts all boats.” Thus, any effort to constrain growth in GDP on the grounds of ecological sustainability is likely to have negative effects on job creation. The solution, therefore, is considered to lie in the creative design of policies that focus on decoupling the “GDP-employment” link (Lawn 2004b).

How to transition toward a steady-state economy while enhancing employment is the focus of the *International Journal of Environment, Workplace and Employment* (Lawn 2004a).[†] This journal provides a forum in which the potential conflict between sustainability and full-employment objectives is considered and solutions are developed that try to “establish sustainable, equitable, and efficient economies” (ibid., p. 4). Since its creation in 2004, a range of strategies have been considered that seek to sever the GDP-employment link and promote steady-state thinking. These strategies include ecological tax reform – for example, taxing the “bads,” such as resource depletion and pollution, and not the “goods,” such as labor and income (Lawn 2004b, 2006); establishing a “basic income” to remunerate non-paid household and volunteer work (Lawn 2005); and creating a “job guarantee” where government provides basic (and ecologically sensitive) employment to labor displaced from the private sector (Forstater 2004; Lawn 2005; Harvey 2006). Of these strategies, ecological tax reform and the job guarantee are considered the most effective, so long as additional quantitative throughput controls are used to keep economic activity within ecological limits (Lawn 2005, 2006). Also see the discussion on work sharing and degrowth in Chapter 3.

Regardless of the approach one adopts, the preceding discussion highlights the important interaction between work and environment that falls into Sector VI of Figure 5.10.

5.3.2 *The effects of a greener economy on employment*

Research on the link between efforts to improve an economy’s environmental performance and the impacts of these efforts on employment is limited, but those studies that do exist reveal some interesting results. Bowen and Kuralbayeva (2015, p. 15) opine that “renewable energy and low-carbon sectors generate more jobs per unit of energy delivered than the fossil fuel-based sector.” The OECD (2017b, p. 5) argues that “dynamic labour markets with sufficient flexibility are therefore crucial to manage the labour market during the green growth transition and reduce the costs of transitioning to green growth.” Bartik (2015, p. 180) argues that

environmental regulations are unlikely to have major net job effects because aggregate demand is unaffected. Environmental regulation reallocates labor demand. This reallocation is from places with heavily regulated industries towards places that produce pollution control equipment or substitutes for the regulated businesses’ products. Job reallocation is greater if the regulation is location-specific.

^{*} For a discussion of the steady-state economy, see Section 1.3.1 in Chapter 1.

[†] Another journal to consider is *Environmental Innovation and Societal Transitions*. This journal provides a platform for reporting studies of innovations and socioeconomic transitions, with a focus on an environmentally sustainable economy and structural resource scarcity and environmental problems, notably related to fossil energy use and climate change.

One strategy for greening the economy, which could result in significant business and employment opportunities, is to **delink economic growth (and employment) from environmental degradation via investments that promote new environment-friendly technologies** (Somavia 2002). Underlying this vision is the assumption that investing in the environment can create a “double dividend” of a better environment and more jobs. The European Commission (1994) put forward a white paper articulating this strategy, but it has not come to pass. Later, the Commission adopted the Lisbon Strategy, succeeded by Europe 2020, arguing that Europe could become the most competitive, environmentally sound, and job-creating economic region, but this did not materialize (Ashford and Renda 2016). The challenge to this approach is that although the implementation of cleaner technologies and production has created new jobs, it has also destroyed older, dirtier jobs involving end-of-pipe pollution control. In addition, skill shortages may well impede the transition to green growth and inadequate training provisions may undermine green programs (WBG 2012, pp. 99–100).

Getzner (2004) identified several interesting observations from a study of firms that implemented environmental protection measures such as environmental management systems, waste-management systems, and water- and wastewater-management schemes. Many of these measures also involved environmental innovations (both process and product innovations). Three findings from Getzner’s (2004) study are of particular interest. First, although the environmental protection measures were found to have only a slightly positive quantitative effect on employment, they resulted in **significant environmental improvements**.

Second, the environmental protection measures and innovations had a **noticeable positive impact on employment quality**. For example, in many firms, employee contact with hazardous materials was reduced, as were smells, noise, heat, and emissions of particulate matter. The more sustainable production methods were also found to change the organization of work through increased labor-market flexibility and new work processes. The extent to which the working environment was improved was found to be correlated with the level of employee involvement in implementing the measures.

Finally, the implementation of environmental protection measures was found to have a **positive impact on the skill level of workers**, primarily because of in-house training programs. The need for workers to enhance their skills in response to sustainable production initiatives led to a corresponding increase in the demand for skilled workers and a decrease in the demand for less skilled workers. In 2009, the American Recovery and Reinvestment Act authorized \$5.8 million in Green Capacity Building grants with the intention of increasing the training capacity to help individuals enter the increasing green job market (US DOL 2010). Research by Bezdek et al. (2008) highlights the potential value of such an investment in training. Their study on the impact of environmental protection measures on employment in Florida and Michigan, concluded that environmental protection “generates jobs that are disproportionately for highly skilled, well-paid, technical and professional workers, who in turn underpin and provide foundation for entrepreneurship and economic growth” (Bezdek et al. 2008, p. 76).

Bezdek et al.’s (2008) findings are important because they **challenge the commonly held belief that environmental protection measures are economically negative**. Indeed, regions that focus on the development of environmental and environment-related industries could enhance their economy by attracting and retaining high-skilled workers.*

* Bezdek et al. (2008, p. 69) defines environmental industries “as those which, as a result of environmental pressures and concerns, have produced the development of products, processes, and services, which specifically target the reduction of environmental impact.” Further, he considers environment-related jobs to be “those created both directly and indirectly by [. . . environmental protection] expenditures” (ibid., p. 69).

Further, Bezdek et al. (2008) argue that many policy makers are unaware of the relative number of jobs created by the environment industry compared with other sectors of the economy. In 2017, it was estimated that there were 4–4.5 million clean energy and sustainability jobs in the U.S., related to energy efficiency, renewable energy, public sector programs, and advanced vehicles (EDF Climate Corps and Meister 2017). Further, the jobs relating to energy efficiency provided wages that were \$5,000 above the national median (ibid.). Globally, the number of green energy jobs is estimated to be around 10 million, with 3.6 million of those jobs located in China (John 2017).

Although firms could voluntarily adopt environmental protection measures and create high-skilled environmental jobs, **the regulatory framework within which firms operate will also have an important role.** Indeed, Getzner (2004, p. 392) argues that

without strict regulation, many measures adopted voluntarily by companies would be uneconomic and would, in all probability, not be taken, since businesses are largely motivated by economic advantages. Environmental restrictions (laws, regulations, employee protection legislation and problems with local residents) put a price on pollution, which in turn encourages voluntary efforts.

Getzner (2004) also recognizes the importance of creating economic incentives to integrate environmental protection measures into production. When these measures are linked with the regulatory framework, they provide valuable market signals to firms that wish to act.

Employment that is created via environmentally sound products, processes, product-services, and services is tempered by a loss of jobs in those industries that are replaced. Typically, these industries are older, more polluting, and less able to adjust quickly to new operating environments. Further, the relative impact on employment of strategies designed to green the economy is likely to depend on a nation's existing industrial sectors, the extent to which cleaner technologies and processes are deployed within these sectors, the available natural and human resources, and the extent to which significant innovation is stimulated.

Although creative destruction appears to be the engine of economic growth, it is useful and important to examine its effects not only from the perspective of the state or the private sector, but also **from the perspective of the labor force.** The prospect of creating "green jobs" in the United States provides a particularly interesting case study of certain aspects of innovation and sustainability.

In general, green energy is considered highly labor intensive, at least initially. The Obama administration proposed a \$150 billion per year investment in clean energy over a decade, which was projected to create a net gain of 1.7 million jobs in the United States (Pollin et al. 2009).^{*} Apart from the **elevated performance of a green stimulus in job creation**, it also entails a series of long-term benefits, including increased consumer savings through the reduction of energy bills; the stabilization of oil, gas, and coal prices through reduced demand and increased energy diversity; and, obviously, a cleaner, low-carbon environment (Pollin et al. 2008).

A green stimulus program would create three kinds of jobs (Pollin et al. 2008, 2009):

- *Direct jobs:* construction jobs created by retrofitting buildings to make them more energy efficient or manufacturing jobs created to build energy turbines;

^{*} In total, some 2.5 million jobs were estimated to be created in the clean-energy sector. However, if the same level of funding were to be spent on conventional fossils, the number of jobs created was estimated to be 800 million. Thus, the estimate of 1.7 million jobs is the difference between these two estimates (Pollin et al. 2009).

- *Indirect jobs*: manufacturing and service jobs in associated industries that supply intermediate goods for building retrofits or wind turbine manufacturing, such as lumber, steel, and transportation; and
- *Induced jobs*: retail and wholesale jobs created by workers in these construction, manufacturing, and service industries when they spend the money they earn on other products of the economy.

The first two categories are straightforward, while the third category is an attempt of the model to capture the “**Keynesian multiplier**” effect.

Other studies of green jobs have led to different conclusions. Getzner (2002) concluded that although the qualitative impact of green technologies is significant, their quantitative impact through job creation is marginal. Furthermore, Pollin et al. (2009) have essentially conducted a classical economic *ceteris paribus* analysis – that is, investment and job creation are seen as a one-step policy, which disregards significant economic processes outside the focus of the model. There are two main criticisms that can be made:

- 1 The model disregards the workers in the traditional energy industry in the United States, many of whom could be displaced.
- 2 The model calculates the jobs that will be created in the immediate short run.

The first criticism is fairly straightforward. Green technologies constitute a clear-cut case of innovation in the Schumpeterian sense. However, as Schumpeter elaborated, innovation unleashes powers of creative destruction, and although the creation of green jobs is indeed creative, there is also an element of destruction, which is typically expressed by the dislocation of competitive industries that were deemed to be technologically inferior. In the case of green energy, the potentially disrupted industries are the traditional energy industries (oil, gas, and coal).^{*} Hence, a truly comprehensive calculation, useful for state policy, would actually focus on the net amount of jobs created and would include a calculation of the number of jobs that will actually be lost in the process.

Furthermore, the introduction of green energy technologies will most certainly have to be reconciled with a series of regulations and policies that will seek to correct the externalities of pollution in energy prices. Hence, these policies (such as CO₂ taxes or cap-and-trade) should be expected to increase traditional energy prices. Thus, an additional and equally important consideration is that higher energy costs could have an adverse effect on the payrolls of energy-intensive companies, such as manufacturers (Wolgemuth 2009).

An additional issue is **average compensation**. In general, not all green jobs are equally green, both in compensation and in how environmentally friendly they are (UNEP 2008). In general, it is important that a significant number of new jobs will be created through a green stimulus program; **however, the nature, quality, and compensation of these jobs are of equal importance**. The U.S. green stimulus program was projected to generate significant numbers of well-paying jobs, but also a relatively high proportion of lower, entry-level jobs. According to Pollin et al. (2008), the average compensation of employees associated with green investment areas was estimated to be about 20 percent less than the average of those in the oil industry. Pollin et al. (2008) claim that this number is deceptive because the true comparison should be made not with already-existing jobs in the oil industry, but with the jobs that would be created if the stimulus were not

^{*} Louie and Pearce (2016) estimated the costs of retraining coal-industry employees to work in an expanding PV industry and found them to be around 0.0052 percent (\$180 million) to 0.0543 percent (\$1.87 billion) of the U.S. federal budget, depending on the policy scenario being considered – e.g., the employees pay for their retraining, states develop their own retraining programs, etc.

spent in green technologies but in alternative ways. This is a valid statement; however, the fact that green jobs are paid less remains and cannot be disregarded, especially given the displacement of jobs in the traditional oil industry, which will also occur and has not been calculated.

A key criticism is that Pollin et al.'s (2008) model assumes a certain labor intensity for green jobs, which, while realistic in the short run, is certainly unrealistic in the long and perhaps even the medium run. In general, as new innovations appear in the marketplace, the form in which they are introduced originally tends to be the most labor intensive. However, as new process innovations take place, labor tends to be increasingly replaced by capital, and many jobs are lost in the process. This paradigm is particularly relevant in the case of ICT, for instance. Hence, although green jobs are accurately considered labor intensive, more light needs to be shed on the duration of their labor intensiveness. For instance, what fraction of the jobs created will involve the initial installation of the facilities versus the operation of the facilities or green service jobs?

There is no objective answer to such questions a priori. Nonetheless, such questions are key for policy planners, and the considerations that they entail should not be disregarded. For a framework to estimate the impacts of green policies on jobs, see World Bank (2012, Box 4.1, p. 97).^{*} See also OECD (2012) for a discussion of green growth policy instruments to tap green opportunities, elaborated with a focus on developing countries.

With regards to the U.S. green stimulus program, a 2016 retrospective review of the clean energy investments in the America Recovery and Reinvestment Act of 2009 found that solar electricity generation increased thirty-fold and wind electricity generation increased threefold since 2008 (Executive Office of the U.S. President 2016). Further, the stimulus program was credited with the creation of 900,000 job-years (a full-time job for one year) from 2009 to 2015. However, no assessment was made of the number of jobs that may have been lost in the fossil fuel sector as a result of the program,[†] and no information was provided on the relative level of incomes that the clean energy jobs provided when compared with more conventional energy jobs.

5.3.3 *Immigration and population*

Human resources, the least mobile of the factor endowments important to nations, increasingly present both a challenge to sustainability and an opportunity for its advancement (see Muradian et al. 2006).

There seems to be a growing incompatibility between government actions to liberalize markets, knowledge, and information and policies that restrict immigration, forcing many who choose to migrate to do so illegally (ECLAC 2002).

Pressures created by immigration and both economic and political migrants raise **economic, social, ethical, and strategic dilemmas**. On the one hand, from an industrialized nation's perspective, immigration alleviates labor shortages (at the prevailing local wage) for lower-paid (and sometimes, but not always, low-skilled) jobs, brings welcomed high-skilled talent to the industrialized North, provides a means to create the financial surplus for a decent retirement for an aging workforce, and enriches the cultural base of a nation. On the other hand, immigration of culturally different peoples looking to improve their

^{*} The World Bank (2012, p. 102) comments that "fears that environmental regulations will lead to massive job losses or loss of competitiveness are probably as unfounded as the hope that green jobs will single-handedly solve countries' employment problems. That said, it is vital to invest in human capital to accelerate growth and to green growth."

[†] For some context, from 2008 to 2016, the number of mining jobs in the U.S. fell from 87,755 to 51,795, a reduction of around 40 percent (U.S. EIA 2017).

situation engenders resentment* and social exclusion, creates more consumption that adds to the ecological/environmental footprint, depresses the salaries of lower-wage jobs, and presents a future retirement burden that portends no end. Interestingly, research on the impacts of immigration finds that such common perceptions of the negative effects of immigration are often unwarranted (ECLAC 2002; Mármora 2001). For example, a study commissioned by the U.S. Congress finds that immigration had only a minor impact on wage and job opportunities of competing local groups (J. P. Smith and Edmonston 1997). The most significant effect was the improvement in the well-being of immigrants, not the reduction in well-being of, or opportunities for, citizens.

Many proponents of sustainable development focus on population – and immigration – control as an important policy tool. However, few have come to grips with the challenge of how to build a society that grows indefinitely but does not create more mouths to feed and more persons to clothe, house, and employ in the face of increasing unemployment and underemployment and falling real wages for many. The immigration of Southern workers to the North allows them to support families back home through remittances, but it does not create economic development and self-sufficiency for the less developed nation. These “social” issues are very much a part of the sustainability challenge. Given the aspirations of those who live in the developing world to increase their standard of living, a future world with 9 billion consumers creates a serious challenge to environmental sustainability. To this group, population control is seen as a discriminatory and untenable policy approach, especially when the first world consumes an ever-increasing percentage of the world’s resources and energy. The globalization of the world’s economy looks set to continue a visible contrast between those who have and those who have not.

5.4 Conclusion

In Chapter 4, we explored the influence of globalization on economic growth from a technological, trade, and financial perspective. In this chapter, we explore the effects that globalization and technological change have on the three pillars of sustainable development – the environment, the economy, and employment. As should be evident, these drivers of change can both undermine and enhance efforts to advance sustainable development, highlighting the importance of understanding their dynamics and how these could be leveraged to affect change. The chapter also reveals the need to adopt a more comprehensive and global view of problems. Throughout this work, we argue for the need to **open up the design and political space** so that a broader range of factors and ideas can be included in potential solutions. This chapter indicates why such a holistic and multidimensional view is needed – i.e., single purpose solutions to highly complex problems are unlikely to work. Even armed with a broader perspective of the drivers of unsustainable development, finding solutions that work is likely to require trial-and-error and flexible mechanisms whereby changes can be made as technology and globalization continue to reshape markets and landscapes.

The next three chapters are focused on technology. They are intended to provide a deep understanding of the process of technological innovation (Chapter 6), what influences the industrial firm – both incumbents and new entrants – to innovate (Chapter 7), and how government policies can foster innovation (Chapter 8). In Chapters 9, 10, and 11, we expand on this foundation by looking at national (U.S.), regional (EU), and

* Interestingly, culturally distinct groups in a society, even if they are not of recent origin like the Chinese minority in some Asian countries, are experiencing increased violence as a result of their entrepreneurship and higher economic status accelerated by trade (see Chua 2004). Unfortunately, economic hardships brought about by unemployment and wage depression in the U.S. and Europe have recently engendered resentment and anti-immigrant animus among a country’s residents.

international regimes to protect health, safety, and the environment, and the connection between trade and sustainability, respectively.

5.5 Additional readings

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Part III

Industrial policy and the role of the firm in pursuing sustainable development

In Part II of this work, we articulated the effects that both technological change and globalization have, or are expected to have, on the three pillars of sustainability. Technological change is both a cause of unsustainability and a vehicle for the improvement of the workings of the industrial state. Therefore, understanding the technological change process, and the possible roles of the private sector and the government in influencing that process, is essential to the design of policy. A number of questions are suggested in this regard. The reader might wish to address them on the completion of all of the chapters in this part of the work.

- 1 How likely is it that the needed sustainability changes evolve without government intervention and over what time period?
- 2 If the government greases the innovation system – that is, improves the climate for innovation – through traditional industrial policy by making it more efficient, for example, increasing rewards to innovation through better patent or IP policy or tax treatment of investment etc., will this give rise to more and faster development of sustainable innovation, or just generate more profits?
- 3 If we move to a more innovation-interventionist and targeted approach with incentives given for more sustainable versus unsustainable innovations in specific problem areas, for example, in energy, what is the likelihood that incumbents versus new entrants will lead the pack?
- 4 Do we need stringent/strong regulatory requirements/sticks instead, or as well? Is the third strategy necessary? Sufficient?
- 5 Who is most likely to respond to regulatory fiats, incumbents or new entrants?
- 6 Are the answers different for different sectors/problems – for example, toxic chemicals versus energy sources/efficiency?
- 7 Are the answers different in different nations?

The focus of technology policy can be broad or narrow. Historically, the focus of industrial policy was to improve the utility and profitability of the products of industrial development. This meant an essentially utilitarian approach, focused on improved performance, lower costs to consumers and users, and increases in profit for the technology providers. Thus, the emergent scholarship on industrial policy quite naturally focused on how innovation occurs in firms and how the general technology business environment could be optimized through strengthening the national (or sectoral) innovation system, that is, strengthening the *determinants* of innovation. While government might be involved in the actual development of “big science” – such as computers and aircraft – for the most part, industrial innovation (especially in the development of saleable products) was to be left to the private sector, with government benignly “greasing the wheel” where useful. Chapter 6 explores these ideas that are probably best characterized as the underpinnings of evolutionary change.

A more detailed look into how firms “learn to innovate” and whether evolutionary processes – enhanced by organizational changes in existing firms leading to enhanced learning – can lead to significant innovation is examined in Chapter 7. The extent to which evolutionary processes – with a minimalist government role – will lead to improving the environment and employment is also examined in this chapter. Beyond picking “the low-hanging fruit” that advantages industry directly by eliminating waste and reducing pollution control costs, or treating labor better because it *might* enhance profitability, it is concluded that firms engaged in evolutionary processes are *unlikely* to contribute to significant innovation in the time period now thought to be needed to address the serious sustainability challenges ahead.

This brings us quite naturally to the focus of Chapter 8: what form(s) could a more interventionist “industrial policy” take? Both management of evolutionary processes through “strategic niche management” and more directive *industrial policy* options are explored, focusing on changing the incentives for technological change. Their influence on competitiveness; health, safety, and the environment; and employment is also discussed for both developed and developing countries. The effects of globalization, mediated through impacts on technology, also have consequences for employment and these will also be discussed.

Following our exploration of more interventionist government policies focusing on economic welfare and the economy, Chapter 9 in Part IV of this work explores two different policy models for addressing health, safety, and environmental concerns from the perspective of the nation–state through *environmental policy*. It focuses on: (1) controlling pollution in various media (air, water, waste, and workplace), product content and characteristics, and industrial chemical production, use, and disposal; and (2) developing an “industrial policy for the environment” in which encouraging or requiring environmentally sustainable production and products are the focus primarily through the tools of environmental policy and regulation. Whether and how technology might be used to improve the environment, employment opportunities, and economic welfare is reserved for the concluding Chapter 13.

6 The importance of technological innovation

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6.1 Introduction

In Part I of this book, we addressed the dimensions and historical evolution of the concept of sustainability. In Part II, we discussed the concept of industrial development, first in the context of the nation–state and then in the context of the globalized economy. We then explored the impact of both technological change and globalization on sustainability, tracing the current and anticipated effects of both on development.

In this chapter that begins Part III, “Industrial Policy and the Role of the Firm in Pursuing Sustainable Development,” we focus on a deeper understanding of technological change and argue that technological innovation is essential for achieving sustainable development. In Chapter 7, we explore the role of the industrial firm in improving production processes, products, and services (that is, competitiveness); in improving the environment (through environmental technology or the prevention of pollution at the source); and in providing employment. In Chapter 8, we address the role of government through various approaches to industrial policy in improving competitiveness and employment. Part IV addresses other roles for government. In Chapters 9 and 10, we discuss nation-based policies and international regimes, respectively, for achieving environmental sustainability and improving the safety of workplaces and products. Chapter 11 discusses the nexus and conflicts between trade regimes, the environment, and employment.

6.2 Types of innovation and the nature of technological change

6.2.1 *Categorizing technological change*

“Technological change” is a general and imprecise term that encompasses invention, innovation, diffusion, and technology transfer. Technological innovation is the first commercially successful application of a new technical idea. It should be distinguished from invention, which is the development of a new technical idea, and from diffusion, which is the subsequent widespread adoption of an innovation beyond those who developed it (Figure 6.1).^{*} The diffusion of a technology is important from an economic and social per-

^{*} The distinction between innovation and diffusion is sometimes hard to draw, however, because innovations can rarely be adopted by new users without some modification. When modifications are extensive, i.e., when adoption requires significant adaptation, the result may be a new innovation.

Invention (the first working prototype)

Innovation (the first commercially successful introduction)

Sustaining innovation – innovation that occurs within the current/dominant technological trajectory

Disrupting innovation – innovation that occurs outside mainstream development trajectory; either

- *Intrinsic innovation: encompassing a new technology, or*
- *Architectural innovation: a new combination of prior-existing technologies*

Diffusion (wider adoption *within* an industry)

Technology transfer (wider adoption across industries or countries)

Product changes/product-services (changes in the final product and/or service(s) delivered by the product)

Process changes (changes in the *process* of making a product or delivering a service)

System changes (systemic changes that include some combination of technological, organizational, social, and institution innovation)

Figure 6.1 The dynamics of technological change

spective because an innovative technology pays off economically, environmentally, and/or socially only when it is applied and replicated.*

The classical model of technological innovation considered *invention*, *innovation*, and *diffusion* to operate in a linear way (see Figure 6.2; Kline and Rosenberg 1986; Schumpeter 1962). Early criticisms of the linear model of technological innovation focusing on the isolated entrepreneurial firm stemmed from the realization that the process was not unidirectional, but rather involved feedback among the three stages (Figure 6.2). Later models of technological innovation recognize the importance of knowledge transfer (Fischer 1999; Kline and Rosenberg 1986) and, more specifically, how learning and feedback are central to the diffusion and adoption of a new technology. Nonetheless, it would be an overstatement to say that the linear model involving three important stages has been rejected; it is now recognized to have more complex temporal and wider stakeholder attributes.

In the classical literature, two main categories of technological innovation are discussed – *product* innovation and *process* innovation (Utterback 1996). A *product innovation* occurs along the lines described above, where a new product is invented and sold in the market, or the composition, design, operation, quality, or function of an existing

* Indeed, the preoccupation of scholars with innovation, in contrast to diffusion, may contribute to under-deployment or lack of development of policies needed to promote diffusion. The diffusion of technology is essential for enhancing sectoral and national revenues, as well as promoting more sustainable industrial, agricultural, transportation, and construction practices. See the special issue of the *Journal of Cleaner Production* devoted to strategies for promoting diffusion (Montalvo and Kemp 2008). See also the discussion of the role of government in promoting innovation and diffusion in Chapter 8. Finally, see a report on deep-decarbonization intended for discussion by the EU Commission that argues that rather than an “innovation deficit” Europe suffers from a “diffusion” (or deployment) deficit in energy-relevant technologies needed to address climate disruption (Ashford and Renda 2016).

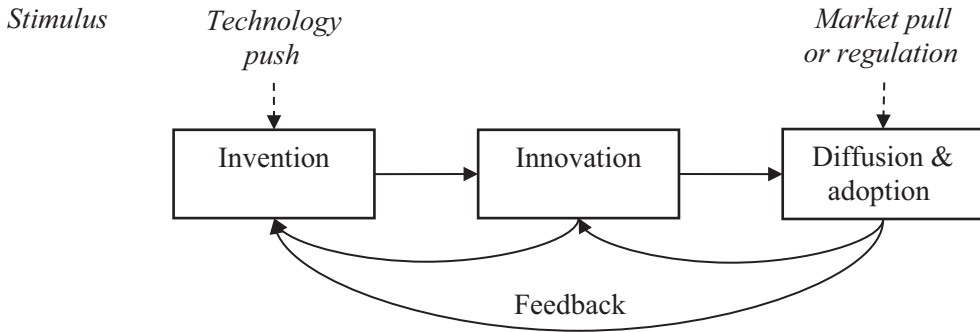


Figure 6.2 Simple linear model of technological innovation with feedback

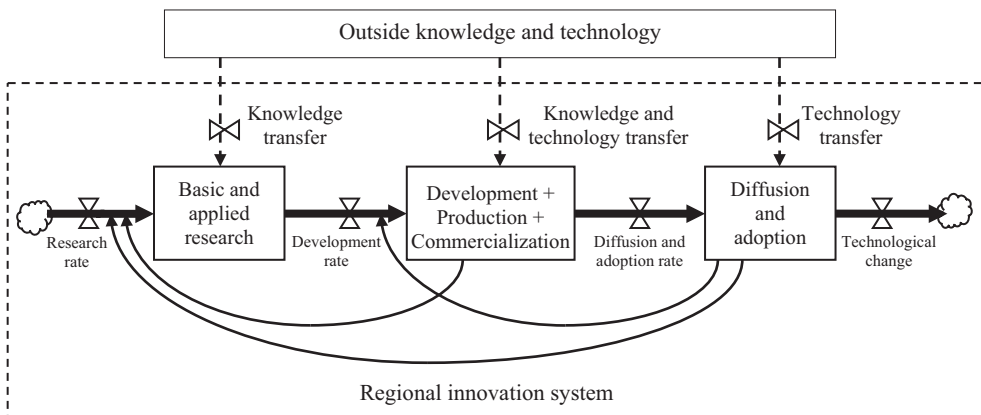


Figure 6.3 The basic model of the sectoral/regional innovation system (embedded in social networks)

product is changed in an incremental or radical way. A *process innovation* occurs when an improvement is made in the way a product is manufactured without significantly changing the final product. Sometimes a process innovation – such as the polymerization of a plastic or dry painting technology – is sold to industrial users and/or consumers and has most of the market characteristics of a product innovation.

Another depiction of the innovation process within an industrial sector or geographic region using terms familiar to innovation scholars is presented in Figure 6.3. This depiction is useful in discussing the role of different societal stakeholders in the innovation process – in other words, the social embeddedness of innovation (see the discussion in the next chapter).

As industrial societies mature, the nature and patterns of innovation change (Abernathy and Clark 1985; Utterback 1987). New technologies become old technologies. Many product lines (for example, washing machines or lead batteries) become standardized or increasingly “rigid,” and innovation, if there is any, becomes more difficult and incremental rather than radical.

In language that is familiar to traditional innovation scholars, an *incremental innovation* involves a step-by-step co-evolutionary process of change, whereas *radical innovations* are

discontinuous and possibly involve the *displacement* of dominant firms and institutions rather than evolutionary transformation (Ashford et al. 2002; Luiten 2001; Moors 2000; Partidario 2003). Christensen (1997) distinguishes the former as *sustaining innovation* and the latter as *disrupting innovation*, rather than “radical.” He argues that both sustaining and disrupting innovation can be incremental, moderate, or radical. Unfortunately, the term “radical” in the literature is used in these two different ways and is a source of confusion. The later discussion in this chapter will clarify the use of these terms.

In Christensen’s original 1997 work, he focuses on *technologically* disruptive changes in disk drives that result in market consequences. In his later work (Christensen et al. 2015), he shifts to implicitly arguing that market consequences, rather than changes in technology itself, define disruption. This change creates unfortunate and unnecessary confusion among the critics in the literature (King and Baatartogtokh 2015). In this work, our focus is on the Schumpeterian notion of technology-stimulated economic change.

Another issue, however, needs clarification: sustaining or disrupting of what? Christensen (1997) uses the term “disrupting” in the context of a customer base that values certain product attributes, and whose changing desires can change the markets for technological variants in products. The context in which we will use the term throughout this book pertains to the product – and also other technological or system changes – from a *technological* as well as a customer-based desirability-of-attribute perspective. In this regard, our use of the term “disrupting” is more in line with Chris Freeman’s (1982a) use of the term “radical” or Nelson and Winter’s (1977) idea of shifting “technological regimes” (see below). Because we take Christensen’s point that the term “radical” should be reserved to describe the *rate* of change rather than its type, we will generally avoid the term as a synonym for “disrupting.”

From a technological perspective, disrupting innovations can be either *intrinsic* or *architectural*. The former is a dramatically different way of achieving functionality, such as the transistor replacing the vacuum tube; the latter may combine technological ideas in a new artifact, such as the hybrid electric and internal combustion engine. Christensen et al. (1998) stress the latter and focus on product technology. Utterback and Acee (2005, pp. 15–16) observe that “innovations that broaden the market create new room for firms to start,” and “the true importance of disruptive technology [...] is not that it may displace established products. Rather, it is a powerful means for enlarging and broadening markets and providing new functionality.”

The problem with restricting one’s analysis to the market determinants of technological change is that this neglects the fact that markets may not respond adequately to sustainability concerns. More is needed than matching the technological capacities of firms with current societal demands. Our inquiry will distinguish between sustaining innovation and disrupting innovation in a broader technological and societal context.

Product lines/sectors that are well developed and have become standardized mainly experience incremental innovation. Changes are focused on cost-reducing production methods – including increasing the scale of production, displacing labor with technology, and exercising more control over workers – rather than on significant changes in products. Process innovation usually gradually declines as manufacturing or production processes are standardized. A useful concept related to individual product lines is that of “technological regimes,” which are defined by certain boundaries for technological progress and by directions or trajectories in which progress is possible and worth doing (Nelson and Winter 1977).

Sometimes, however, the dominant technologies (such as the vacuum tube, the mechanical calculator, and landlines) are challenged and rather abruptly displaced by significant disrupting innovations (such as the transistor, the electronic calculator, and mobile then smartphones), but this is relatively rare, although very important (Christensen 1997; Kemp 1994). We will argue that disrupting innovations – involving more than incremental changes in product or process attributes – may be needed to achieve sustainability. As industrial

economies mature, innovation in many sectors may become more and more difficult and incremental, and regulatory and governmental policies are increasingly influenced, if not captured, by the purveyors of the dominant technology (regime), which becomes more resistant to change. However, occasionally, traditional sectors can revitalize themselves, as in the case of cotton textiles*

Even if an existing firm is driven by a desire for greater profits or market share, it faces a dilemma (Christensen 1997) of whether to continue developing innovation in its traditional and successful product line or to embark on a different (Schumpeterian) pathway that requires changes in its technology and perhaps even in its markets. In an empirical study of the determinants of successful disrupting innovations requiring a transformation of both core competencies and markets, Herrmann et al. (2007) put forth the following hypotheses, consistent with the expectations of Christensen (1997):

- 1 The greater the capacity to transform competencies, the higher the propensity of a company to introduce radical[†] product innovation.
- 2 The greater the ability to transform markets, the higher the propensity of a company to introduce radical product innovation.
- 3 The more pronounced the orientation toward technological innovation is in a company, the more likely the company will be in a position to transform its competencies.
- 4 The more a company can be described as a learning organization,[‡] the more likely the company will be in a position to transform its (a) competencies and (b) markets.
- 5 The greater the willingness of a company to take risks, the more likely the company will be in a position to transform its (a) competencies and (b) markets.
- 6 The more a company orients itself on a long-term basis, the more it will be in a position to transform its (a) competencies and (b) markets.
- 7 The more a company distinguishes itself through traditional customer orientation (in terms of customer-led business), the less likely it will be in a position to transform its markets.

Not surprisingly, willingness to take risks and an orientation toward technological innovation had the biggest statistically significant positive influence on the required transformation capabilities and thereby on disrupting product innovation. Citing the literature, Herrmann et al. (2007, p. 101) note that “most case studies on radical [i.e., disrupting] innovations describe the high time requirements: a threshold of 10 years is often reached and in some cases substantially exceeded.”

* Under the economic threat of more stringent worker protection standards for cotton dust exposure, the leading U.S. textile firm decided to redesign and modernize its technology to reduce occupational exposure to both cotton dust and noise and to improve production efficiency. It stands out as one of the rare instances where an industry reinvented and replaced itself.

† Herrmann et al. (2007) use the term “radical” to mean “disrupting” in the Christensen formulation.

‡ The dynamic nature of the innovation process for discontinuous (i.e., radical or disrupting) product innovation is further developed by a theory of “probe and learn,” whereby an iterative process of introducing novel products into nascent markets receives feedback from different and shifting consumers/users of those products that involve different design modalities until a successive market and customer base emerges (Lynn et al. 1996). In other words, the “product attributes” valued by the relevant customer base, described as “value networks” by Christensen (1997), are fluid and must be discovered by the innovator, who must use that learning to modify the product. This is reminiscent of a “co-evolutionary” process later described by Kemp and Rotmans (2001). “Development of a discontinuous innovation becomes a process of successive approximation, probing and learning again and again, each time striving to take a step closer to a winning combination of product and market” (attributed to Charles Lucy by Lynn et al. 1996, p. 19). The process is more empirical than analytic. See Chapter 7 for a discussion of organizational learning and innovation.

Sartorius (2006) recites the importance of disrupting innovation and the difficulty and resistance of incumbent firms to depart from their historical pathways (that is, exhibiting path dependency), reflecting not only “lock-in” to continued patterns but also “lockout” from changes necessary to become more sustainable. He also adds a further dimension. He distinguishes first-order sustainability, which focuses on specific innovations to achieve a particular environmental goal (articulated in government regulations or strong social demands), from second-order sustainability, which enables an industry system to adapt continually to new and changing challenges. Lock-in refers not only to the routines of a particular firm but also to the system in which it is embedded (for example, markets, economies of scale, governmental rules, and short-term time horizons), which present continuing resistance and barriers to future change that would otherwise allow wider choices among more sustainable trajectories. Sartorius (2006) argues that therein lays the real and most difficult challenge. Firms are driven by short-term cost and risk-reduction concerns rather than longer-term investments in uncertain futures.* Further, Sartorius (2006) emphasizes that co-evolution in the technical, economic, and social spheres is a necessary characteristic of system changes that are capable of achieving second-order sustainability. The most favorable likelihood of achieving system changes representing second-order sustainability is in those industries that have been besieged by first-order sustainability challenges that move them on to second-order changes, such as parts of the chemical industry or, lately, industries with high energy costs. This observation supports the proposition that prevalent stringent regulation is a precondition to achieving second-order, long-term sustainability. Sartorius (p. 278) comments:

The government typically plays a crucial role in overcoming existing barriers to competitiveness [by forcing the internalization of social costs] in the relevant markets. In doing so the government inevitably faces opposition from those whose interests are negatively affected: the incumbent industry and other groups paying the price for measures taken. Typically, the government or policy makers in general are not inclined to neglect such opposition [giving rise to regulatory capture] unless the promoting forces from other parts of the society are sufficiently strong. More so, major techno-economic changes require a general openness or even a readiness to change (i.e., a period of instability) on the part of the political system. For these reasons, the techno-economic factors will have to be supplemented by both political and social factors.

Lock-in is a problem that affects the extent of the *diffusion* as well as innovation of environmentally superior or energy-efficient technologies. Using reasoning similar to that of Sartorius, Carrillo-Hermosilla (2006) argues that as a result of increasing returns to adoption of energy technologies produced by economies of scale, “apparently inferior designs can become locked in a historically dependent process in which circumstantial events determine the winning alternative.” He opines “that it is relatively unlikely that conventional policy measures, not necessarily focused on technological change, may alone be able to bring about this radical [disrupting] change in technologies and practices” (ibid., p. 718). His recommendations to encourage what he calls “techno-environmental transitions” (focusing on the diffusion of superior technologies) must involve co-evolutionary processes, including strategic niche management, market-transformation programs, demand-side management, and voluntary environmental agreements.

* Sartorius cites the work of Porter and van der Linde (1995) in arguing that firms that take environmental externalities into account up front when they are undertaking environmentally sound innovation ultimately benefit financially. Note, however, the discussion of the earlier work of Ashford et al. (1985) and Ashford et al. (1979) that incumbents are likely to undertake incremental rather than radical innovation.

Firms may innovate for “main business” purposes or in order to achieve compliance with health, safety, and environmental regulations or demands (Ashford et al. 1979). Focusing on product innovations in the disk-drive industry, Christensen (1997) has argued that incumbents* are unlikely to come up with the next radical (that is, disrupting) innovation. Analyzing a broader set of product innovations in consumer durables and office products, Chandy and Tellis (2000) have challenged the idea of the “incumbent’s curse” and also the general proposition that small firms are likely to be disproportionately responsible for radical innovations. On the latter point, it is argued that greater access to capital and knowledge of relevant markets and the financial ability to tolerate losses from failed attempts to innovate, combined with greater organizational tolerance for radical ideas, go a long way toward countering the inherent innovativeness of smaller, more flexible firms. Although “first-mover” advantages are emphasized in the literature (Nehrt 1998), Chandy and Tellis (2000, p. 14) argue that the larger incumbents who delay entry into the market do even better, concluding that “dynamic organizational structures and strong technological capability may keep large, incumbent organizations nimble and innovative, but many managers and academics have tended to focus on inertia-prone incumbents.”

In their essay “How Useful Is the Theory of Disruptive Innovation” in the *Sloan Management Review*, King and Baartartogtokh (2015) give the impression that they have convincingly challenged the widespread validity of the theory. However, their analysis focuses on market success, the acceptability of changes by the established customers, the creation of new customers, and the market responses of the threatened incumbents. Their analysis, like Christensen’s later work (2015), is not focused on the technical meaning of disruptive technology, i.e., whether it is architecturally or intrinsically different than the technology and practices being displaced. All the consequences of Christensen’s theory that King and Baartartogtokh analyze are just *market* consequences – not an analysis of what technically disruptive technology that offers a changed functional perspective has the potential to do.

Without resolving the apparent contradictions of the commentators concerning what kinds of firms are likely to come up with disrupting innovation for what is essentially main business innovation, innovating for sustainable development purposes involving health, safety, and environmental concerns – which are less likely to be seen as driven by new market opportunities for profit – may present a different dynamic. The evidence from innovations spurred by stringent regulations seems to favor displacement of the incumbents of problematic technologies by new entrants (see generally Ashford et al. 1985; Ashford et al. 1979; Ashford and Hall 2011).

As the work of Chandy and Tellis (2000) demonstrates, not all commentators are convinced of the general proposition that disrupting innovations come from incumbents. In the hard-disk drive industry, on which Christensen (1997) builds this proposition, Chesbrough (1999) argues that three institutional factors promote or inhibit the formation (and success) of startup firms differently in Japan and the United States: the technical labor market, the venture-capital market, and the structure of buyer-supplier ties. Especially important is the ability of new firms to lure away high-level and specialized technical manpower, a characteristic found to a much greater extent in the United States. Chesbrough observes that “most of the architectural shifts in technology documented [by the ‘new-entrant’ proponents] were led by new organizations, but not new people” (ibid., p. 457). The pattern is seen in other industries as well. Chesbrough posits that “rigid labor markets therefore increase the benefit of incumbency over newly entering firms” (ibid., p. 458). Venture-capital markets and the structure of buyer-supplier ties combine with labor-market features to provide “institutional factors” that favor new entrants in the

* Citing others, Chandy and Tellis (2000, p. 2) define an incumbent as “a firm that manufactured or sold products belonging to the product generation that preceded the radical innovation.” Christenson’s (1997) formulation is essentially the same.

United States and incumbents in Japan. This study provides a word of caution about over-generalizing in predicting where disrupting innovation will originate and what policies work best in a particular national or sectoral context.

Sectors other than the established ones, notably those based on emerging technologies, may experience increased innovation. The overall economic health and employment potential of a nation as a whole is the sum of these diverging trends and is increasingly dependent on international trade. Whether nations seek to increase revenues on the basis of competition in technological performance or, alternatively, cost-driven strategies can have an enormous impact on employment (Charles and Lehner 1998). As will be discussed later, health, safety, and environmental regulation, structured appropriately, as well as new societal demands, can also stimulate significant technological changes that otherwise might not have occurred at the time (Ashford et al. 1985; Ashford and Hall 2011).

A technological innovation can be characterized by its *motivating force*, by its *type*, and by its *nature*. The motivating force behind technological change can be the result of an industry's main business activities, or it can evolve from the industry's efforts to comply with or respond to health, safety, or environmental regulations and pressures (Ashford et al. 1979). Historically, about one-third of main business innovations have their origins in "technology push" (innovations looking for application) and about two-thirds from "market pull" (meeting an existing customer/societal demand or a regulatory requirement). Regulation, market signals, and anticipated consumer, societal, or worker demand can affect any of the characteristics of innovation. In the following chapter, we discuss the evidence that the most significant driving force for technological change identified by business managers is environmental legislation and enforcement.

Referring again to Figure 6.1, concerning the *type* of innovation, four different levels of technological change need to be considered: (1) product changes, (2) shifts from products to product-services; (3) process changes; and (4) more far-reaching system changes that not only include technological innovation but also effects on employment, the organization of the firm, and societal demands. Innovation can be product-oriented, meaning that it involves changes in the design of the final product or service. It can extend further to include shifts to *product-services*, in which the firm envisions delivering a desired service or benefit to the customer in creative new ways, with the goal of minimizing resources, energy use, and pollution. An example is selling copier *services* to customers – in which the copier company owns the machine and performs all maintenance and service on it while it is in use – instead of selling copy *machines*. This kind of change is described subsequently in more detail. Technological innovation can also be process-oriented,* that is, it can occur as part of the *production process* of a product or the delivery of a service.

System changes are the deepest and broadest in scope. They extend outside the boundaries of the firm to include many actors, including suppliers, competitor and collaborator

* In acknowledging the importance of technological innovation for both the environment and employment in hopes of attaining triple sustainability, it may be useful to consider the differential effects that product versus process innovation may have on the environment and employment. Cleff and Rennings (1999) argue that the benefits of product innovation may be more readily recognized and therefore pursued by industrial firms. It has been suggested that product innovations for new markets can result in new net employment, partly because of their greater reliance on demand-pull forces (Brouwer and Kleinknecht 1996; Matzner et al. 1990; Edquist et al. 2001), but that this is not true for all product innovations (Charles and Lehner 1998). This, of course, does not justify neglecting policies that promote process change. In fact, product innovation that is more closely linked to process innovation and in which there is more reliance on a learning-based mode than on a scientific breakthrough is argued to create more employment (*ibid.*). See Section 7.7 in the following chapter for a more in-depth discussion of innovation and employment. Note especially the focus of Kleinknecht in Section 7.7.1 on a Schumpeterian argument against liberalization of the labor market, which would act to discourage labor-relevant innovation.

firms, government authorities, and civil society. They involve the re-conception and reordering of entire production chains and stakeholder networks, for example, shifting from nonlocal industrial agriculture to locally grown organic food systems, or simultaneously altering production, employment, distribution, and transportation regimes to move people and deliver goods more efficiently, with less energy use and pollution.

As already discussed, in the context of product change, the *nature* of a technological innovation can be evaluated according to whether it serves either to *sustain* or *disrupt* established product lines and value networks of customers with well-defined demands (Christensen 1997). Christensen's concept of a "value network" is "the context within which a firm identifies and responds to customers' needs, solves problems, procures input, reacts to competitors, and strives for profit" (ibid., p. 32). In Christensen's formulation, sustaining innovations occur when established firms push the envelope to continue to satisfy existing consumers with improved products within the prior but expanded technological trajectory. Disrupting innovations cater to different, perhaps not yet well-defined customers with product attributes different from those in the established producer-consumer networks.* Alternatively, the distinction between sustaining and disrupting innovation might be focused on the technological nature of the change, a distinction that invites incentives focused not only on product changes (which may be the main driver in market-pull innovation) but also on changes involving process changes, shifts to product services, and wider system changes. This is not to downplay the importance of consumer demand, but to put it in a proper context, because many desirable technological changes will need to come from more interventionist and regulatory approaches if sustainable development is to be achieved in a timely fashion. We explore these ideas further in Chapters 7, 8, and 9.

The dynamics of technological change were summarized in Figure 6.1. The three dimensions of technological change – the *type* of change, the *rate/degree* of change, and the *nature* of change – are represented in Figure 6.4. It turns out that different kinds of changes affect competitiveness, employment, and the environment differently. This suggests that the emphases of a nation's industrial policy matter for sustainability.

The organizational implications of sustaining versus disrupting innovation by the industrial firm are profound and are addressed in the following chapter. In the case of sustaining innovation, organizational learning is central; in the case of disrupting innovation, development follows a different path, with learning taking on an entirely different and radical meaning, involving breaking with established patterns and creating new architectures of people and artifacts. Christensen (1997) reviews why established firms might find it difficult to reinvent themselves. In Chapter 7, we explore the importance of networks in revealing opportunities for disruptive change to incumbents and outsiders.

6.2.2 Evolutionary versus revolutionary change

A further important distinction is the difference between the development of technology – whether product, process, product-service, or system – that proceeds in an evolutionary way (or in a co-evolutionary way where technology developers and customers and/or society both change what is produced and demanded, respectively, over time) and what might be termed "revolutionary" development of technology that is driven by influences more exogenous to the firm's immediate sphere of interest, such as government intervention or regulation, strong societal pressures, stockholder demands, or an energy crisis.

Much innovation scholarship examines evolutionary theory as it relates to *products* (as contrasted with process, product-service, or system-level change). Here the (changing) nature of the customer base is all important because (ideally) firms innovate with the end

* The creation of new products in this case is not a wave built on prior waves of technological advance but rather occurs in an entirely new trajectory, often creating a new market.

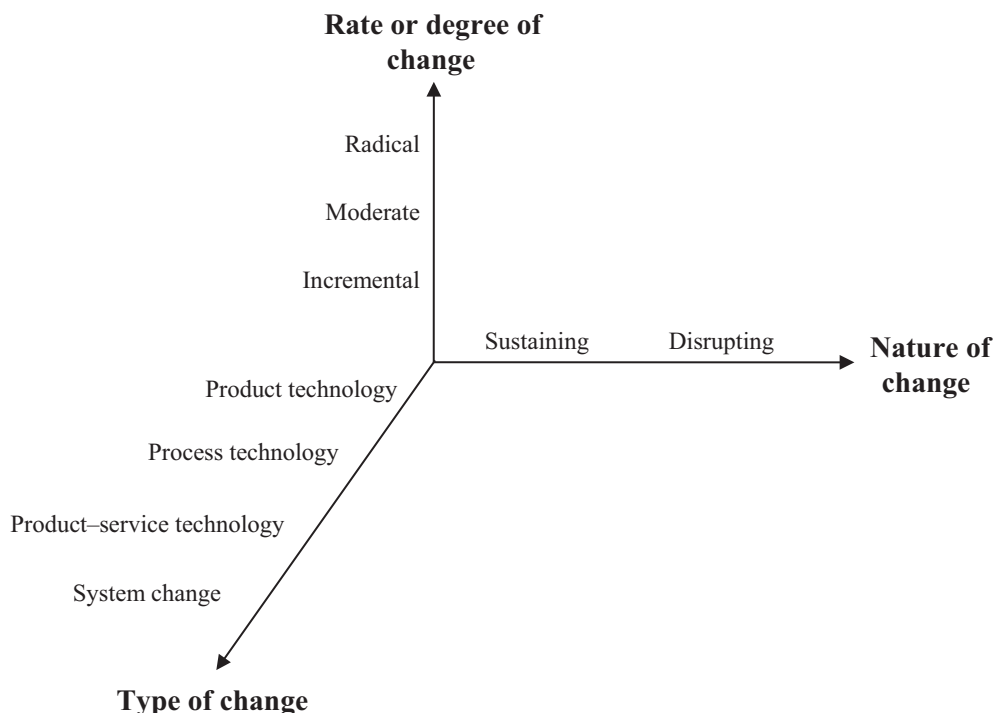


Figure 6.4 The important dimensions of technological change

customer in mind. Indeed, the survival of the technology and ultimately the firm depends on how well customers take up the innovation.

In the context of encouraging sustainable development transformations, supply-side policies (for example, subsidies, R&D support, and favorable tax treatment of investment) can be general or can focus on encouraging technological changes with certain performance characteristics in mind. Demand-side policies affecting or altering societal preferences (for example, purchasing, tax incentives, public-service advertising, counter-advertising, and education) may be useful in implementing or gaining acceptance of sustainable development policies, but they are not nearly as important as they are in evolutionary approaches. Evolutionary approaches may proceed far too slowly to stem sustainability concerns related to global climate change and increases in toxic pollution. These two statements suggest that if one's (political) preference is for evolutionary transformations, changing societal preferences should receive attention, but we argue that supply-side policies, as well as regulation and other interventions, are needed for significant transformations. These ideas are further developed in the next two chapters. See especially the notions of transition management (TM) and strategic niche management (SNM) associated with evolutionary and co-evolutionary approaches to technology development which are addressed in Section 8.3.3 in Chapter 8.

Christensen (1997) does not develop his ideas beyond the product domain or explore how development might be different under strong governmental or societal interventionist policies that supersede evolutionary changes. Process changes and innovation, although important to workers, may not be very important to customers. Producers of products may develop more sustainable processes to make their products, but usually not

because customers demand those changes. Thus, Christensen's concept of "value networks" and new customer bases may not be relevant in the same way as in the product domain. Distinguishing sustaining and disrupting technologies may be useful, but these "innovations" are not driven by customers of the product, but rather by producers and manufacturers. On the other hand, in shifting from products to product-services, customers may be as important as – or more important than – they are in the product realm, as we argue later. System changes, the most far-reaching changes, involve a number of producers and actors – and perhaps service providers – in a more dramatic realignment of actors. See especially the discussion of system innovation in Section 8.3.2 in Chapter 8.

In Chapter 7, we develop a behavioral model that describes for product, process, product-service, and system changes the influence of incumbent versus new-entrant firms, the likelihood of sustaining versus disrupting technology, and implications for different customer bases. We first examine (for changes involving products, processes, shifts to product-services, and systems) the extent and nature of changes that might be expected under a co-evolutionary approach where organizational structure and organizational change (driven by learning and involvement with networks) have a large influence on the extent to which sustainability can be expected to be achieved.

We then turn to interventionist approaches in Chapter 7 (what might be called "revolutionary" approaches in contrast to evolutionary approaches), where organizational characteristics influence the extent to which the incumbent technology firm can or cannot respond with needed significant technological change. Here Christensen's concept of disrupting change is key and is likely to involve new entrants – possibly because they are catering to a new emerging customer base representing strong societal demand (which is unlikely in the short run), but also, or alternatively, because government is demanding changes in technological performance (on behalf of society, with or without well-formulated demand). Again, in the context of changes involving products, processes, shifts to product-services, and systems, we explore (1) who is – and who is not – likely to develop those technologies under strong government directives or societal demand and (2) the implications for future organizational changes (especially in the context of systems).

Before we turn to these ideas in Chapter 7, we move from a focus on how innovation occurs in the individual isolated firm to the *context* in which it occurs where the firm is embedded in and connected to societal institutions and other actors.

6.3 National innovation systems

A further refinement of the innovation process places it within a systems context. Chris Freeman is credited with articulating the first modern version of the idea of "innovation systems" (Freeman 1982b; Freeman and Lundvall 1988). The idea was expanded in the classic work of Nelson and Rosenberg (1993). In this earlier work, innovation is "seen as a continuous cumulative process involving not only radical and incremental innovation but also the diffusion, absorption and use of innovation" (Johnson et al. 2003, p. 3). Excerpts from Nelson and Rosenberg's classic work are worth reading.

Excerpt from Richard R. Nelson and Nathan Rosenberg, Chapter 1: "Technical Innovation and National Systems," pp. 3–28 in Richard R. Nelson (ed.), *National Innovation Systems: A Comparative Analysis* (New York and Oxford: Oxford University Press, 1993). Excerpted with permission.

Our orientation [. . .] here [. . .] is [. . .] on the factors influencing national technological capabilities. [. . .]

The "systems" concept is that of a set of institutional actors that, together, plays the major role in influencing innovative performance. [. . .]

Firms and Industrial Research Laboratories

By the beginning of World War I the industrial research laboratory, a facility dedicated to research and the development of new or improved products and processes, and staffed by university trained scientists and engineers, had become the principal locus of technical advance in the chemical and electrical industries, and was beginning to become important more and more widely. [. . .]

There are several reasons why the industrial research laboratory, rather than university laboratories or government facilities, became the dominant locus of the R&D part of innovation in most (but not all) fields. First, after a technology has been around for a period of time, to orient R&D fruitfully, one needs detailed knowledge of its strengths and weaknesses and areas where improvements would yield big payoffs, and this knowledge tends to reside with those who use the technology, generally firms and their customers and suppliers. [. . .] Second, profiting from innovation in many cases requires the integration of activity and planning of R&D, production, and marketing, which tends to proceed much more effectively within an organization that itself does all of these. [. . .]

Other Institutional Actors

[. . .] Universities in most countries are, first, the places where much of the basic research in fundamental sciences such as physics is undertaken, although the reliance on universities as a locus of basic research, as contrasted with national laboratories, varies across countries. [. . .]

Many fields of academic science are expressly applications orientated. The very names “material science,” “computer science,” and “pathology” signal fields of inquiry closely linked to particular practical problems. So too the engineering disciplines, which were expressly established not only to train people for work in industry, but also to develop the scientific foundations of industrial technologies.

In certain cases, university based institutions have been directly oriented toward helping a particular industry or other client advance its technologies. [. . .]

Government laboratories also are an important part of many national innovation systems. In the United States, government laboratories play important roles in, for example, the fields of agriculture, health, and nuclear energy. However, with only a few exceptions, agriculture being a major one, in the United States government laboratories are tied to public sector missions in contrast to being established to help civilian industry. And, again with a few exceptions, in the United States the universities, rather than government laboratories, are seen as the appropriate sites for fundamental research.

In other countries public laboratories play a significantly larger, or different, role. [. . .]

Today public monies support not only research at universities and government laboratories, but R&D in industry. For the most part government support of industrial R&D in the United States has been limited to projects of direct governmental interest, principally those involving military and space needs. [. . .]

Technological Communities, Boundaries, and National Innovation Systems

[. . .] The important interactions, the networks, are not the same in all industries or technologies. We have pointed to differences between systems technologies and chemical product technologies in the nature of inter-industry interactions. In some technologies universities play a key role, for example, pharmaceuticals and computers. In others they play a more modest one, for example, aircraft and steel. Government funding is

important in some industries, such as aircraft and agriculture, and unimportant in others. But although its shape and character differ, in virtually all fields one must understand technical advance as proceeding through the work of a community of actors. [...]

Certainly the policies and programs of national governments, the laws of a nation, and the existence of a common language and a shared culture define an inside and outside that can broadly affect how technical advance proceeds. Put another way, national differences and boundaries tend to define national innovation systems, partly intentionally, partly not. Further, general perceptions about national societies and cultures tend to reify national systems. [...]

National Systems and Transnational Technology

[...] There is good reason to believe that in recent years, just as the idea of national innovation systems has become widely accepted, technological communities have become transnational as never before. There has been, first, a strong trend for manufacturing business firms to become multinational. [...]

[...] Engineers and applied scientists now are taught pretty much the same thing in schools in different countries. The dramatic lowering of national barriers to trade following the war, and the recent convergence of living standards and factor prices in the major industrial nations, means that, increasingly, firms face roughly the same market environment wherever their home base. [...]

Nelson and Rosenberg's (1993) discussion clearly articulates that the innovation process is embedded within an innovation "system" involving both institutional actors and individuals within and outside the firm itself. Johnson et al. (2003, p. 4) observe:

A first common characteristic [of innovation systems] is the assumption that national systems differ in terms of specialization in production, trade and knowledge (Archibugi and Pianta 1992). The focus is here upon the co-evolution between what countries do and what people and firms in these countries know how to do well. This implies that both the production structure and the knowledge structure will change only slowly and that such change involves learning as well as structural change.

A second common assumption behind the different approaches to innovation systems is that elements of knowledge important for economic performance are localized and not easily moved from one place to another. [...] Important elements of knowledge are embodied in the minds and bodies of agents, in routines of firms and not least in relationships between people and organizations (Dosi 1999).

A third assumption central to the idea of innovation systems is a focus on interactions and relationships. The relationships may be seen as carriers of knowledge and interaction as processes where new knowledge is produced and learnt. This assumption reflects the stylized fact that neither firms and knowledge institutions nor people innovate alone. Perhaps the most basic characteristic of the innovation system approach is that it is "interactionist."

Sometimes characteristics of interaction and relationships have been named "institutions" referring to its sociological sense – institutions* are seen as informal and formal norms and rules regulating how people interact (Johnson 1992; Edquist and

* We regard this restrictive use of the word "institution" in the literature in this sense as unfortunate and would prefer a term such as "the socio-political context." In this book, when we use the term "institution," we refer to both government and to structural changes and changes in norms and rules. This distinction is especially important because one criticism of innovation systems research is said to be that it ignores the role of the state (Johnson et al. 2003).

Johnson 1997). In a terminology emanating from evolutionary economics and the management literature “routines” are regarded as more or less standardized procedures followed by economic agents and organizations when they act and when they interact with each other (Dosi 1999).

The concept of innovation systems encompasses the *determinants* of innovation and hence provides an enticing framework for policy analysis and design.

The approach emphasizes interdependence and nonlinearity. This is based on the understanding that firms normally do not innovate in isolation but interact more or less closely with other organizations, through complex relations that are often characterized by reciprocity and feedback mechanisms in several loops. This interaction occurs in the context of institutions – e.g., laws, rules, regulations, norms and cultural [. . . attributes]. In fact, the central role of institutions is emphasized in practically all specifications of the concept of innovation systems.

(Johnson et al. 2003, p. 5)

Tsamis (1999) developed a useful model for a regional innovation system that focuses on the *process* of innovation and the *roles* that each major player has in the process (Figure 6.5). Although it is possible to identify a number of ways to categorize the major players in the innovation process (Braczyk et al. 1998; Padmore et al. 1998), Tsamis (1999) uses the following in his model: government, education and training institutions, customers, technology transfer and diffusion agencies, firms, and financial services.

The value of Tsamis’s qualitative model for a regional (or, equally usefully, for a national or industrial sectoral) innovation system is that it (1) identifies how each player influences different aspects of the innovation process (see the solid-line arrows A to L), (2) indicates the type of interactions that occur among the players *within* each step of the innovation process (see the dashed connectors 1 to 8), and (3) recognizes the interactions that occur among the players *across* the three steps of the innovation process (see the dotted arrows I to V). The model is developed for a traditional industrial innovation process that focuses on improving the general climate for innovation. The dynamics of interactions between these and other key actors are further addressed in the next chapter.

Edquist (1997, p. 14) defines a system of innovation (SI) as “all important economic, social, political, organizational, and other factors that influence the development, diffusion, and use of innovation.” An SI is “about the determinants of innovation, not about their consequences,” and is thus distinguished from new growth theory (discussed in Section 3.2.2 in Chapter 3), which “deals with the effects of innovation and knowledge” (Edquist 2001, p. 2). The SI approach often neglects learning by firms in terms of routines and databases, but also particularly neglects individual learning in terms of education, that is, the building of human capital. Edquist (2006) observes that although “the importance of national systems of innovation has to do with the fact that they capture the importance of the political and policy aspects of processes of innovation,” the SI construct neglects the role of the state, including its physical institutions and its system of laws, rules, and infrastructure.

In the next chapter, we examine the role of the industrial firm and its network partners in achieving sustainable development through organizational learning and innovation. In the chapter after that, we take up the role of the state, i.e., government, in implementing alternative forms of industrial policy to improve competitiveness and employment. In both these subsequent chapters, we explore in greater depth the importance of technological change.

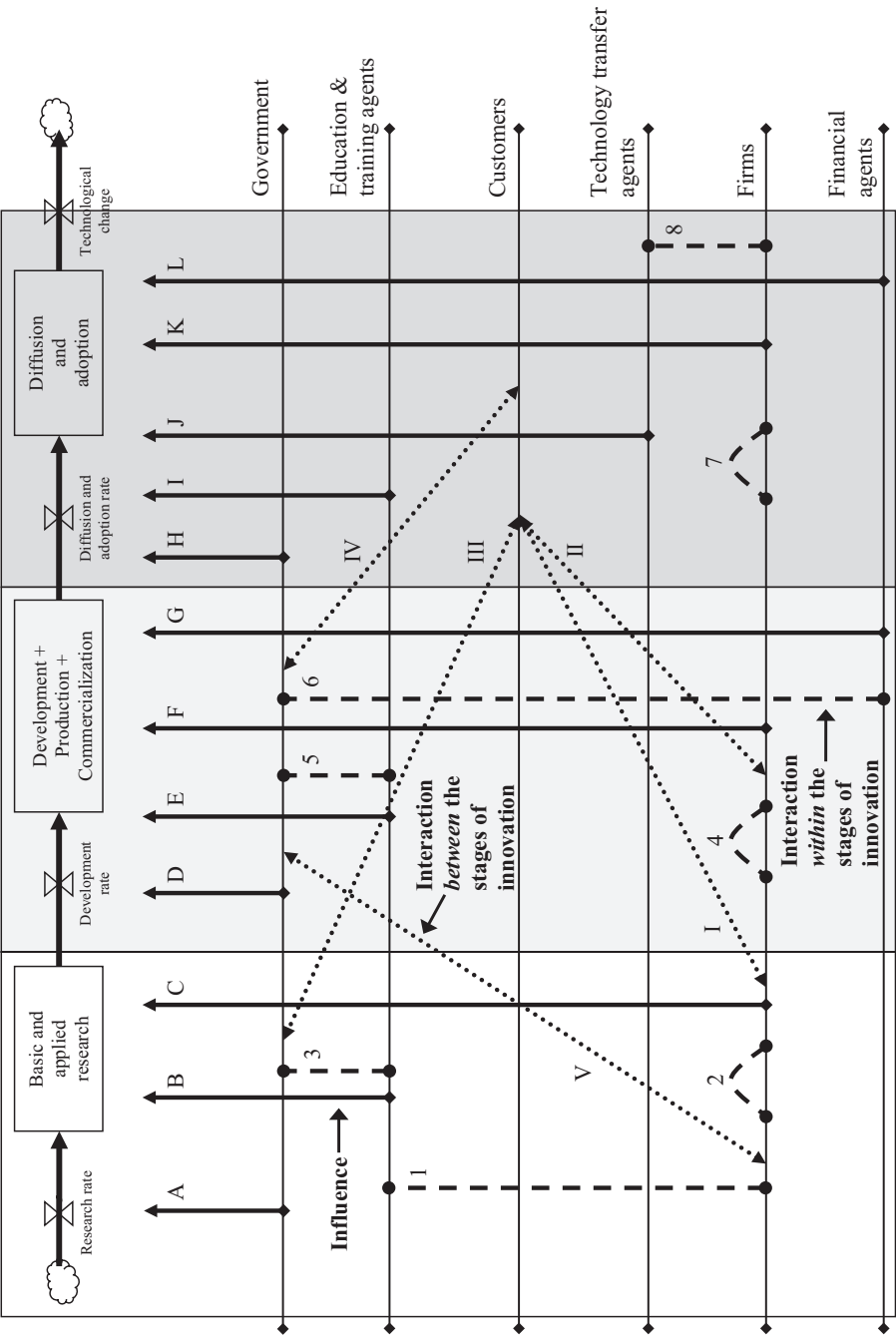


Figure 6.5 Diagram of a generic innovation system
Source: Adapted from Tsamis (1999, p. 39).

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7 The role of the industrial firm in achieving sustainable development*

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7.1 Introduction

In early chapters, we argued that four types of innovation – technological, organizational, institutional, and social (Ashford 2005; Rennings 2000) – will be essential in transforming

* We would like to thank Kate Parrot for her work in co-authoring a version of this chapter that was published in the 2011 edition of this book.

industrialized/industrializing nations into sustainable ones. These distinctions may not always be very sharp (Rennings 1998, 2000), but they are helpful in mapping the full range of innovations. Technological innovation is defined as the first commercially successful application of a new technical idea (or an invention). Organizational innovation refers to changes in the private sector, while institutional changes pertain to changes in the organization of government and of nongovernmental organizations (NGOs). Of course, innovations in one domain influence the other domains. In this chapter, we focus primarily on the role of firms in advancing organizational and technological innovation to advance sustainable development.

We consider organizational innovation to be novel changes in and among various organizational aspects of a firm's *functions*, such as R&D/product development, marketing, environmental and governmental affairs, industrial relations, worker health and safety, and customer and community relations.*

Change in the organizational structure of an industrial firm has long been recognized as both an important determinant and a consequence of technological change (Andreassen et al. 1995). Technological change can proceed gradually in an evolutionary way, or it can advance discontinuously with spurts of changes pioneered by new entrants or by existing firms reinventing themselves. Organizational factors influence, and are affected by, both evolutionary and discontinuous change.†

This chapter discusses the key organizational characteristics of the industrial firm and the nature of organizational change that either inhibits or may generate progress toward sustainable development. As discussed in previous chapters, sustainable development encompasses a process that co-optimizes (1) competitiveness, (2) the environment, and (3) employment. The ability of a firm to innovate within one or more of these three dimensions is related to its access to information via external and internal networks, and whether it has the willingness, opportunity, and the capability/capacity to change its current practices. By focusing on environmentally oriented technological changes and consumer satisfaction, this chapter explores the scope of change that can be expected from existing firms versus new market entrants. The policy implications related to encouraging firms to innovate for sustainable development are discussed in the concluding section. The chapter begins by taking a brief look at the pressures that stimulate environmentally responsible actions by firms.

7.2 Pressures for corporate environmental responsibility

In general, firms experience a variety of pressures that compel them to pay more attention to the environmental impacts of their activities. H. E. Williams et al. (1993, p. 118) list some of these pressures:

* An informative study by Lynch (2008) of manufacturing and non-manufacturing businesses in the United States concluded that the incidence and intensity of organizational innovation – defined as workforce training, employee voice, work design, and shared rewards – were positively associated with past profits and were more likely to occur in young, nonunionized manufacturing plants where management had an external focus. Further, organizational innovation was enhanced by firms belonging to networks that exchanged best practices but could be constrained by a low-skilled workforce. Hence, investment in training (i.e., human capital), as well as other factors such as R&D, physical capital, and ICT, appeared to complement organizational innovation (ibid.). In addition, Hage (1965, 1999) argues that the complexity of the division of labor (and the knowledge it collectively holds) is also a central factor behind organizational innovation because it affords greater adaptiveness or flexibility in meeting external environmental changes.

† For a discussion of defensive planning in reducing vulnerability to shocks (such as an industrial accident or collapse of a key supplier) and maintaining flexibility in the face of changing business environments, see Sheffi (2007).

- Increasingly stringent environmental legislation and enforcement;
- Increasing costs associated with pollution control, waste disposal, and effluent disposal;
- Increasing commercial pressure from the supply, consumption, and disposal of both intermediate and final products;
- Increasing awareness on the part of investors of companies' environmental performance in view of the cost implications associated with liability and the "polluter pays" principle;
- Increasing training and personnel requirements, together with additional information requirements;
- Increasing expectations on the part of the local community and the workforce of the environmental performance of firms and their impact on the environment.

To these should be added competition from foreign firms as a result of the increased globalization of markets for products and services (see the discussion in Chapter 4).

In H. E. Williams et al.'s (1993) study of 117 UK firms, government legislation and enforcement was considered as the most tangible and the one that determined the character of company responses. Another study of nearly sixty major companies, government labs and agencies, and universities aimed to determine why firms were engaging in proactive environmental behavior (Gutowski et al. 2005). The authors found that the motivating factors cited by firms included the pressures listed above, plus additional motivators that could confer a competitive economic (first-mover) advantage, such as being first to achieve a cost-effective product take-back system and being first to achieve product compliance.* Other motivating factors included corporate image (including avoiding embarrassment by NGOs and others); regulatory flexibility; International Standards Organization (ISO) 14001 certification; market value; and (demand from) green purchasing and ecolabeling.†

In addition to possible economic advantages of complying with health, safety, or environmental regulations or social demands, stock value and stockholder responses may drive the firm toward more environmentally sustainable practices (Johnston 2005).

Given the broad range of factors that influence industrial activity, an important question is which of these can guide economic activity toward sustainable development. More important, which *entity* is responsible for promoting these factors? Figure 7.1 attempts to capture the different postures that might be taken by government, corporations, workers, and consumers in the context of citizen, NGO, and shareholder scrutiny. For each key actor, a continuum is shown that ranges from a capitalist/utilitarian to an ecological economic/Rawlsian posture. This continuum implies that governments, corporations, and consumers that adopt an ecological economic/Rawlsian posture are more likely to promote sustainable development than those that adopt a capitalist/utilitarian approach. For example, a government could act as a trustee for stakeholder interests and advocate – through policy and regulation – a more sustainable approach to development. Alternatively, corporations might take the lead by acting in a socially and environmentally responsible manner and minimize or (even better) eliminate the negative impacts associated with their products and services. Finally, the burden could rest on consumers,

* See especially the work of Michael Porter and Eric van der Linde (1995a, 1995b).

† A. A. King et al. (2005) find that ISO 14001 certification, a voluntary standard for environmental management systems, provides evidence of an underlying management system, and that such a system is associated with environmental performance improvement. However, ISO 14001 certification is not a signal of superior environmental performance. Rather, firms that pollute more seek certification as a way to manage and reduce their liabilities and to improve their image.

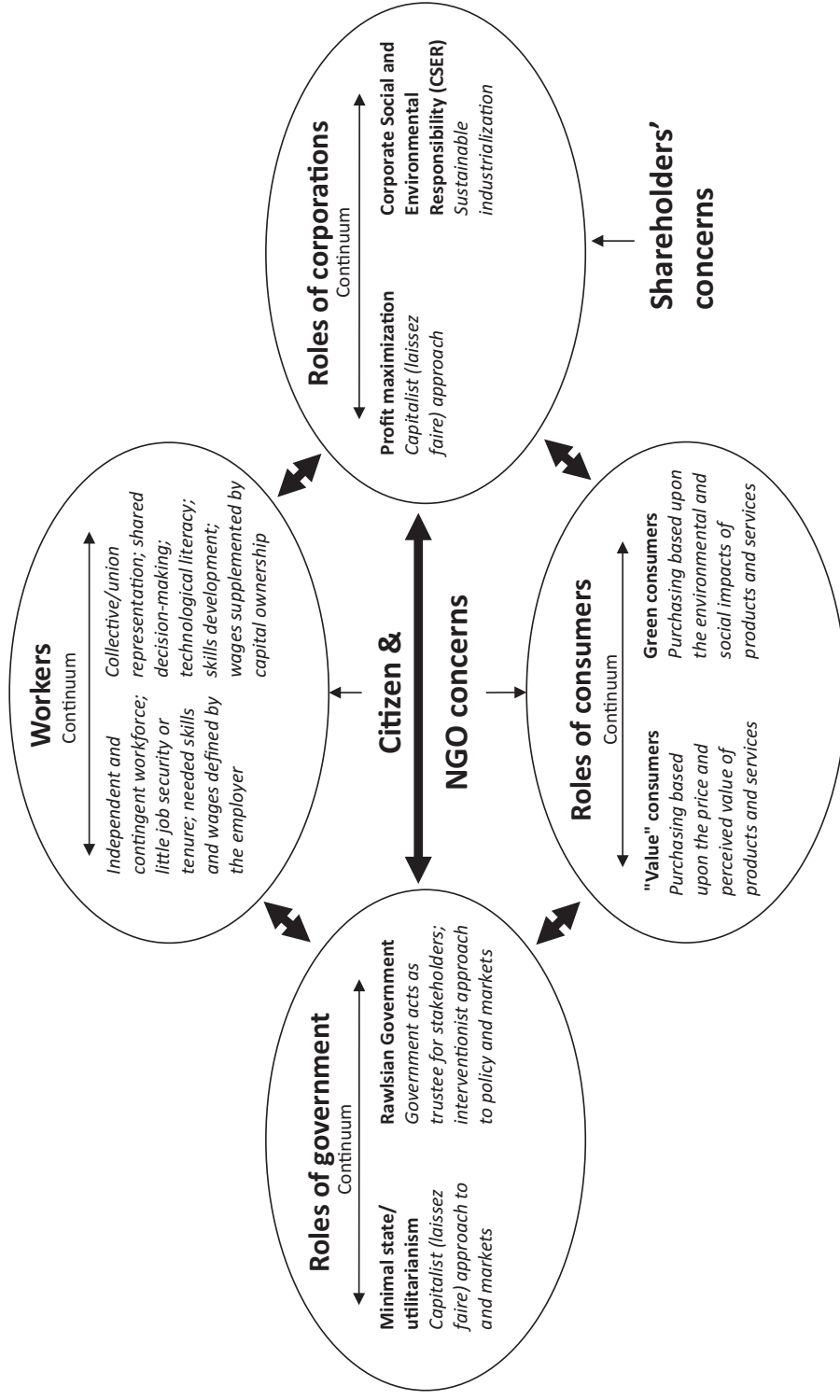


Figure 7.1 Different operating postures that might be adopted by government, corporations, workers, and consumers in the context of citizen, NGO, and shareholder scrutiny

whose “green” purchasing habits could shape demand for highly sustainable products and services.

The capitalist/utilitarian posture represents the current approach to development adopted in many industrialized and emerging economies. In this regard, it might be considered the “business-as-usual” approach. Governments, corporations, and consumers that adopt this posture can and are making progress toward sustainable development. However, throughout this text, **we view the business-as-usual approach as inadequate to encourage the *rate of change* needed to address some of the most challenging problems facing humanity, such as climate change and resource depletion. Therefore, we advocate an ecological economic/Rawlsian approach because we consider this posture to align more closely with the principles of sustainable development.**

The worker continuum reflects the nature and security of jobs rather than whether a job advances sustainable development. Independent and contingent workers face little job security and, in many cases, simply respond to the needs of the employer. Jobs in the growing service and sharing economy typically fall into this category (Katz and Krueger 2016). The problem with these jobs is that individuals rarely qualify for health care or retirement benefits, increasing their vulnerability to unexpected health or other types of problems. At the other end of the continuum (Figure 7.1) lie the more traditional jobs where workers, in theory, receive a living wage that reflects their skills and ability and have the opportunity to engage in shared decision-making with management.

We believe that workers will continue to seek meaning and fulfillment in their jobs, where work is a source of dignity that enables individuals to contribute to a firm’s competitive edge. A major challenge, though, is the pressure that innovation – which continually increases the productiveness of capital relative to labor – places on the value of labor, which can undermine the ability of workers to secure and maintain a living wage – see Brynjolfsson and McAfee (2014) on how technology is changing the dynamics of employment. Not only does the economy need to become inherently sustainable, it also needs to support social cohesion by enabling everyone to access basic goods and services. To this end, we foresee a future where individuals receive income from both their work and from increasing ownership of productive capital (see Section 3.6.1 in Chapter 3; R. Ashford et al. 2012).

It seems clear that all actors have some responsibility in advancing sustainable development. The question is how this responsibility should be distributed across government, corporations, consumers, workers, citizens, shareholders, NGOs, and more. The answer to this question clearly rests on the political and social environment within a nation or region. In this chapter, we focus primarily on the pressures on, and responses of, the business firm to growing concerns about unsustainable forms of industrialization.

7.3 Responses of firms to social demands

Since the mid-twentieth century, there has been a growing literature and debate on corporate social responsibility (CRS) (Aras and Crowther 2010). It is possible to structure this literature into four areas that consider the primary responsibility of corporations as: (1) *creating wealth* over the long term; (2) leveraging the corporation’s *social and political power (or rights)* in a socially responsible way; (3) *integrating social demands* into business activities; and (4) making business decisions based on *ethical values (or the right thing to do)* to advance a good society (Garriaga and Melé 2013). In this section, we consider how firms have responded to social demands for more environmentally sound activities, which touches on the latter two areas.

An important work by Hoffman (2001) on corporate environmentalism in the U.S. chemical and petroleum industries provides some answers to this question. By looking at the responses of corporations to the modern environmental movement that began in

the 1960s (see Chapter 2), Hoffman (2001) identified several distinct phases of corporate activity that changed as the environmental movement grew. During the 1960s, the chemical industry viewed emerging environmental problems as a challenge it could address through management and technology improvements. There was a common belief that “government intervention was [. . .] unnecessary, and environmentalists’ concerns were viewed as exaggerated and not scientifically based” (ibid., p. 12). This view changed dramatically during the 1970s, when the chemical industry was caught off guard by the formation of the EPA and subsequent environmental legislation. Corporations became defensive in their response to environmental regulations that they perceived as biased toward environmental concerns. Hoffman (2001, p. 80) characterizes corporate environmentalism during this period as externally directed “technical compliance.”

Another major shift in corporate attitudes began in the mid-1980s from the dominant response of fighting and resisting adaptation to environmental regulation to accepting regulations and incorporating them into core business strategy and operations (Fischer and Schot 1993; Hoffman 2001). Corporations moved beyond technical compliance and began to develop managerial structures that integrated environmental concerns into their organizational functions. Part of this attitudinal shift can be attributed to global NGOs, which were beginning to hold corporations publicly accountable for their social and environmental impacts. Dramatic accidents, such as the *Exxon Valdez* oil spill off the coast of Alaska, the explosion at Bhopal, India, and careless handling of social and environmental concerns, such as Shell Nigeria’s exploitation of the Ogoni people’s native lands and the Nike child labor fiasco, outraged world opinion and lent a moral imperative to the growing civil society movement.

At the beginning of the 1990s, the balance of power between the chemical industry, government, and environmentalists began to equalize, and corporations started to adopt a proactive approach to environmental protection (Hoffman 2001). Once again, corporations viewed environmental problems as a challenge they could address, but this time there was recognition that external stakeholders (such as environmentalists, competitors, government, investors, and insurance companies) had an important role to play.

The history of corporate environmentalism in the chemical industry provides some insight into how firms responded to social demands for less environmentally damaging activities. Their response could be characterized as a complex and dynamic process, influenced by existing institutional and organizational processes and changing social perceptions on what environmental protection really means (Hoffman and Ventresca 2002). For example, environmental NGOs that lobby government and industry for change each have their own conception of the environment and what industry should do to protect it. Thus, beyond regulatory compliance, corporations must decide which NGOs present legitimate environmental concerns before addressing these concerns through improvements to their existing services, products, processes, and/or product-services.

At the turn of the twenty-first century, businesses began to realize that corporate social and environmental responsibility (CSER) was effectively part of the license to operate in a transparent, globalized world. Those firms that refused to alter their rhetoric and their behavior ran the risk of liability and of attracting unwanted attention to valuable brands and reputations (Brammer and Pavelin 2010). Hence, leading-edge companies began to define new standards for environmental and social best practice. They institutionalized a larger set of environmental concerns in corporate policy and in dedicated staff positions (Tomer 1992). Many found value in “win-win” strategies of reducing wasted energy and resources and fattened the bottom line in the process.

As part of this trend, firms are now broadcasting their environmental commitments as part of their firm’s identity. As of 2015, over 90 percent of the Global Fortune 250 companies were publishing some sort of report disclosing their social and environmental impacts (KPMG 2015). In 1990, the number was zero. Business schools have also jumped

on board, expanding their offerings to include courses that address environmental and social issues, and some, like the University of Michigan and Yale, even offer dual master's degrees in business and natural resources fields. Clearly, concerns about corporate environmental impacts have graduated from the activist fringe to occupying a place in firms' core strategic considerations. We argue that the shift toward voluntary corporate social and environmental responsibility is not enough to address the massive and widespread social and environmental problems that we face today,* especially with the election of an anti-environmental administration in Washington in 2016.

Throughout this book, we argue that production, consumption, the environment, and employment ought to be co-optimized and considered simultaneously in an integrated way. CSER tends to target the first three of these dimensions, perhaps because employment is often considered as being central to the functioning of a corporation. However, innovation in production, transportation, energy, agricultural, health care, etc., frequently advances without concern or planning for the subsequent impact on the nature and level of employment. Although compensatory policies related to education, retraining, and the reorganization of work exist or are being planned, they are *reactive* to technological changes. Here we need to take a lesson from the environmental problems created by rapid and extensive technological change. **We recognize that it is not sufficient to consider the effects on the environment as an afterthought. Environmental quality needs to be built in. Similarly, it is likely that thinking about work after technologies are planned and disseminated may be far too late to address their possible adverse consequences effectively. Taking a proactive approach to considering the employment impacts of new innovations is important and should become an integrated part of CSER.**

As discussed in the previous section, the responsibility for advancing sustainable development falls across multiple actors. In this chapter, we explore the private sector's role as an indispensable partner in sustainable transformations. We begin by looking at how organizations learn and innovate, before asking which forms of learning might lead to evolutionary versus revolutionary change.

7.4 Organizational innovation and learning

Much of the literature on organizational innovation is concerned with intrafirm changes in and among various organizational aspects of functions of the firm, such as R&D, marketing, environmental and governmental affairs, industrial relations, worker health and safety, and customer and community relations. The counterpart of organizational innovation in government – what might be called institutional innovation – is also a crucial factor and plays an important role in the policy initiatives for sustainable development addressed in Chapter 13. In this chapter, however, we focus specifically on the firm.

* Benneer (2007, p. 327) examined fourteen state-based regulatory systems that mandated management-based regulation (MBR) and concluded that MBR had a “measurable positive effect on the environmental performance of manufacturing plants.” She found that “plants subject to management-based regulation experienced larger decreases in total pounds of toxic chemicals released and were more likely to engage in source reduction activities” (ibid.). Benneer's (2007) study provides preliminary support for the notion that plants with greater complementarity between planning efforts and pollution reduction will have larger effects from mandated MBR. Greater effects were found for firms that were not members of Responsible Care, the chemical industry's flagship voluntary program, casting doubt on the effectiveness of this program as an industry self-regulatory initiative. Similarly, A. King and Lenox (2000) report that U.S. chemical companies that signed onto Responsible Care improved their environmental performance more slowly than nonparticipating firms. See also Karkkainen (2001).

7.4.1 *Organizational theory and the limitations of the neoclassical model*

The field of organizational theory can be thought of as sociological theory as applied to organizations.* Business scholar Thomas Gladwin (1993, p. 47) summarizes the field in this way:

Organizational theory focuses on the basic characteristics of organizational participants, goals, social structure, technology, and external environment, at different levels of analysis. It embodies multiple perspectives or frames of reference, viewing organizations variously as rational, natural, and open systems, using a range of images or metaphors (e.g., organizations as machines, organisms, brains, cultures, political systems, psychic prisons, flux and transformation, and instruments of domination).

Organizational theory holds more explanatory power for firm behavior than does the conventional economics conception of the firm. The traditional neoclassical view sees the firm – subject to constraints – as a profit-maximizing “black box.” Indeed, Friedman (1953) argues that economic models do not need to capture reality; rather, only their forecasts must agree with empirical observations. If one considers the firm as a black box, its internal activities become unimportant because the end result is known – that is, it is defined by an economic rationale. But the neoclassical model fails to account for why, when faced with the same set of incentives and regulations, some firms respond minimally, while others consciously choose behavior that is non-opportunistic, long term, and responsible to interests that go beyond those of their shareholders (Tomer 1992).

With regard to technological innovation, the neoclassical model has a number of failings. Neoclassical theory holds that corrections of market failures for factors important to growth should be the extent of government intervention; that is, governments should not intervene to promote or subsidize the development of technologies. Obviously, the government does intervene to support technological development in areas that are important to national security and economic competitiveness, for example infrastructure for information and communications, the military, and transportation, including the auto, rail, and aircraft industries. The government also intervenes where the risks of development are too high to entice industry to develop technologies, for example where the government supports research on cancer therapies and then hands over the research to pharmaceutical companies for commercialization.

The limitations of the standard neoclassical model with regard to organizational learning and technology choice are instructive (Stoughton 1996):

- Continuous process improvement (through the organization of production and fine-tuning of equipment) is as important as new process investment over the long run. This type of continuous improvement is embedded in learning and experience within the firm and cannot be acquired on the market. Thus, the ability to use a given technology efficiently is tacit, acquired knowledge. In the context of advanced manufacturing technologies, Zammuto and O'Connor (1992) argue that the benefits gained from technological investment are heavily influenced by organizational design and culture. That is, the greater an organization's emphasis on flexibility-oriented values, the more likely it will benefit from productivity gains following the installation of new

* For surveys of organizational theory, see Aldrich and Ruef (2006); Astley and Van de Ven (1983); Baum (2002); Daft (1992); Morgan (1989); Pfeffer (1982); Scott and Davis (2006); and journals such as *Management Science*, *American Sociological Review*, *Organization Studies*, *Journal of Management Studies*, *Organization Science*, *International Journal of Organization Theory and Behavior*, and *Annual Review of Sociology*.

process technologies. This argument indicates that organizational design and culture can play a critical role in achieving competitiveness.

- Firms do not have perfect information when they are selecting technologies. At best, technology choice is boundedly rational, and access to technology information is uneven. Firms, particularly in developing countries, are likely to have knowledge of only a fraction of the suite of technologies available to them. Larger firms, which may already have an advantage in technology search activities by virtue of available resources, are also more likely to have a multinational enterprise (MNE) partner and thus have an additional conduit of information. (See the later discussion of the importance of “outsiders” in technological innovation.)
- A firm’s ability to switch to more productive/efficient technologies can be limited by previous capital investments – that is, technology choice is “sticky.”
- The transfer and adoption of technology are not costless. For example, there are often costs to adapt technologies to local raw-material, scale, and input requirements. Further, there are learning costs (training) and transmission costs associated with technology transfer.

Organizational theory is critical to overcoming the limitations of the neoclassical view of the firm and of technological innovation as they relate to sustainable development. But compared with the attention that has been paid to institutional and market failures, organizational failure within business firms has been given little consideration. This is unfortunate because environmentally undesirable behavior on the part of firms is as much a matter of organizational failure as it is one of markets that do not internalize environmental costs (Gabel and Sinclair-Desgagne 1993). Firms always have a choice of ways to respond to environmental concerns.* They exhibit a wide range of responses, from active evasion or grudging compliance with environmental regulations to innovative behavior that aims for zero net environmental impact from all products, services, and production activities. We explore some of the motivating forces as well as the organizational barriers to environmentally proactive behavior in Section 7.6.

7.4.2 Organizational learning

Within the broad field of organizational theory is a well-established subfield called “organizational learning” (Argote and Ophir 2002; Fiol and Lyles 1985; Hedberg 1981; Huber 1991; Lazonick 1998; Levitt and March 1988; J. March 1991; Miller 1996; Schulz 2002; Shrivastava 1983).† In this subfield, the processes by which organizations “learn” are described differently in the literature, and an accepted definition or substantiated theory of organizational learning remains elusive. For example, Levitt and March (1988) view organizational learning as the encoding of history and experience in routines that guide a firm’s behavior. Huber’s (1991) formulation expands this view by relating organizational learning to four constructs: knowledge acquisition, information distribution, information interpretation, and organizational memory.

* Indeed, Michael Porter argues that firms often see “first-mover advantages” by complying early with environmental demands in the development of advanced compliance technologies (Porter and van der Linde 1995a, 1995b).

† A closely related field of study is “inter-organizational learning,” which focuses on learning that occurs through the interaction of two or more organizations (Ingram 2002). An inter-organizational learning process can be characterized as one in which the actions of a “sender” organization stimulate learning in a “receiver” organization (ibid.). In this situation, the relationship between the two organizations becomes an important consideration.

Lazonick (1998) considers organizational learning in the context of the “skill-based hypothesis.”* Miner et al. (1999) consider how organizations learn from failure. Others view a firm’s ability to learn – or absorb new information – as a function of its prior related knowledge (Cohen and Levinthal 1990). Akgün et al. (2003, p. 862) view organizational learning through a socio-cognitive lens, where learning is the result of “reciprocal interactions of social and cognitive processes embedded in organizational structures, cultures, and interactions.” For our purposes, we adopt Miller’s (1996) typology of organizational learning. Miller (p. 486) defines organizational learning as “the acquisition of new knowledge by actors who are willing to apply that knowledge in making decisions or influencing others in the organization.” Learning is distinct from decision-making in the sense that learning increases organizational knowledge, while decision-making need not.

Miller (1996) describes organizational learning theories along two dimensions. The first is *voluntarism* versus *determinism*, or the extent to which firm actors are “relatively free in action versus constrained by cognitive [. . .], resource [. . .], political [. . .], or ideological structures” (ibid., p. 487). Global analysis and strategic planning by top managers are given as examples of a relatively unconstrained kind of learning that can expose critical assumptions about a firm’s core competencies and its markets and explores a wide range of possible actions. Other scholars view organizational learning as happening more incrementally as the firm conducts small experiments that generate minor modifications in products and processes (Cyert and March 1963; J. G. March and Olsen 1976). An even more constrained kind of learning occurs within existing routines and programs: for example, with experience employees can learn to calibrate and operate a piece of machinery properly. Both of these kinds of learning can be described as “learning by doing,” but they are different.

This typology parallels the different kinds of technological change described in greater detail in Sections 7.6.4 and 7.6.5. As the design space expands from (1) *optimizing* existing technologies to (2) *adopting* better, already-established technologies to (3) *creating* new technologies, organizational learning must also expand accordingly, from constrained (or determined) to free (or voluntary). Determinism points to a small design space and the tendency for an organization to become locked in by its own routines and ways of thinking to particular products and processes. Lock-in can happen as product lines develop and mature and firms become more heavily invested in existing technologies (this is one kind of so-called bounded rationality) (Sorensen and Stuart 2000). Firms that are “locked in” can miss important emerging trends and opportunities for radically new technologies, leaving opportunities open for new firms to enter with radical, disrupting innovations (see Section 7.6). Progress made by firms pursuing established avenues for growth is said to exhibit “path dependencies.” The paradox that as organizations make sustaining/process innovations they begin to lose touch with environmental demands (or their customer

* Lazonick (1998) highlights an important difference in the way U.S. and Japanese manufacturing firms involved managers and workers in the process of organizational learning between the 1950s and the 1990s. Whereas Japanese firms utilized the creative potential of their machine operators by involving them in the development of technology, U.S. firms tended to confine this task to the managerial level. As a result, new manufacturing technologies in U.S. firms reduced the need for skilled workers on the shop floor. (The deskilling of the workforce is one factor behind the growth of wage inequality between white and blue-collar workers in U.S. manufacturing firms; see Section 3.3.1 in Chapter 3.) The broad skill base of Japanese firms meant that they were able to respond (i.e., innovate) more quickly than U.S. firms to societal demands for new products, a flexibility that enabled them to capture a significant proportion of the U.S. market for manufactured goods. Lazonick (1998) argues that the slowdown in the loss of the U.S. automobile market to Japanese firms during the 1990s was due to investments by U.S. automobile manufacturers in broader and deeper skill bases. This argument supports the “skill-based hypothesis” – i.e., that investments in broad and deep skill bases will enable (manufacturing) firms to innovate and achieve sustained prosperity (ibid., p. 205).

base – see Section 7.5), can be resolved by the extent to which these organizations shift their learning strategy from one of *exploitation* to *exploration* (J. March 1991).

The second dimension along which Miller (1996) contrasts organizational theories is whether decisions are based on *methodical analyses* and concrete standards or on *emergent institutions* and subtle values. In the first type of decision, managers are seen as rational actors who use cost–benefit analysis and hard data on competitive options to make decisions. This theory of the firm rests on norms of economic technical rationality. Facts are gathered carefully and methodically, and decisions emerge from rigorous modeling and statistical analysis. Thus, organizational learning tends to be deductive and based on objective facts obtained through systematic analyses.

In the second type of decision, organizational actions are more spontaneous and emergent in nature. Firm actors are “driven by subtle normative considerations, fads and rituals, and even personal hunches and motives” (Miller 1996, p. 487). This is an intuitive form of learning that is tacit and inductive and centers on instincts and impressions. When asked, managers operating from this place often cannot explain how they arrive at a particular decision. The source of their knowing is not always clear even to them. See Sections 7.6.1 and 7.6.2 for more discussion of managerial motivation and behavior.

The following subsections consider different ways in which organizational learning can occur within networks. The focus on networks is important because as organizations establish more complex and dynamic relations with other entities, the locus of innovation and learning, which are key determinants of competitiveness, is likely to shift from intra- to inter-organizational collaborative networks (Gray 1989; Huxham and Vangen 2005; Sturgeon 2000).

7.4.3 Networks

The networks that comprise firms and in which they are embedded – involving actors inside and outside the company – are an important dimension of organizational theory (W. E. Baker and Faulkner 2002; Borgatti and Foster 2003; Granovetter 1985; Pfeffer 1982; Powell 1990; Uzzi 1997, 2000).^{*} Networks can help stimulate innovation and learning (Tsekouras et al. 2012); they can also serve to inhibit learning and change. In Chapter 6, we examined the innovation process in firms that are embedded in, and interact with, a variety of network actors.

Networks facilitate learning through the dissemination of knowledge and/or skills among their member organizations. The firm participates in networks involving suppliers, consultants, trade associations, geographically close industries, consumers, workers, government, and others. Ashford and Meima (1993) identify several kinds of networks:

- 1 Those within the organization (units performing planning, production, and innovation functions), which are termed “intra-organizational networks”;
- 2 Those connecting units in the supply chain (suppliers, contractors, and consumers/customers), which are termed “trans-organizational networks”;
- 3 Those involving other organizations – that is, public interest and community-based groups, competitors, and regulators – which are termed “supra-organizational networks.”

The members of supra-organizational networks are not usually tied contractually or commercially to the firm. They are examples of “outsiders.” The authors also identify a fourth

^{*} In discussing the different kinds of capital needed for a society to advance, natural capital, physical capital, and human capital are usually mentioned. Networks are a way of analyzing what is called “structural capital.”

kind of network whose activities are not related directly to the firm: community-worker networks such as environmental-labor coalitions pressing for better and more coordinated environmental and occupational health and safety programs, policies and laws, and right-to-know coalitions that coordinate toxics information in the workplace and in the environment (Lewis and Henkels 1996).

Ashford and Meima (1993) identify four purposes that networks can serve: (1) to provide *internal* sources of technical ideas and information; (2) to provide technical ideas and information from sources *external* to the firm; (3) to create performance requirements/constraints or provide information about market demand and opportunities; and (4) to provide a means to advance shared decision-making with those external to the firm. "Purpose [1] is served by intra-organizational networks. Purposes [2] and [3] are served by both trans and supra-organizational networks, while purpose [4] is served more specifically by customers, workers, and community-based groups" (*ibid.*, p. 12).

Traditional organizational theory is focused primarily on intra-organizational and trans-organizational (that is, within the supply chain) networks, which create the context for the strategic process, management decision-making, employee values and attitudes, internal creativity and innovation, resistance to change, and many other phenomena usually considered "organizational" determinants of change. Following this line of thinking, researchers Roome and Clarke (1993) argue that informal networks at the intra-organizational level are "most important for learning related to the application of new technologies; networks on higher levels are weaker, little true collaboration seems to take place, and the deliberate, strategic management of network learning is rare" (Greening of Industry Network 1993, p. 14). This may indeed be true in an *evolutionary* context, where the focus of learning is within the *existing* firm for an established customer base. However, change that is more *revolutionary* (that is, disrupting in Christensen's (1997) formulation)* is likely to be stimulated by new configurations and interactions among business, government, and civil society networks. This broader network view that focuses on the "sociology of technology" is often referred to in Europe as the "the social shaping of technology" (SST) (MacKenzie and Wajcman 1999).

Within the field of SST are several network approaches that try to explain how dynamic systems of actors come together to form networks. These include actor network theory (Callon et al. 1986; Latour 1987; Law 1999), techno-economic network (TEN) theory (Callon et al. 1992), industrial-networks theory (Håkansson 1987, 1989; Håkansson and Snehota 1985), and sociotechnical networks theory (Elzen, Enserink, et al. 1996). See Ashford and Hall (2011) for a more detailed treatment of these network approaches.

In a discussion of trends and opportunities for innovation for sustainability, Dijkema et al. (2006, pp. 221–222) argue that the pathway to a sustainable enterprise consists of the following four phases:

- Phase I companies or sectors react to societal pressure to "do something for the environment" through standards, procedures, and environmental care systems. Their "leitmotiv" is to "clean up their act because they must," largely to preserve their license-to-operate.
- Phase II companies consider sustainability on the agenda. They discuss internally: how can we deal with it? What stakeholders are of relevance? What new activities do we envisage? Which innovation activities can be reframed?
- Phase III companies realize and acknowledge that sustainability is crucial for their long-term continuation and extend their value chain, namely through new entrants and adopting new processes.

* See the discussions of disrupting innovation in Sections 6.2.1 and 8.2 in Chapters 6 and 8, respectively.

- Phase IV companies formulate sustainability strategies in interaction with external stakeholders. Sustainability is perceived as a continuous process. The innovation activities repeatedly need redefinition and reformulation, beyond [a] firm's boundaries.

What is perhaps most interesting about these phases is the growing importance given to new entrants, the interaction with *external* stakeholders, and networks. Dijkema et al. (2006, p. 222) also argue that “the perception of time plays a critical role in the interaction between sustainability and innovation.” They maintain that the business-as-usual firm tends to focus on its own organizational structure and near-term problems, whereas sustainable enterprises tend to value extended inter-organizational networks and are more concerned with far-reaching life cycle issues of global importance.

The idea that new entrants (or outsiders) and external stakeholders are likely to play an important role in innovation and learning for sustainability is worth considering further.* Van de Poel's (2000) work on outsiders and their role in technical development is of particular relevance to this discussion. Van de Poel (2000, p. 383) defines outsiders as “actors not involved in technical development or decision-making about technology and not sharing the rules that guide the design and further development of a technology.” He continues (*ibid.*):

The totality of such rules is defined as the technological regime. Outsiders thus do not share the existing technological regime. If outsiders nevertheless become involved in technical development, they may well trigger innovations that depart from the existing technological regime and that possibly transform that regime.

Van de Poel (2000) distinguishes three categories of outsiders: societal pressure groups, professional scientists and engineers, and outsider firms. In his conceptualization, outsiders who both (1) are outside or at least marginal in the relevant system of interaction around technological innovation and (2) do not share some of the relevant rules with respect to technical development can trigger radical (that is, disrupting) technical change if they get involved in technical development in other ways than by adopting the rules of the existing regime. We explore the role of outsiders in technological change in more detail in Section 7.6.6.

In the following section, we consider various mechanisms that attempt to include stakeholders in the learning process to promote sustainability through reducing the impact of environmentally destructive activities.

7.4.4 Social networks: learning collaborations with stakeholders

The recent emphasis on sociotechnical networks may be due to the growing influence of stakeholders other than shareholders on the firm (see Figure 7.1). For instance, companies have discovered that since the 1960s, civil society has developed unheard-of power and sophistication to negotiate concessions on environmental and social issues. Waddell (2005) describes how new governance structures were formed by tying together diverse organizations in an intricate network that generates innovation and produces societal learning and change (SLC). SLC is viewed as changing relationships and bridging the

* For an earlier discussion of the role of outsiders in stimulating disrupting (or “competence-destroying”) technological change, see Tushman and Anderson (1986).

differences among the core systems of society – economic, political, and social, represented, respectively, by business, government, and civil society. Waddell's (2005, p. 10) theory emphasizes voluntary cooperation:

By working together voluntarily, each participating organization achieves its own goals by changing its relationship with others to co-ordinate their actions and create synergies. SLC is driven both by each group's goal and by a vision of how to build society's capacity to achieve a jointly valued societal goal.

Network governance theories provide a more structured approach to the interaction of public, private, and semiprivate actors in networks (Dewulf et al. 2009; Klijn and Koppenjan 2000).^{*} In particular, network-management strategies are used to improve the interaction between network actors (process management) and to adjust the institutional characteristics (network constitution) of networks to improve their effectiveness or focus actors on common objectives (Dewulf et al. 2009). Network governance emphasizes less formal and more interactive forms of governance, where stakeholder dialogue and deliberative policy making are viewed as alternatives to state authority and hierarchical government structures.

In their work on social networks, Hall and Ingersoll (1993) focus on how firms can collaboratively learn new knowledge and skills through working with stakeholders.[†] They find that companies expect all stakeholders (except investors) to become more important in the future. They argue that learning from stakeholders is essential in developing core competence for discovering environmentally focused, solution-oriented strategies because it requires changes in a firm's value structure and that the firm develop different skills and attitudes. The firm must shift from a deal-oriented, transactional, and mechanistic approach to a more relational, open, and learning orientation – one that is *voluntary* and *emergent*, in Miller's (1996) typology. A profound revision of the current understanding and practice of stakeholder dialogue – as an open-ended learning process rather than an outcome-focused (on growth and profit) “negotiations” process – is necessary. Reciprocal trust is seen as essential in engaging nonbusiness stakeholders in a collaborative effort.

Supra-organizational networks include nonbusiness stakeholders like community citizens, NGOs, and regulators. In some respects, these stakeholders are “outsiders” (“societal pressure groups,” in van de Poel's formulation). At the community level, social networks embodied in public-based interest groups are potentially important in transforming the firm into a sustainable enterprise, even though the experience to date has not been encouraging. This experience includes (1) company communication about plant-based risk to the surrounding community (Chess 1993), (2) industry-created citizen advisory panels (Lynn 1993), (3) government-mandated emergency planning committees (Rest and Krinsky 1993), and (4) the negotiation of “good-neighbor” agreements between plants and the community (Lewis and Henkels 1996).

On a broader scale, green consumers and environmentally minded NGOs (part of a supra-organizational network) may play a part in encouraging green technology development. Green consumers may be concerned about a number of attributes of a product made by a particular company, including (1) whether the product is manufactured in an

^{*} Kemp (2008) views networks as important for guiding/influencing transitions toward sustainability. Participation in a network can limit – in a positive sense – the choices available to actors, which provides a collective orientation and reduces uncertainty. Other mechanisms that can be used to coordinate a transition are markets (i.e., changes in prices that influence economic decisions) and hierarchy (i.e., state or company plans/goals that can influence economic activities) (ibid.).

[†] Here stakeholders may include some members of supra-organizational networks, such as members of the community.

environmentally sustainable way, (2) whether its use is energy conserving, (3) whether its disposal is environmentally acceptable, and (4) whether the manufacturing (or disposal) is safe for workers. Directly assessing or verifying claims of being environmentally sustainable or being a green product, however defined, is difficult for consumers (Goleman 2009). Either government or consumers' organizations might have a role to play here by collecting and analyzing appropriate information. Ecolabeling – such as the EnergyStar logo that is placed on energy-efficient appliances – can also be helpful in distinguishing green goods in the marketplace. However, products can be made to look better or worse depending on how the question of environmental impact is framed. For example, the issue of worker impact is often left out of the assessment, resulting in trading better “environmental” performance for worker endangerment.

Government regulators constitute key supra-organizational actors in fostering technological change. However, whether they interact with the firm in a cooperative manner or act to “force” change makes a difference. The evidence for significant technological change stimulated by cooperative approaches is not impressive. In 1994, the U.S. EPA founded the voluntary Common Sense Initiative (CSI) with the goals of finding “cleaner, cheaper, smarter” ways of reducing pollution and formulating proposed changes in the existing regulatory structure to effectuate them. The CSI succeeded in fostering an ongoing dialogue on issues important to the future development of environmental policy. In this sense, it had a positive impact. But in the end, the bulk of the CSI negotiations reportedly did not focus on pollution-prevention strategies, let alone innovation, and thus fell well below the EPA's original expectations. An independent report issued in 1999 concluded that although there had been a small number of sector-specific modifications, the EPA had made little progress in addressing broad regulatory changes through the CSI, and CSI successes were not being integrated into core EPA programs (Ashford and Caldart 2007). The CSI provides an example of an unsuccessful attempt at institutional innovation.

It is evident that the extent to which networks facilitate firm-based learning that achieves multiple goals through technical and organizational innovation – rather than reinforces prior patterns leading to technological and managerial lock-in and path dependency – depends on a wide range of determinants. This type of learning is not easily programmed and may rely on the competence and strength of participant personalities and network outsiders, as well as the structure of the networks themselves.

The following sections build on several ideas developed throughout Section 7.4 and ask whether organizational learning that leads to evolutionary change is sufficient to make significant progress toward sustainable development. To use the language of Lundvall and Johnson (1994), what is needed is the creation of a “learning economy,” where new knowledge continually replaces old and competitive advantage is secured by environmentally innovative and socially conscious firms. Such an approach could lay the foundation for a steady-state economy (see Section 1.3.1 in Chapter 1).

7.5 Evolutionary or co-evolutionary transformations and customer satisfaction and values

In this section, we examine the importance of organizational factors for evolutionary technological change, driven by customer or social demand. The notion of evolutionary technological change implies that existing rather than new firms or networks are the change agents. In Section 7.6.5, the question whether evolutionary change is sufficient to realize sustainable forms of development is raised. The central issue is the rate at which technological change occurs. In this section, technological change is considered in the context of existing firms and networks that respond to consumer values and demands.

Although Christensen (1997, p. xviii) holds that disrupting technologies “underperform established products in mainstream markets,” this may not always be the case for innovations that are disrupting in terms of sustainable development.* For example, Tesla’s all-electric vehicles – a disrupting technology to ICE (internal combustion engine) and hybrid vehicles – have top of their class safety and performance characteristics and are to be built in the Gigafactory that aims to have a zero net energy use.

From the perspective of sustainable development and the firm, one could say that the goal is to provide sustainability attributes important to customers through any combination of artifacts (products) and services. Ehrenfeld and Hoffman (1996) write that “sustainability requires paying attention to the nature of [...] artifacts, their creation, use, and what happens to them after their productive lifetime, as well as the context within which they are used.”

It is important to clarify the distinction between artifacts (products) that are purchased directly by consumers and those that are purchased indirectly to enable a service to be delivered. The product policy and design community talks about reducing environmental impacts of consumption by shifting from the sale of products to the provision of services. The current literature and policy discussions, including terms like “product as service,” often suggest that providing services to customers is generally more sustainable than selling products. This gives the impression that products (generally considered to be material in nature) are substantially different from services (generally considered to be immaterial). But artifacts are always involved, whether a customer owns them or acquires their “services” through other arrangements.†

Given this context, our analysis extends beyond Christensen’s definitions to analyze (1) the *means* by which satisfaction is delivered to customers,‡ (2) the *nature* of the satisfaction that is delivered to the customer, and (3) the behavior or values of the customer in relation to the first two factors.

7.5.1 *The means of delivering satisfaction to customers*

The artifact or service and/or the process by which it is manufactured or delivered can be changed to reduce resources, energy use, and pollution. One could say that this is the *means* by which satisfaction is delivered to customers. As discussed previously, these

* As we discussed in the previous chapter, Christensen uses the term “disrupting” in the context of a customer base that values certain product attributes, and whose changing desires can change the markets for technological variants in products. The context in which we will use the term throughout this book pertains to the product – and also other technological or system changes – from a technological as well as a customer-based desirability-of-attribute perspective.

† In a restaurant, a classic service provider, the chef uses a stove, food processor, and other tools, just as we might at home, where we purchase and consume food products ourselves. The commuter whose car, a product, has broken down calls a taxi service, which transports the customer using nearly identical technology. Both of these situations contain a mix of artifacts, infrastructure, and an institutional context in which they are employed. Some services, like airplane transport, require artifacts beyond the means of most consumers, but no one would suggest that they have little environmental impact. The terms “product” and “service” and related distinctions are ambiguous and mystifying, especially regarding their overall environmental impacts. These two categories are merely different modes of delivering satisfaction, each with its specific set of artifacts, context, and consumer behavior. The conventional terms “products” and “services” have been applied by economists, designers, market researchers, and others to situations where a customer either ends up owning something (a product) or only receives a benefit (a service). It should be clear that sustainability benefits, if they can be found, cannot be associated directly with these distinctions.

‡ Again, process changes, while not important to customers, may be demanded by workers and unions.

changes can occur in a way that is technologically disrupting or technologically sustaining. The development of the ICE, which represents decades of refinement of the same basic concept, provides a good example of sustaining innovation – one that follows the lines along which technology has been developing historically. As discussed above, Tesla’s vehicles, which break from past technological developments, are an example of a disrupting technological innovation.*

7.5.2 The nature of customer satisfaction

Another dimension along which to evaluate a technological innovation is the *nature* of the satisfaction that is delivered to the customer. The innovative new product or service may (1) provide customer satisfaction in essentially the same way, perhaps even without the customer noticing or caring about the innovation; (2) have attributes or qualities that are essentially the same in concept but provide a noticeably different quality or kind of satisfaction; or (3) represent a wholly different way of delivering the desired level of satisfaction. In the first case, the producer does not need to be concerned with significant changes in customer values or behavior. This could involve imperceptible or irrelevant changes in the product, or changes in manufacturing or production processes. In the second and third cases, significant changes in customer behavior and/or values may be required to gain acceptance.

An example of the first dimension of change is genetically modified (GM) foods, which confer benefits on farmers through reduced fertilizer and pesticide use but are indistinguishable to the consumer from non-GM foods. Indeed, in countries like the United States where there are no labeling laws, customers do not even know that they are eating GM foods. Another example of this kind of change is the “green” rubber developed by Nike, which contains 80 percent fewer carcinogens. The outcome of years of product reformulation and testing, green rubber does not even register with customers, despite Nike’s attempts to educate them. Even if Nike’s customers did know about the company’s efforts to green sneaker rubber, they make their purchasing decisions not on environmental considerations but on product performance, which green rubber delivers to the high and exacting specifications of the previous, carcinogen-laden sneaker rubber.

Ecologically friendly dishwashing soap is an example of an innovation that is the same in basic concept as the original but differs in the quality of satisfaction. Because of their different product formulations, many ecological dish soaps do not generate the billowy suds that traditional soaps do. Some customers do not mind this difference in product performance, but others do. Recycled-content plastic that is used for decking and park benches is another example. In this case, the products are promoted for their superior attributes of low maintenance and durability when compared with wood.

A wide range of innovations fall into the third category, where customer satisfaction is provided in a significantly/wholly different manner than before. This involves expanding the design space to include product–service systems rather than incrementally improving existing designs. Here, fresh perspectives on delivering customer satisfaction are explored by inquiring how technologies and systems can be designed to deliver products and services with a minimum of resource use and pollution. For example, bicycle or car-sharing services meet customers’ need to get from one place to another without the necessity of

* When they were first introduced, the hybrid-electric car was an example of an “architectural disrupting innovation” involving a new combination of prior advances. The Tesla vehicles provide an example of an “intrinsic disrupting innovation,” where the technologies have been developed along an entirely new and different trajectory from previous market technologies. A future where public transportation replaced personal mobility services would represent a system innovation.

owning them. However, this aspect of the “sharing economy” could actually result in a more automobile trips being taken than would have previously occurred (Cohen 2016; Schaller 2017).

Beyond rethinking corporate product–service offerings, entire systems may need to change, for example, changing agricultural growing and distribution systems so that more and better-tasting food is produced locally or regionally without pesticides or herbicides.

7.5.3 Changes in customer behavior and values

As Christensen has pointed out, disrupting product innovations often appeal to a customer who values a different set of attributes than those the original technology possessed. We argue that for sustainable development innovations, this is true in some instances but not in others. In some cases, if the customer does not or cannot detect (or apparently does not care about) differences in product or service attributes, he or she will adopt technological innovations with little or no change in values or behavior unless costs are significantly greater. This is largely the case for GM foods in the United States. The situation in Europe, on the other hand, is quite different. In the United States, producers of genetically engineered foods were reinforced by their traditional consumer network that these foods would be acceptable, and they therefore ignored a small but vocal and different group of consumers who ultimately became a serious force with which to contend. The values of European consumers have not thus far proved adaptable in the direction of accepting GM foods; in fact, they have gone the other way.

In other cases, a significant change in customer values and/or behavior is required to adopt technological innovations. This is the thesis on which Christensen’s definition of disrupting innovation rests: “[Disrupting product technologies] underperform established products in mainstream markets. But they have other features that a few minority (and generally new) customers value. Products based on disrupting technologies are typically cheaper, simpler, smaller, and frequently, more convenient to use” (Christensen 1997, p. xviii). It may be true that disrupting technologies for sustainable development have these positive features, but it is also true that sustainable development innovations can be more expensive, complex, and inconvenient to use, at least at first. This is often because these new products and services internalize negative externalities that would otherwise be borne by the society as a whole. The products and services must either be able to compete on their own merits against traditional competitors or be supported by “minority” customers who value their environmental attributes even if a sacrifice in performance, price, or convenience is required.

What has been said about products can also be said of product–services. However, a shift from satisfying customers by a shift from products to product–services requires much more attention to the marketability and customer acceptance of those changes (Besch 2005).

7.6 The relationship between organizational learning and change and technological innovation

What do organizational learning and change have to do with technological innovation? In this section, we focus on intra-organizational networks: the firm’s organizational structure and the way its groups learn to work together. These factors affect how well the firm can adopt new environmental innovations and generate its own innovations. In order for innovation to occur, actors inside the firm must have the *willingness*, the *opportunity/motivation*, and the *capacity or capability** to innovate (Ashford 1994, 2000). These three elements affect

* Johnson et al. (2003) observe that in the context of third-world development thinking, there is an increased focus on capabilities, rather than resource endowments, as the main instruments and values in development. See Section 1.2.2 in Chapter 1 for a discussion of capabilities.

each other, of course, and each is determined by more fundamental factors such as the social and industrial networks in which the firm is embedded and the incentives that are created by government regulation.

7.6.1 Willingness

Willingness is determined by (1) attitudes toward changes in production in general, (2) an understanding of the problem, (3) knowledge of possible options and solutions, and (4) the ability to evaluate alternatives. Improving factor 3 involves aspects of capacity building by means of the diffusion of information through trade associations, government-sponsored education programs, interfirm contacts, and the like. Changing attitudes toward changes in production (factor 1) often depends on attitudes of managers and on the larger culture and structure of the organization, which may either stifle or encourage innovation and risk taking. Factors 2 and 4 depend on internal intellectual or knowledge-based capacities.

The willingness to adopt or create new environmentally sustainable innovations depends on the commitment of management to nurture new approaches that require time and investment and may be at odds with its traditional customer value network. In the current climate, where managers are constrained by system norms that discourage longer-term investments that may not have an overwhelming and immediate business case, it is not surprising that they are rare. Even rarer is the successful development of a disrupting innovation, one that departs from the traditional ways of delivering value to customers and/or threatens to alter fundamental production processes. Often, in instances where firms pursue a dual strategy of supporting a successful product or service line while trying to innovate a new one, the new initiatives are often shortchanged in the allocation of resources and top-flight researchers (Christensen 1997).

7.6.2 Opportunity/motivation

Opportunity and motivation involve both supply-side and demand-side factors. On the supply side, technological gaps can exist between the technology currently used in a particular firm and the already available technology that could be adopted or adapted (known as diffusion or incremental innovation, respectively), or the technology that could be developed (that is, significant sustaining or disrupting innovation). Consciousness of these gaps can prompt firms to change their technology, as can the opportunity for cost savings. Regulatory requirements can also define the changes that will be necessary to remain in the market. On the demand side, three factors can push firms toward technological change, whether through the diffusion of existing technology or through incremental/moderate/radical sustaining innovation: (1) regulatory requirements; (2) public demand for more environmentally sound, eco-efficient, and safer industry; and (3) worker demands and pressures arising from industrial relations concerns. The first factor can result from changes in customer value networks. All these factors, however, may stimulate change too late in the dominant technology firms if new entrants have already seized the opportunity to engage in developing disrupting innovations.

7.6.3 Capacity/capability

Capability or capacity can be enhanced by (1) an understanding of the problem, (2) knowledge of possible options and solutions, (3) the ability to evaluate alternatives, (4) resident/available skills and capabilities to innovate, and (5) access to, and interaction with, outsiders. Knowledge enhancement and learning (2) can be facilitated through deliberate or serendipitous transfer of knowledge from suppliers, customers, trade associations, unions, workers, and other firms, as well from the available literature. The skill

base of the firm (4) can be enhanced through educating and training operators, workers, and managers on both a formal and an informal basis, and by deliberate creation of networks and strategic alliances not necessarily confined to a geographic area, nation, or technological regime.

Interaction with outsiders (5) can stimulate more radical and disrupting changes. This last method of enhancing the capacity of firms to undertake technological change involves new “outsider” firms and stakeholders with which the firm has not traditionally been involved. Capacity to change may also be influenced by the innovativeness (or lack thereof) of the firm as determined by the maturity and technological rigidity of particular product or production lines (Ashford 1994, 2000; Ashford et al. 1985). Some firms find it easier to innovate than others. The heavy, basic industries, which are also sometimes the most polluting, unsafe, and resource-intensive industries, change with great difficulty, especially when core processes are involved. New industries, such as computer manufacturing, can also be polluting, unsafe (for workers), and resource- and energy-intensive, although conceivably they may find it easier to meet environmental demands.

It has been increasingly argued that *organizational* innovation and learning within the firm, rather than technological innovation per se, are the areas most in need of exploitation, especially in Europe (Coriat 1995).^{*} Former Shell executive Arie de Geus, who is widely credited with originating the concept of the “learning organization,” has remarked that “the ability to learn faster than your competitors may be the only sustainable competitive advantage” (de Geus 1988, p. 71). In a competitive global context, firms are increasingly finding an underutilized source of competitive advantage in their employees’ knowledge and willingness to innovate. Andreassen et al. (1995, pp. 322–323) argue:

The organizational principles and procedures which now underlie the bulk of economic activity follow from past commitments to mass production – to the standardization of product, to the specialization of task, to economies of scale and to a competitive framework narrowly constructed on the basis of price. These competitive attributes have now been supplanted by a new competition in which variety is to the fore, in which product innovation and quality supplement price competition and within which instead of the labor force being seen as a cost to be minimized, it is now recognized as the key competitive asset.

Firms that operate within traditional hierarchical structures find that they are at a disadvantage in capturing the kind of competitive advantage that Andreassen and colleagues and de Geus describe. Some critics point out that corporate culture itself interferes with the learning process. “The prevailing system of management has destroyed our people,” said total quality pioneer W. Edwards Deming. “People are born with intrinsic motivation, self-esteem, dignity, curiosity to learn, joy in learning” (Deming 1990). Deming (1990) claims that the unexamined assumption held by many managers that what cannot be measured cannot be managed has led to an obsession with managing by numbers at the expense of cultivating an organizational environment that stimulates innovation and knowledge creation. Technology, organization, and people combine to influence change. The willingness, opportunity/motivation, and capability/capacity to change all three must be addressed in order to encourage sustainable development. Factor ten (or greater) improvements require radical shifts in production, use, and consumption patterns and are not tied to any particular technological fix. Shifts to product-services, which

^{*} The type of organization innovations that are needed for sustaining innovations may be different from those for disrupting innovations (see the later discussion).

change the focus from the production of products to the delivery of functions and utility (services), are central to dematerialization, energy deintensification, and the creation of new employment.

The successes of companies like Google, Facebook, and Apple have inspired many companies to pay more attention to elements such as corporate culture and identity, organizational structure (for example, hierarchical or “flattened”), knowledge creation and circulation within the firm, management style, employee empowerment for decision-making, the ability to learn from mistakes, responsiveness to external stimuli, and the capacity to innovate. Certainly, changes in management attitudes, capabilities, and incentives are important determinants of the ability of the firm to change and adopt or create new technologies.

With this framing, in the next section we explore three types of environmentally oriented technological changes *within* firms (see Section 7.6.4). These changes are potentially relevant in the context of evolutionary change. In Section 7.6.6, we address more dramatic, disrupting changes that come from *outside* the existing firm or from a firm reinventing itself. We also address the more expansive concept of system changes involving more than a single firm and its supply chain(s). We label these five categories of change types I to V. They are as follows:

Environmentally oriented technological changes *within* existing firms (discussed in Section 7.6.4)

- I Changes in internal environmental management practices
- II Adopting and adapting better existing, off-the shelf technologies (diffusion/incremental innovation)
- III Development of new technologies and new applications of existing technologies by existing firms (mostly involving sustaining innovation)

Environmentally oriented technological changes *outside* existing firms (discussed in Section 7.6.6)

- IV Displacement of the problematic technology (product or process) by a new entrant (who mostly develops disrupting innovation)
- V System change necessitating a reorientation or reorganization of industry

7.6.4 *Environmentally oriented evolutionary technological changes within firms*

7.6.4.1 *I – Changes in internal environmental management practices*

The first kind of change occurs when employees adapt to comply with regulations or expected norms using the firm’s *existing* organizational structures, routines, products, and processes. This kind of change does not require reconfiguration of the firm’s products or processes. In this sense, it is a change that the customer is not aware of because it does not affect the saleable product or service. This kind of change often involves better information sharing and knowledge transfer among people *within* the organization, preceded by or following attitudinal changes. An example is building energy commissioning and maintenance, where mechanical and electrical systems are regularly calibrated and maintained to achieve maximum efficient performance. This kind of change could be considered tuning or maximizing the use of existing technology. The reporting of toxic chemical emissions required by U.S. community right-to-know legislation has resulted in

predominantly good-housekeeping improvements to limit future emissions, rather than fundamental production changes (Ashford and Caldart 2007).

Another example comes from a yogurt manufacturing plant that was incurring high wastewater-treatment costs. An investigation into the causes of the waste found that a significant source was the small portion of fruit additive that was not extracted from its container by the automated manufacturing system. When workers removed the almost-empty containers to replace them with full ones, they dumped the small remainder portion directly into the wastewater drains in the floor. When the company discovered this, it set up a small collecting bin, which would keep the fruit waste out of the wastewater system. In theory, the fruit waste could be composted as organic waste. It was calculated that this single change would reduce wastewater-treatment costs by up to 50 percent. Unfortunately, the company reportedly was never able to convince its recalcitrant union workers to support the change, and the bin sat empty while employees continued to dump remainder fruit into the floor drains (Parrot 2005). This example underscores the necessity of involving workers, as well as managers, in corporate change.

However, a potential challenge to incorporating employees into the change process is how to overcome bounded rationality. For example, a firm included its employees in brainstorming possible solutions to its chemical safety problems. However, since there was no outside influence in this process, the solution space was essentially constrained to technical approaches easily accessible to the firm, resulting in little diffusion of potentially radical/disruptive technologies (Ashford and Zwetsloot 2000; Zwetsloot and Ashford 2003).

7.6.4.2 II – Adopting and adapting better, existing off-the-shelf technologies (diffusion/incremental innovation)

The second kind of innovation involves improving environmental performance by adopting better existing technologies that are proved in the field and are accessible to the firm. In order to make use of such technologies, the firm must change some combination of its products and associated operating or manufacturing processes. This type of change, as in the first type, does not involve any changes in the delivery of customer satisfaction. Many of these changes involve shifting the response of firms from end-of-pipe pollution control to pollution-prevention or clean technologies. In examining the results of mandated requirements to report what pollution-prevention changes firms had made in connection with the reporting of toxic-substances emissions data, the EPA noted that most of those changes involved simple substitutions (EPA 1991).

An example of this kind of change is the automobile industry's switch from traditional wet paint technology to electrostatic powder coating, which both reduced worker exposure and air emissions of volatile organic compounds (VOCs) and saved on material costs. Another example is the installation of sulfur scrubbers on the emissions pipes of coal-fired power plants. The electricity industry is especially cost conscious, and the high price tag of scrubbers, in the millions of dollars, is a considerable barrier to implementation. Government regulation of air emissions is the primary driver for change in this case, although significant worker or citizen demands could stimulate technological change. Provided that government regulation is not too demanding, the regulated firm often adopts or adapts existing technology to meet new/existing standards.*

* Porter and van der Linde (1995a) tacitly assume that the regulated firm will innovate to comply with regulation and thus gain "first-mover advantage." We term this the "weak" form of the regulation-induced innovation hypothesis. See the discussion in Section 7.6.6.1 of more disruptive/radical change pioneered by others who take over and displace the original product market – the "strong" form of the regulation-induced innovation hypothesis (also see Section 8.3.5 in Chapter 8 and Section 9.8 in Chapter 9).

Sometimes, even if a better technology is widely available and carries significant business and environmental benefits, firms resist adopting it because it would require a departure from standard operating practices and/or would trigger higher costs in other areas of the firm. Organizational rigidity and an organizational culture that discourages learning and innovation can prevent the adoption of attractive technologies, even those that are superior in performance and cost. Indeed, the following wide range of challenges to technological change can arise throughout the business firm (Ashford 1993, pp. 293–295):

Technological challenges

- Skepticism about performance of certain technologies and therefore a reluctance to invest
- Process inflexibilities

Financial challenges

- Research and development costs of technology
- Costs related to the risk of process changes with regard to consumer acceptance and product quality
- Non-comprehensive cost evaluation and cost benefit analysis, as well as cost calculation methods
- Lack of understanding and difficulty in predicting future liability costs (for example, the cost of waste disposal)
- Short-term profitability calculations resulting in low tolerance for longer payback periods of equipment investment
- Alleged drawback in competitiveness because other companies are not investing in environmentally beneficial technologies
- Lack of capital investment flexibility due to low profit margin
- Economies of scale preventing smaller companies from investing in environmentally beneficial technologies
- Possibilities that investment in process modification can be inefficient for old companies
- Financial (and even technical) commitment of the company to a recent capital investment (such as a wastewater-treatment plant) that limits future investment options
- Actual cost of current technologies masked in operating costs

Labor force-related challenges

- Inability to manage a technology development program within the company
- Reluctance to employ trained engineers for the alleged time-consuming design of environmentally beneficial technologies
- Increased management requirements because of implementation of environmentally beneficial technologies

Consumer-related challenges

- Tight product specifications (for example, military purposes)
- Risk of customer loss if output properties change slightly or if a product cannot be delivered for a certain period

Supplier-related challenges

- Lack of supplier support in terms of product/input characteristics, good maintenance service, and expertise in process adjustments

Managerial challenges

- Lack of top management commitment
- Lack of engineering cooperation to break hierarchical separation of areas of responsibility (for example, production engineers do not cooperate with environmental engineers)
- Reluctance on principle to initiate change in the company (“Uncle John did it this way; therefore we are doing it the same way!”)
- Lack of education, training, and motivation of employees in good-housekeeping methods or operation and maintenance of environmentally beneficial technologies
- Lack of expertise of supervisors

This list provides some indication of the organizational inertia that can bound or constrain the actions of a firm even if there is a desire for change.

7.6.4.3 III – Development of new technologies and new applications of existing technologies by existing firms (mostly involving sustaining innovation)

The third kind of innovation is when (1) a firm develops a new technology or (2) applies an existing technology in an innovative way. Sources of innovation include actors in trans- and supra-organizational networks, such as suppliers, consultants, industry associations, and academic institutions, among others. This kind of change may implicate one or all three kinds of changes in the delivery of customer satisfaction: (1) where the customer perceives no difference in the product or service; (2) where the customer does perceive a quality difference in what is essentially the same kind of product or service; or (3) where the customer’s needs are met in a completely different way.

What would motivate an incumbent firm to make these changes? If the changes are sustaining *product* innovations, the incumbent firm may be motivated to pursue them if there is customer, regulatory, or social demand (see Figure 7.1). However, if the changes required are of the disrupting kind demanded by a nascent customer demand, Christensen (1997) holds that it is doubtful that they will be developed by an incumbent firm. Christensen (1997) provides several factors that could characterize the (rare) successful management of disrupting innovation by the dominant technology firms:

- Managers align the disrupting innovation with the “right” customers.
- The development of those disrupting technologies is placed in an organizational context that is small enough to get excited about small opportunities and small wins, for example, through “spin-offs” or “spin-outs.”
- Managers plan to fail early, inexpensively, and perhaps often in the search for the market for a disrupting technology.
- Managers find new markets that value the (new) attributes of the disrupting technologies.

Ensuring that these factors are present makes sense for encouraging the kinds of disrupting innovations described by Christensen (1997) that are outside the core competency of the firm and would otherwise threaten to destroy the market for the firm’s main

products or services. Christensen uses as examples changes in computer disk size, the evolution of construction equipment from steam shovels to gasoline and then diesel-powered machines, the impact of hydraulic technology on cable-actuated technology, and leaps in communication technology, such as the development of the telephone.

However, as described in Chapter 6, **Christensen's conception of disrupting innovations is different from our definition, which is framed within the context of sustainable development. In our view, demand or requirements for different product or process attributes come not only from evolving customer demand but also from regulation and/or strong societal demand.** Examples are regulation-induced changes in the use of bis-phenol A in the plastic liners of canned food and the public demand for a reduction in cell-phone related traffic accidents by the addition of the attribute of hands-free calling, not necessarily demanded by cell-phone users themselves.

Disrupting innovations in terms of sustainable development *can* fall inside the core competency of incumbent firms *and* supply the existing customer base. An example given previously is the hybrid-electric vehicle, which was developed and is manufactured by incumbent firms. The vehicle was introduced to the same customers and markets that use the traditional technology; therefore, it is not necessary for firms to develop a new customer base, as Christensen prescribes. In other words, the new "niche market" emerges from the existing customer base.

But what is true for any kind of sustainable development innovation is that it is unlikely to occur without either strong social demand or regulation.* Of course, regulatory requirements that are viewed as disruptive by the firm and its managers often require disrupting technological changes. This perception can lead managers of established firms pursuing sustaining innovation to resist regulation and to try to influence the introduction of regulation that can be satisfied by sustaining innovations (if not by diffusion of their existing technologies). This reinforces the view that disrupting innovations are necessary and that the policy instruments chosen to promote sustainable development need to reflect these expectations. This view is discussed further in Section 7.8.

The discussion thus far has been limited largely to consumer products. Changes related to *process* technologies or shifts from products to product-services and system changes may involve a different set of dynamics. Process innovation, which may be invisible to product customers, is likely to occur within existing firms or their suppliers.† In this instance, new product entrants are unlikely to displace the successful incumbent innovator. In addition, workers may be valuable sources of production process change, as in the case of a large chemical company that sponsored a contest for its workers to submit ideas for energy-saving projects with a return on investment of over 100 percent. Everyone thought that the opportunities for energy savings would be exhausted within a few years, but instead, workers generated more and more project ideas, and the company's annual savings grew from \$3 million in 1982 to \$37 million at a high point in 1989. People associated with the project believed there were "almost an infinite number of projects out there" (Cebon 1993, p. 175).

Two examples of shifts from selling products to selling product-services come to mind: (1) where the original product manufacturer instead sells a service (see the Xerox example below), or (2) where a new entrant sells a service that makes the purchase or lease of a

* For a more optimistic view that large firms in established product markets can sufficiently transform, see Hamel (2000), Hart and Milstein (1999), and Hart and Sharma (2004). For a further defense of evolutionary transitions, see Rotmans et al. (2001).

† An established supplier may be displaced by a new entrant providing a better process, but the incumbent supplier has every incentive to innovate in order to keep its (privileged) market position.

product unnecessary, for example, where the provision of a clothes-cleaning and washing service removes the need to own a washing machine and dryer.

A noteworthy example where a major incumbent firm pursued disrupting innovation is the development of formaldehyde-free resin by the resin suppliers to fabric manufacturers making permanent-press fabric to be used in clothing manufacturing.

7.6.5 *Is evolutionary change enough?*

The literature on corporate “sustainability” and corporate social responsibility is replete with examples of proactive environmental behavior of types I, II, and III (discussed above). However, a growing consensus is that although technological and organizational changes like these have produced significant and positive results, they still fall short of sustainable development goals. Many firms put considerable effort into improving or “greening” core business practices and profitable product and service offerings but stop short of completely redesigning or reconfiguring them in line with sustainability goals (Watson 2016). Furthermore, even while they have been engaged in greening themselves, firms have continued to oppose regulatory action that would hold them more accountable for their actions (UCS 2012).

If we recall that a sustainable future requires technological, organizational, institutional, and social/cultural changes, it is likely that an evolutionary pathway is insufficient to achieve the goals of sustainable development. The distinction between incremental and disrupting innovation – be it technological, organizational, institutional, or social – is not simply line drawing along points on a continuum. Incremental innovation generally involves continuous improvements, while radical (that is, disrupting) innovations are discontinuous (C. Freeman 1992), possibly involving displacement of dominant firms and institutions rather than evolutionary transformations (Ashford 1994).

Significant industrial transformations occur less often from dominant technology firms than from new firms that displace existing products, processes, and technologies. This can be seen in examples of significant technological innovations over the last fifty years, including transistors, computers, and polychlorinated biphenyl (PCB) replacements (Ashford 1994, 2000; Ashford and Heaton 1983; Strasser 1997).

It is argued that more disrupting innovation, rather than incremental sustaining innovation, is needed to achieve factor ten (or better) improvements in both resource productivity and pollution reduction (Schmidt-Bleek 1998). Similarly, radical interventions in employment policy may be needed to offset increasing unemployment (for example, in some European countries) and underemployment in the United States. Such improvements require more significant and revolutionary changes (Andersen and Massa 2000; Reijnders 1998). The capacity to change can be the limiting factor – this is often a crucial missing factor in optimistic scenarios. This implies the need for instruments, policies, and targets that are very different from those to foster incremental improvements.

Especially in industries that are “flexible” and always changing their products, we may be justifiably enthusiastic about existing firms’ ability to move toward sustainable production. In this case, closer relations with suppliers, customers (or users), and NGOs may be particularly helpful.* But where the product line is “rigid” or mature – as was the case

* In a study of innovation patterns within existing technological regimes, van de Poel (2003) identifies several mechanisms that can enable and constrain the creation of radical (i.e., disruptive) technology. For example, he finds that firms with R&D-dependent innovation patterns are more likely to transform (or disrupt) an existing technological regime than firms that adopt user-driven innovation patterns, where the primary focus is to respond to new functional requirements from consumers. On the basis of his analysis, van de Poel argues that the development of radical technological alternatives by incumbent firms (within

for PCBs and is the case with other unsustainable technologies – change is not easy, and Schumpeterian revolutionary waves of creative destruction replace the product via new entrants to the market – often necessitated by stringent regulation.

The notion of Schumpeterian creative destruction is aptly expressed in the following passage about BP:

[Former BP CEO Lord John] Browne [. . . was] trying to prepare BP for the end of the fossil-fuel game – by cutting the emissions of carbon dioxide that it creates while producing oil and gas, by shifting to cleaner fuels like natural gas [. . .] and ultimately by positioning itself as a producer of alternative and renewable energy: hydrogen, wind, solar.

But whether the company – which made its fortunes in the oil fields of Iran and later on the North Slope of Alaska – can survive the shift to a new energy economy remains an open question. “That’s a huge level of wishful thinking,” says one American scientist who has advised BP’s senior management on climate change and renewable energy. “Of course they say they see themselves that way, and of course they’re going to try. But whether they will have any chance of successfully outcompeting newcomers in renewable energy is a very big question. Because historically, once those transformations have happened, the existing companies have not held the edge. These companies, some of which have existed for a hundred years, are essentially about extracting petroleum. And in a world where you don’t extract petroleum anymore, the first order of expectation is that you’re dead.”

(Frey 2002)

The needed transformations may require going beyond product (or process) innovation into the product service area or may involve system changes. Rigid industries whose processes have remained stagnant also face considerable difficulties in becoming significantly more sustainable. Shifts from products to product-services rely on changes in the use, location, and ownership of products in which mature product manufacturers may participate, but this requires significant changes involving both managerial and social (customer) innovations. Changes in sociotechnological systems, such as transportation or agriculture, are even more difficult (Vellinga and Herb 1999). **This suggests that the creative use of law is a more promising strategic instrument for achieving sustainable industrial environmental transformation than the reliance of the more neoliberal forms of ecological modernization on firms’ economic self-interest** (Andersen and Massa 2000; Mol 1995).

Government has a role to play in providing the opportunity for technological transformation and sustainable development through the setting of clear standards and policy goals while allowing flexible means for industry to achieve those goals – in the spirit of “backcasting” (as opposed to “forecasting” to assess future problems) used in the Netherlands for the Dutch National Environmental Policy Plans (Vergragt and van Grootveld 1994). This approach involves setting long-term goals – as much as fifty years ahead – and putting policies in place to encourage the needed transformations (Keijzers 2000, 2002; Vollenbroek 2002).^{*} Care must be taken to prevent dominant technological regimes from capturing or unduly influencing government regulation or negotiation processes (Ashford et al. 2002). New entrants and new technologies must be given a chance to evolve to address environmental problems. Direct support of research and development, tax

the existing technological regime) “is an important mechanism in addition to the process of development of alternatives in niches and the introduction of radical innovations by outsiders” (ibid., p. 66).

^{*} It has been argued that these transformations or “transitions” can be managed (Rotmans et al. 2001) through “strategic niche management,” but others are skeptical about the adequacy of this evolutionary approach (Ashford et al. 2002; A. Smith and Kern 2007). See especially the discussion in the following chapter.

incentives for investment in sustainable technologies, and other technical assistance initiatives that fall under the rubric of “industrial policy” are other areas where government can make a difference (Nelson and Rosenberg 1993). Ideally, an “industrial policy for sustainability” would include provisions relating not only to production and the environment but also to consumption, employment, and trade. Regulatory and other policy design and implementation are largely in the hands of government. The government has to do more than simply serve as a referee or arbiter of competing interests because neither future generations nor future technologies are adequately represented by the existing stakeholders. See Chapter 13 for a fuller discussion.

7.6.6 Environmentally oriented technological changes outside existing firms

In Section 7.6.4, we discussed three kinds of environmentally oriented technological change within existing firms: (1) when employees adapt or change in order to comply with regulations or expected norms by making the best use of the firm’s *existing* organizational structures, routines, and processes; (2) adopting better technologies – those that are already proved elsewhere and in close reach in terms of their availability and the industry’s awareness and knowledge of them; and (3) when a firm develops a new technology or applies an existing technology in an innovative way. We also touched on some of the many internal challenges that incumbent firms must overcome to innovate successfully. Challenges are technological, financial, and managerial and also arise from the internal labor force, suppliers, and consumers.

Psychologically and strategically, firms dedicate their talent and resources to established product lines and ways of doing business. Utterback’s distinction between competence-enhancing and competence-destroying innovations is useful here (Chandy and Tellis 2000; Tushman and Anderson 1986; Utterback 1987). Firms will invest in innovations that bolster and enhance their core business competency and resist innovations that threaten to destroy it. An automobile firm that is given the right signals from regulators and from social systems will invest in innovation that results in products with better fuel efficiency, fewer toxic chemicals, and enhanced recyclability and reusability at the end of life.

This is sensible for proven and profitable lines of business, but it also means that the incumbent firm has less incentive, financial capital, and managerial and labor commitment to devote to innovation. Automobile firms are unlikely to innovate means of transportation other than the private automobile unless those innovation centers are housed in a wholly different business unit. Such firms may even resist attempts to move society away from a reliance on private vehicles, by lobbying against rail construction and subsidies for mass-transit projects. We turn now to the fourth and fifth types of technological change, which involve new actors and new networks of relationships.

7.6.6.1 IV – Displacement of a problematic technology (product or process) by a new entrant (who mostly develops disrupting innovation)

In the fourth kind of technological change, a competing firm or inventor (1) develops a new technology or (2) applies a technology in a different way. For example, the digital camera displaced the traditional camera technology developed by Kodak that relied on film and film developing. These digital cameras are now being displaced by increasingly sophisticated smartphones. Thus, the displacement process is continuous. Once a disruptive technology becomes established in a market, it too is at risk of being displaced.

Van de Poel uses the term “technological regime” – originally coined by Richard Nelson (Nelson and Rosenberg 1993) – to “conceptualize trajectories of technical development and change” (van de Poel 2000, p. 384). In this framework, technical artifacts are

understood to have a dual nature, “both a physical object and fulfilling a social [consumer] function.” Technical artifacts can be designed to meet requirements and specifications and to achieve certain criteria. These rules are shown to the left of Figure 7.2. Technical artifacts also have a physical structure that can be created by following and using design concepts and tools, respectively. These elements are shown to the right of Figure 7.2. Also, some rules in technological regimes are more general and abstract, while others are specific and explicit. Van de Poel (*ibid.*, p. 386) lists the rules that govern technological regimes as follows:

- Guiding principles are general principles that relate the design of a technology to doctrines and values that are used to legitimate a technological regime and its outcomes.
- Promises and expectations about future technology will, when shared in a technological regime, be translated into more specific requirements for new technology and so guide the development of new artifacts.
- Design criteria define the functions, functional requirements, and boundary conditions to be met by an artifact.
- Design tools are tools used in the design process, like scientific knowledge, design heuristics, technical models, and design methods and approaches.

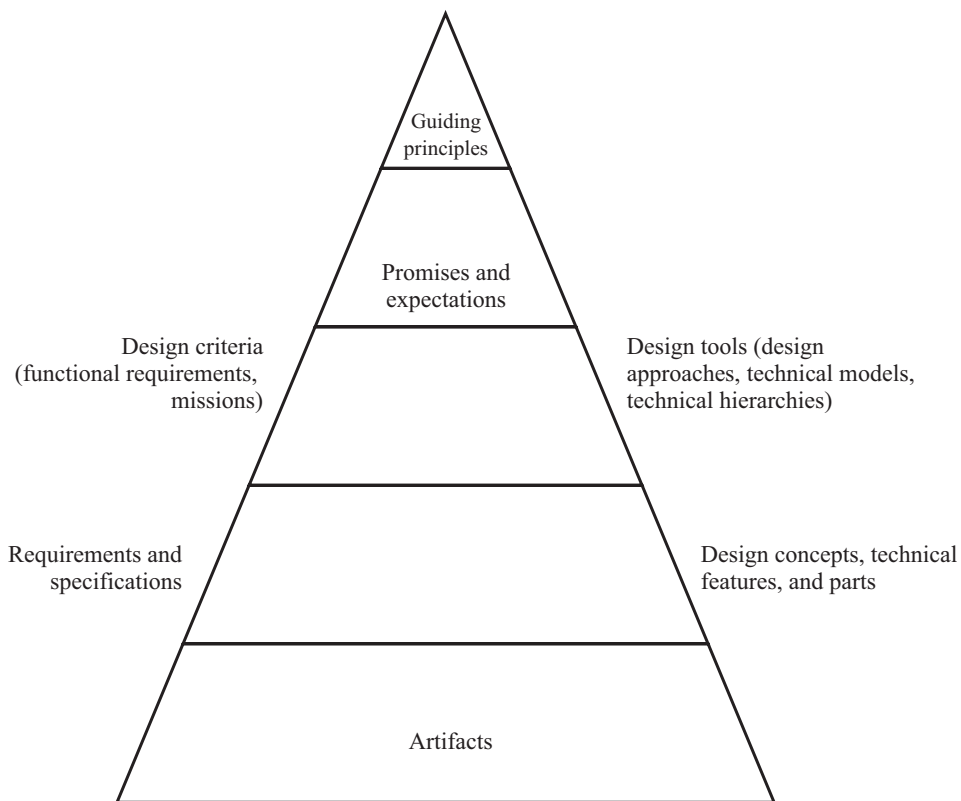


Figure 7.2 The triangle of technical development

Source: Adapted from van de Poel (2000, p. 385).

- Design concepts are concepts for design of a class of artifacts. Technical features and component parts are characteristics of such artifacts.
- Requirements and specifications are a specification of the more general design criteria.

Firms or inventors that introduce what C. Freeman (1992) and van de Poel (2000) call “radical” technological changes, which we will call “intrinsic disrupting innovations,” deviate from the existing rules of technological regimes. In contrast, insiders usually follow existing rules. Van de Poel (2000) uses the example of the turbojet revolution, where the existing aero-engine community had proposed to exploit the existing aircraft propulsion technology further using piston engines with propellers. It was people outside this community, who held radically different ideas about aircraft propulsion, who in fact initiated the turbojet revolution. This is an example of an *intrinsic* disrupting innovation, not the *architectural* disrupting innovation discussed by Christensen (1997) and Utterback (1987).

As described in Section 7.6.5, gradual, we believe evolutionary change is insufficient for the dramatic reductions in overall resource use and pollution that are needed for the transition to a sustainable economy. Van de Poel’s (2000) three types of outsiders – societal pressure groups, engineers and scientists (or entrepreneurs), and outsider firms – all have important roles to play in this transition. Societal pressure groups articulate new functions, design criteria, and requirements. They can encourage the use of technology and promote social experiments that use alternative technologies. Professional engineers and scientists (and entrepreneurs) work on the concept, early prototyping, and design specifications of new technological artifacts, while outsider firms take production to scale in the marketplace. The critical role that outsiders can play in advancing disruptive innovation is the reason we believe the design, decision, and political space needs to be opened up so new voices and ideas can be heard.

7.6.6.2 V – *System change necessitating a reorientation or reorganization of industry*

Beyond disrupting technological changes that displace product markets, shift the satisfaction of needs from products to providing product-services, or involve process innovation, the approach to meeting a particular societal or consumer demand may involve entire system changes. For example, changes to truly sustainable agriculture may change not only how, where, and by whom crops are grown and transported, but also consumer demand and acceptability. Decentralization of production, crop rotation, changes in pesticide and fertilizer use, and hybridization of crops, both conventional and through bioengineering, may all be involved. Another example of a systems change would be the transformation of industrial systems from reliance on fossil fuels to hydrogen. These kinds of far-reaching/systemic changes are likely to involve organizational, institutional, technological, and societal innovation. The role of government in supporting or stimulating transformative change is explored in Chapter 8. The critical question raised in this chapter is how much government intervention should there be?

Of course, significant technological changes also involve changes in the skills necessary both to develop those changes and to employ new technology in production and services. The next section addresses the relationship between the development of new technologies, or the new application of existing technologies, and the skills and capabilities of employees needed in the firm. We also consider how organizational changes can be structured to create or restructure *employment* as one of several important sustainability goals.

7.7 Innovation to stimulate employment

At the core of achieving justice and social inclusion in the globalized economy – an important determinant of a sustainable economy – is the right of working people and

citizens to benefit from industrial transformations. The ultimate governance challenge is to achieve a fair division of the fruits of the industrial or industrializing state, and a safe and healthful environment and workplace. This requires environmental sustainability, but also sufficient job opportunities, job security, and purchasing power, as well as rewarding, meaningful, and safe employment – that is, sustainable employment. Even if concerns of equity were not of paramount importance, inadequate and widely disparate employment opportunities are a source of civil and political instability in both the developed and the industrializing world.

In formulating policies for *environmental sustainability*, *economic growth* and *environmental quality* should be optimized simultaneously, rather than having *environmental interventions* occur after harmful technologies are in place. *Employment concerns* deserve no less a place in center stage; *economic development (competitiveness)*, *environmental quality*, and *employment* must be co-optimized. *Systemic changes* must be pursued and selected that intentionally benefit employment.

In this section, we explore the interrelationship between technology change and organizational changes that can be structured with employment goals in mind. Positive employment goals include work that (1) is safe and gratifying, (2) is adequately remunerative, and (3) meets national employment goals.

The specter of “technological unemployment,” that is, unemployment caused by labor-saving technology, has haunted workers since the beginning of the Industrial Revolution. The reaction of English workers, led by Ned Ludd, to the new capitalist mode of production in the textile industry was the destruction of machines that threatened their livelihood. Social and economic theorists similarly issue dire evaluations of the impacts of productivity-enhancing technology. Marx warned that by investing in machinery, factory owners would spawn vast numbers of unemployed workers. In the 1940s, Norbert Weiner, a pioneer of computing, forecast that computing technology would destroy so many jobs that the Great Depression would pale by comparison.

Brynjolfsson and McAfee’s (2014) book *The Second Machine Age* provides insight into the likely impacts of this computing power through the lens of autonomous vehicles and powerful digital technologies. The implications of these technologies are that firms will need to understand and leverage the interconnections between organizational and technological innovations, without losing sight of social (e.g., changes in consumer values – see Section 7.5.3) or institutional influences (e.g., stringent environment regulation – see Sections 8.3.4 and 8.3.5 in Chapter 8) that may create or destroy markets. The question raised in this section is to what extent are employment considerations put front and center in decisions relating to the creation of new technologies.*

It is true that over the past two hundred years, millions of workers have been replaced by machines. But during the same period, new jobs have grown continuously, as have the real incomes of workers, at least until about the 1970s, when inequality began to grow. Some observers hold that this historical growth in jobs and income occurred as a *result* of technological innovation, not in spite of it (Stewart et al. 2014). Many neoliberal economists continue to point to technological change as an engine of economic growth and a source of continually increasing prosperity for the global workforce.

What, then, should we believe? Technological unemployment, or technology as a driver of continual prosperity and employment? On the one hand, the “end-of-work” literature, represented by Jeremy Rifkin’s (2004) work, focuses on technological innovations that would make workers redundant – the so-called labor-saving effect of technological change. On the other hand, conventional economic thought emphasizes a variety of mechanisms, such as lower prices and cycles of continuous innovation, that spur greater employment

* See Section 3.3.1 in Chapter 3 for a discussion of the impacts of technological change on wages and employment.

prospects and higher standards of living for all workers. Each school of thought carries threads of the truth, and each undervalues and underestimates the other. Vivarelli (1996, pp. 21–22) summarizes the two poles as follows:

In such a situation, the discussion about the employment consequences of technical change is closer to a stalemate than a fruitful debate. The two positions are extremely apart with respect to their methodologies, aims, and scope; in addition their diffusion is limited to two different pools of people: the “end of work” literature talk[s] to the general public while the economists talk to academics and policy makers. These two streams of literature do not intercept each other and so we can assert the survival of two opposite orthodoxies: one which is dominant among specialists and policy makers and the other one which is dominant in the general public opinion.

Vivarelli stresses that it is easy to point out the adverse effects of labor saving innovation, but the indirect effects of technical change and unpredictable job opportunities that can be opened by new products and sectors also have to be taken into account. Piva et al. (2003) suggest that while skilled workers are generally favored by technological change and workplace reorganization, blue-collar workers are very vulnerable when they are exposed to labor-saving organizational and technological changes. A holistic firm-level strategy (on-the-job training), and extrafirm education and training are prescribed. “In other words,” the authors conclude, “only education and training can maximize the joint impact of technological and organizational change on firms’ performance and aggregate welfare” (ibid., p. 16).

There is an attempt to bridge these two different visions of the future in “new growth theory,” which asserts that the *combination* of technological, organizational, and social factors more adequately explains growth (and the Solow residual) than R&D, capital, or human investment alone.* This is because greater investment in both physical and human capital may create positive externalities and aggregate economies of scale effects rather than simply augment the productivity of labor. Further, it is alleged to lead to more rapid diffusion and adoption of new production methods and techniques.†

In 1992, the OECD was cautious about the conclusiveness of the evidence for new growth theory (OECD 1992, chap. 8). But by 1996, the OECD was enthusiastic about the importance and revolutionary promise of the “knowledge-based economy,” arguing that unlike capital investment, the rates of return to investment in education and training seem to increase over time, and further, that industrial networks facilitate the ability of firms to share and combine elements of know-how to even greater advantage (OECD 1996). Thus, through the lens of “knowledge-based” work, the importance of “networks” took on new significance and seemed to provide support for new growth theory. These networks promote inter-firm interactive learning and are regarded as important components of “national innovation systems” – the institutions, actors, and practices that influence innovation in general (R. R. Nelson 1996; R. Nelson and Rosenberg 1993).‡ More

* See Section 3.2.1 in Chapter 3 and the discussion of new growth theory in “Chapter 8: Technology and Economic Growth” in OECD (1992, pp. 167–174). The Solow residual is the part of economic growth that cannot be explained by capital or labor accumulation and is posited by Solow to represent the impact of technological innovation.

† What is missing from this rationalization is the need to reverse the trend of replacing labor with capital, not by merely training and educating workers, but by codesigning work that utilizes both human resources and technological artifacts such that more skilled labor is actually intelligently designed into production and services. This follows the now-old Scandinavian tradition of “socio-technique” of the Tavistock school. See Davis and Taylor (1972).

‡ National innovation systems include not only support for R&D; the training and education of scientists, engineers, entrepreneurs, and managers of technology; more favorable tax treatment of investment;

recently, the OECD (2013) focused on the contribution of “knowledge-based capital” (KBC) – i.e., non-tangible forms of capital such as “data, software, patents, designs, new organizational processes and firm-specific skills” (ibid., p. 17) – to economic growth. A key enabler of KBC are knowledge networks and markets (KNMs), which are “the set of systems, institutions, social relations, networks and infrastructures that enable the exchange of knowledge and associated intellectual property rights” (ibid., p. 253). KNMs provide important services to the innovation system in relation to connecting actors within a network and enforcing laws that govern the network. Thus, “knowledge networks” that broker KBC seem to be an increasingly important factor driving economic growth. An important question, though, is to what extent workers are benefiting from this growth.

An in-depth analysis of technological change and employment was undertaken by Edquist et al. (2001). It is generally acknowledged that product innovation usually creates employment and process innovation destroys employment, although there are counter-acting forces in both instances. When new products replace old ones, labor-saving processes are usually also used, so net job gains are not certain. Employment opportunities are more likely if the new products are cheaper and consequently (1) command a sufficient increase in demand and units sold or (2) create an increase in disposable income enjoyed by consumers that is spent on other products.

Thus, although the immediate effect of new products may be to increase employment, there may be a loss of jobs from the product(s) they replace. Because of the tendency for new production to be more capital intensive (that is, more labor saving), there could easily be a net loss of jobs. Product innovations that neither substitute for an existing product nor are later sold as process innovations have the greatest effect on employment creation.

Process innovation and organizational innovation can have different consequences for employment. The shift to services has a mixed result, depending on whether R&D intensive manufacturing sectors or knowledge-intensive service sectors are involved. The latter tend to be more employment creating. To quote Edquist et al. (2001, p. 119):

The most important sources of [. . .] productivity growth [involving fewer workers] are technological or organizational process innovations. While compensation mechanisms can mitigate job losses, they can promote net employment gains only when growth in production (that is, demand) outstrips productivity growth.

In sum,

the relation between “growth” and “employment” is by no means simple and mechanical. Some kinds of growth create jobs, other kinds destroy jobs, and there is the phenomenon of “jobless growth.” Economic growth does not automatically or always lead to employment growth and productivity growth normally leads to fewer jobs induced by process innovation. Therefore a general policy of growth will not necessarily create more jobs.

(ibid., p. 118)

The analysis offered by Edquist et al. (2001) implies that the most certain pathway to net job creation is to produce more products, with the consequence of more use of materials

regulations; and support of exports, but also networks involving trade associations, suppliers and other firms, customers, and workers. In the context of new growth theory, these networks are said to effectively compound accumulated knowledge and provide new energy for both growth and employment. See Section 6.3 in Chapter 6 for a discussion of national innovation systems.

and energy, which is likely to increase the environmental footprint of an economy. They do not analyze the possible impact of shifts from products to product-services that could have the effect of both increasing employment and decreasing energy and material use.

7.7.1 Low-wage, cost-cutting versus innovation driven, quality firm strategy

The posture that firms adopt with respect to their growth strategy has significant implications with regards to their approach to innovation and employment. At one end of the continuum, firms can seek competitive advantage by cutting costs (or maximizing efficiency). At the other end, firms can advance an innovation-driven approach to capturing market share through new products, services, and product-services.

Charles and Lehner (1998, p. 222) argue that a “cost-oriented competitiveness policy” is likely to slow down the structural adjustments of advanced economies by motivating companies and whole industries to “remain too long in traditional markets.” They write, “policies aiming at reducing labour costs by means of deregulation, increased labour market flexibility, or cuts in social security systems work in the same direction, as they often remove pressure for productivity growth” (ibid.).

Kleinknecht’s (1998, 2015) work on the Dutch labor market corroborates that of Charles and Lehner. The Netherlands has achieved reductions in unemployment by focusing on labor-market flexibility, achieving concessions for wage moderation in centralized bargaining, and lowering minimum wages, in particular for young workers. Payroll taxes were also scaled back, especially on low-wage groups. But Kleinknecht argues that lower labor costs may be successful in the short run but harmful to innovation and performance in the long run. The argument for this is that too modest wage increases, downward wage flexibility, and other attempts to make labor markets more flexible are likely to discourage firms from making investments in productivity-enhancing technology, which will have an overall negative effect on employment and company profits in the global marketplace (ibid.). There are other features of the Dutch model that deserve emphasis. The Dutch government retained its commitment to providing high levels of education at the high school level to potential labor-market participants. In addition, wage disparity between high-skilled workers and lower-skilled workers was kept at a minimum through fiscal and tax means. The result was that workers who were better educated than the private sector thought it needed and whose skills were increasingly regarded as valuable by employers were rewarded by higher wages, such that wage disparity actually decreased in the Dutch economy.

The Dutch model was seen as the solution to the persistent unemployment in European countries that kept wages and social benefits high. Is there a labor and industrial development policy that can simultaneously keep wages up, unemployment low, and innovation high? Charles and Lehner (1998, p. 223) argue that “the type of innovation which is the key to new employment is one which develops markets in new directions and creates new markets and thus enhances a strong leading-edge economy.” As Schumpeter has described, companies in the leading-edge economy can exploit a temporary monopoly resulting from their superior products and services (Schumpeter 1939). As we have already established, advanced industry economies have already shifted in the last ten to fifteen years from technocentric to anthropocentric production systems – those that capitalize on human intelligence and are designed for continuous improvement and learning. Instead of a cost-driven strategy that calls for reduced labor costs, Charles and Lehner recommend that industrial economies aim for an innovation-driven strategy, which depends on a large number of human interfaces in the company that are likely to produce organizational learning, creativity, new ideas, and well-paying jobs.

At the firm level, Locke and Kochan (1999) differentiate between a cost-based (cutting costs) and a quality strategy for improved competitiveness and argue that the latter has the

most positive implications for labor. They also point out that some firms have combined massive layoffs and downsizing with the (later) development of advanced models of labor-management partnership and employee participation. Cost cutting and quality are not mutually exclusive – some firms do them in sequence, and some even try to do them at the same time, although in the process they often destroy and later must try to rebuild the trusting relationships on which a quality strategy depends (*ibid.*, p. 373).

Sisson (1995, pp. 52–53) puts forward a number of interesting hypotheses about the cost-cutting strategy versus the quality strategy that are worthy areas for future research:

- Management in industries with high capital-labor ratios, such as chemicals/pharmaceuticals, is more likely to follow a quality strategy, whereas management in industries with low capital-labor ratios, such as clothing, is more likely to pursue a low-cost strategy.
- Management in companies that have “stuck to their knitting” (to borrow from Peters and Waterman 1982) is more likely to follow a quality strategy, whereas management that is diversified or has become part of diversified companies is more likely to pursue a low-cost strategy.
- Management in companies that practice strategic planning or strategic control from headquarters is more likely to follow a quality strategy, whereas management that relies on financial control is more likely to pursue a low-cost strategy. [. . .]
- Management in companies belonging to [. . .] successful clusters of internationally competitive industries is more likely to follow a quality strategy, whereas management in stand-alone companies or companies not part of a successful cluster is more likely to pursue a low-cost strategy. [. . .]
- Management in general is more likely to be under pressure to adopt a quality strategy in countries where there is a highly centralized trade union movement than where bargaining is decentralized and the power rests in the workplace.
- Management in general is more likely to adopt a quality strategy in countries where there is a high measure of state regulation, especially in the training of workers (e.g., Germany and France), whereas management in relatively unregulated countries such as the United Kingdom and the United States is more likely to follow a low-cost strategy.
- Management in general is more likely to adopt a quality strategy in countries where there is a protected environment (e.g., Germany, France, and Japan), whereas management in countries with a stock market – which puts greater emphasis on short-term profitability and encourages predatory behavior (e.g., the United States and the United Kingdom) – is more likely to follow a low-cost strategy.

The last point relating to unions is especially important because firms do not have much control over whether there is a stock market or a high degree of state regulation, but they do have great influence on union formation. Osterman et al. (2001, pp. 188–189) sum up the historical role of unions in America and future directions for their growth:

One of the most important contributions of the American labor movement from the 1930s through much of the postwar period was their success in upgrading the working conditions and living standards of the “unskilled” or “semi-skilled” production workers in the manufacturing sector. That so many auto workers, steel workers, and other workers moved their families into the middle class was no accident of market forces. Econometric studies drawing on national, industry, and company data sets have consistently demonstrated that unions have improved the wages and benefits of workers in entry-level or lower-level jobs and thereby reduced income differentials. Moreover, by negotiating rules governing access to training and internal job

ladders (in addition to providing opportunities to take leadership positions in the labor movement), unions helped integrate low-wage workers into the opportunities for upward mobility in the internal labor markets of the time.

Therefore, the revival and rebuilding of unions and collective bargaining [. . .] should be seen as an integral part of a national strategy for addressing both the income and the opportunities that can be created in today's low-income labor markets. However, the strategies unions use to achieve these goals will have to be more varied than in the past, insofar as many low-income workers are scattered in non-standard job settings, many come from immigrant, racial-minority, and cultural-minority communities, and many lack basic language, social, and behavioral skills needed to succeed in the labor markets. This is one of the reasons we have suggested that unions and community groups work closely together in a variety of political and organizing efforts.

7.7.2 Re-conceptualizing the need for innovation in approaches to employment enhancement

Nations pursuing either performance-driven increases in competitiveness or cost-cutting strategies have articulated a need to increase labor productivity, defined as output per unit (or cost) of labor input.* Labor productivity is only a macroeconomic indicator and hides important details relating to how increases in labor productivity are actually achieved. Labor productivity can be improved in three ways: (1) by utilizing better tools, hardware, software, and manufacturing systems; (2) by increasing workers' skills; and (3) by a better matching of labor with physical and natural capital and with information and communication technologies (ICT).

When strategy 1 is pursued by a firm or a nation, technological unemployment can result, even if skills remain the same, because labor may not be able to demand its former share of production profits since management owns an increased (capital) share of the factors of production. Further, if the adoption of labor saving technology also involves a deskilling of labor, workers will extract even lower wages. Close analysis of the consequences of pursuing strategy 1 shows that it is not the *productiveness* of labor that has increased, but rather the productiveness of capital.

In contrast, following a national or firm-based strategy that improves the skills of workers, even using the same technological artifacts (strategy 2), will improve both their productiveness and labor productivity. Strategies pursuing skill enhancement should increase rewards to workers, *ceteris paribus*, because workers are more valuable to employers. On the other hand, if improvements in technology accompany skill enhancement, these two dynamic factors work in opposite directions. The outcome for wage adjustments may be uncertain. Improvements in workplace technology are inevitable, except perhaps in very low-skilled work, so romanticizing that the pathway to higher wages will be facilitated by skill enhancement alone may not suffice. In addition, labor markets respond to supply

* In theory, increasing worker productivity lowers the costs of goods and services, thereby lowering prices and ultimately increasing the demand and sale of goods and services. It can be argued that at least in some markets, more workers may be subsequently hired than displaced as a consequence of needing fewer workers to produce a given quantity of goods and services. If we put aside the potential environmental problems associated with this model of continual throughput and consumption, several important employment-related questions remain. First, are wages increased or reduced following productivity improvements? Second, what are the productivity-related impacts on job tenure and security? Finally, are more jobs created or lost through the productivity gains? The answers to these questions will likely depend on the form of competitiveness – that is, cost-cutting versus innovation driven – pursued by industry.

and demand dynamics. If no new opportunities for jobs are created, merely increasing the skills of workers may actually lower the wages of skilled workers in some labor markets, because the supply will be increased, but not the opportunities for work.

Scenario 3 – codesigning work that utilizes both human resources and technological artifacts such that more skilled labor is actually intelligently designed into production and services – is not pursued to a significant extent in the United States, Europe, or Asia, although it showed great promise in the 1970s following the Scandinavian tradition of “socio-technique” pioneered by the Tavistock school (see Davis and Taylor 1972). Designing jobs that match labor (that is, human) skills to technology is an area that could yield considerable dividends beyond simply increasing the skills of labor to use technology that was not designed with humans in mind more effectively.

7.8 Policy implications

The relationship between industrialization and its effects on the environment has captured the serious attention of national governments and international organizations, especially in light of increasing globalization. Sustainability in products, processes, and services has been increasingly emphasized by placing the environment at the center of some industrial transformations – or at least on a par with competitiveness. The key to *environmental* sustainability was recognized early as involving the design and implementation of environmentally sound products, processes, and services, rather than addressing environmental concerns as an afterthought in industrial systems. At the same time that the environment has become more important in economic policy, European as well as American industrial economies have also begun to pay attention to the restructuring of labor markets to reflect changes brought about by emerging technologies, new environmental priorities, and globalization. However, policies have been largely reactive rather than proactive toward new job creation and better organization of work.

Just as thinking about the environment before industrial development is planned and implemented is necessary to optimize environmental quality, consideration of labor concerns also requires deliberate and intelligent actions before embarking on industrialization efforts in guiding industrial transformations. We believe that exploring options and opportunities for co-optimizing economic development (competitiveness), environmental quality, and labor/employment concerns, all of which have implications for the organization of work, will be one of the most challenging and important issues of the coming decades.

The broad lens of sustainable development needs to refocus on the interrelated concerns of the economy, the environment, and employment. All three are affected by rapid technological change and globalized trade and must be addressed together in a coherent and mutually reinforcing way. In this chapter, we have discussed the important difference between a cost-reduction versus an innovation-based strategy for competitiveness. While innovation-based markets may take longer to generate sustained economic benefits, they may outlast markets driven by cost-reduction strategies. The consequences for workers may differ as well, with the former approach holding the potential to promote skill enhancement and generate more well-paid and rewording work than the latter. The focus of a nation on trade also has important employment implications. The United States’ historic focus on promoting globalization and expanding markets stands in contrast to the EU approach that focuses more on creating an efficient internal market in which its various members compete on performance. In the United States, wage disparity has grown since the 1970s, whereas in some parts of the EU, notably the Netherlands, wage disparities are much smaller.

The changing global economy, however, presents challenges for all nations as concerns about the number of jobs, job security, wages, and occupational health and safety increase. **In the private sector, labor needs a role in choosing and implementing information-based technologies. In the public sector, there is a need to integrate industrial development**

policies with those of employment, occupational health and safety, and the environment. From the perspective of labor, these require implementation of the *right to know*, the *right to participate*, and the *right to benefit* from industrial transformations. **Above all, there needs to be a commitment on the part of government and industry to reconceptualize the relationship between employment and technology, going beyond information-based technological change and redesigning human-technology interfaces that represent new relationships between human capital and technological artifacts.** The alternatives are to tolerate increased income and wage inequality and unemployment, implement larger income transfers through expanded welfare, or turn workers into owners by increasing their access to capital for industrial expansion, as suggested by binary economics (see Section 3.6.1 in Chapter 3).

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8 Government policies to foster innovation, economic growth, and employment

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8.1 Introduction

We have argued earlier that **technological innovation is essential for achieving sustainable development**. More specifically, that **innovation can be focused on improving (1) production processes, products, product-services, and services (that is, competitiveness); (2) the environment (through environmental technology or the prevention of pollution at the source); and (3) employment (through the design of better sociotechnical systems)**. In Chapter 9, we discuss nation-based policies for achieving environmental sustainability through regulation. Here, we address various approaches to industrial policy to improve competitiveness and employment. Government policy to foster innovation for competitiveness can take various forms:

- 1 It can provide a suitable business and financial environment through the general support of physical infrastructure (for example, transportation systems) and legal infrastructure (for example, patents) for entrepreneurs and the private sector to flourish.
- 2 It can inject itself more intrusively into the innovation process by providing federal support for science and new product development (for example, pharmaceuticals, computers, aircraft, nanotechnology, and biotechnology in universities and government research institutions/laboratories and military research), which can then be handed off to the private sector for commercialization.
- 3 It can actively manage evolutionary change in industrial firms by a series of financial and market incentives.

- 4 It can create future mandatory targets for performance and operation that may be beyond the current capacity of incumbent firms (for example, by requiring more stringent fuel economy standards that would advance a range of vehicle power systems).

These alternative approaches are listed by increasing levels of intervention and are discussed in this chapter.

In Chapter 5, we provide a broad overview of the challenges to sustainability policy posed by the complex interdependencies among *the environment, work, and the economy* (the three pillars of sustainability), and the current state of and changes in the international economy (globalization) that, owing to these interdependencies, have strong, linked effects on each of the pillars.

Articulating policy approaches to sustainability, however, requires more than an understanding of the *challenges* to sustainability posed by the international context. **Integrated sustainability policies must use, alter, or supplant existing policies (and the institutions that administer them) in the areas of the economy, the environment, and work.** Thus, knowledge of the existing policy tool set and institutions is necessary.

Therefore, in this and the following chapter, we turn to a comparative examination of *national* policies with regard to each element of the sustainability tripod. In this chapter, we focus on promoting economic prosperity and economic development (emphasizing technological aspects) *and* employment (specifically, the aspect of “work” related to labor as one of an economy’s many factor endowments). Hence, we here address many aspects of traditional “industrial policy.” The next chapter focuses on governmental initiatives to improve workplace conditions – the other half of employment issues – *and* the environment.

Where appropriate, we shall also examine the theoretical models underlying the application of policy. A relevant question is how policy prescriptions change when a different, sustainability-oriented model forms the basis for a policy intervention. In previous chapters, we have stressed that achieving sustainability is an *integrative* process and have explicitly acknowledged the difficulties involved in presenting different elements of the literature separately. Unfortunately, there is little difficulty in separately examining the established policy approaches with regard to the economy, the environment, and work. Historically, these areas have been treated quite separately, and this feature represents a significant obstacle to achieving sustainability.

In Chapter 3, we focused on the importance of technology in achieving economic prosperity and economic development, and that focus is maintained in this chapter. We recall that the focus of the literature on technology is often divided between developed and developing economies. In developed economies, the focus of policy is on promoting innovation and accelerated diffusion of new technologies. In developing economies, the focus is more on the acquisition of technological capabilities to locate, use, and adapt existing technology (that is, diffusion or incremental innovation), and less on moderate or radical innovation. This is consistent with the dominant view that the comparative advantage of “developed” economies lies in innovation and in high value-added technological “frontier” activities, whereas late-developing countries tend to achieve economic transformation as technological followers, without the benefit of innovative technologies.* However, innovative approaches need not be limited to technological changes. Organizational, institutional, and societal innovations may originate in developing nations. We

* However, see the discussion in Section 8.7 that argues that the developing world suffers more from demand-side failure than from supply-side deficiencies.

give significant attention to the impact of globalization on policy making and the policy environment in both types of economies.

8.2 Types of technological change and sustaining and disrupting innovation*

The increasing pace at which new technology is being adopted by societies is having the effect of stimulating still more rapid technological change. Today, technological innovation drives high-technology industries in many industrialized nations. The desire to provide customers with new and better products and services – or to reduce/eliminate negative externalities associated with the use or manufacture of products/services – means that companies are pitched in a constant battle to be the first to bring the latest technologies to market. In this environment, companies that rely on incremental innovation can see their markets disappear as new radical (i.e., disrupting) innovations enter and displace their products from the marketplace. The purpose of this section is to look at the process of technological change and innovation and ask what types of changes are necessary to transform systems toward sustainable development. Further, this section considers how these changes might be affected by both supply- and demand-side policies.

For policy evaluation and design, we argued in Chapter 6 that it is important to classify technological change and innovation in a functionally useful way. At the outset, we suggested four different kinds of technological change:

- Product changes;
- Process changes;
- Shifts from products to product-services; and
- More far-reaching system changes.

All four types of technological change are necessary to achieve sustainable development. However, the impact of each type of change will depend on whether it is incremental, moderate, or radical in nature and on the scale at which the change occurs (regional, national, or international). One way to consider these factors is to look at differences in the processes of technology development. An important distinction is the difference between technology development that proceeds in an *evolutionary* manner (or in a *co-evolutionary* manner where technology developers and customers change what is produced and demanded, respectively, over time) and technology development that is driven by *government intervention* or *societal demand*. In both cases, each of the four kinds of technological change presented above can occur.

As discussed in Chapter 6, an *incremental innovation* involves a step-by-step co-evolutionary process of change, whereas *radical innovations* are discontinuous and possibly involve the *displacement* of dominant firms and institutions (Ashford et al. 2002; Luiten 2001; Moors 2000; Partidario 2003). Christensen (1997) labels the former “sustaining innovation” and the latter “disrupting innovation” (rather than radical innovation) and argues that both sustaining and disrupting innovation can be incremental, moderate, or radical. Unfortunately, the term “radical” is used in the literature in these two different ways and is a source of confusion. We adopt Christensen’s formulation in our discussion. The following discussion of product innovation should help clarify its use.

* The discussion here somewhat duplicates that found in Chapter 6, but it is reintroduced to allow this chapter to be read on a stand-alone basis.

Much of the innovation scholarship relates to evolutionary theory in the context of products, and here the (changing) nature of the customer base is important. In particular, in defining and distinguishing *sustaining* and *disrupting* product innovation, Christensen (1997) relies on the concept of “value networks” made up of different customers. He notes that incumbent firms tend to develop predominantly sustaining product technologies for existing customers, while new entrants pioneer disrupting product technologies for a new customer base. Christensen’s (1997) research does not extend beyond the product domain to explore how development might be different under strong governmental or societal interventionist policies that supersede evolutionary changes. In the context of encouraging sustainable development transformations, supply-side policies (for example, subsidies, R&D support, and favorable tax treatment of investment) can be general or can focus on encouraging technological changes with certain performance characteristics in mind. In contrast, demand-side policies (for example, government purchasing, tax incentives, public-service advertising, counter-advertising, and education) are designed to influence societal preferences and may be useful in implementing or gaining acceptance of sustainable development policies. Although demand-side policies are less interventionist, they can have a significant effect on evolutionary processes of change. The critical question is whether the rate of change toward sustainable development is likely to be sufficient under an evolutionary (*laissez-faire*) approach to innovation, or whether a more interventionist approach is required. **An argument made in this book is that evolutionary approaches may proceed too slowly to stem sustainability concerns related to important problems such as global climate change and toxic pollution.**

We have already mentioned that Christensen’s (1997) theories focus on the product domain. Although *process changes* and *innovation* are important to workers, they are not very important to the customers of a product. Producers of products may develop more sustainable processes to make their products, but these actions are not normally driven by customer demand. Hence, Christensen’s (1997) concepts of “value networks” and new customer bases may not be as useful in the process domain as they are in the product domain. Distinguishing sustaining and disrupting *technologies* may be useful, but these “innovations” are driven by producers and manufacturers who operate within a demanding regulatory environment, rather than being influenced by product consumers. For shifts from products to *product-services* – for example, purchasing a photocopying *service* rather than a photocopying machine – customers may be even more important than they are in the product realm because these shifts may involve behavioral changes on the part of the consumer. Finally, *system changes* involving a number of producers and actors – and perhaps service providers – involve a more dramatic realignment of actors.

In the discussion that follows, a behavioral model is developed that describes for product changes the influence of incumbent versus new entrants, the likelihood of sustaining versus disrupting technology, and implications for different customer bases.

We have created Figure 8.1 to help explore different types of innovation.* It presents a matrix that can be used to locate an innovation in one of twelve categories. The matrix shows where a sustaining or disrupting innovation originated (that is, from an existing firm or new entrant), its type, and whether the innovation serves existing customers or a new customer base. Although it can be difficult to draw clear boundaries between these descriptors, the framework provides a first-order approximation of whether an emerging technology is of a sustaining or disrupting nature.

* Although the matrix concept is relevant to product, process, product-service, and system innovations, the focus of this figure is on product innovation. See Figure 8.5 and the accompanying text for other categories of change.

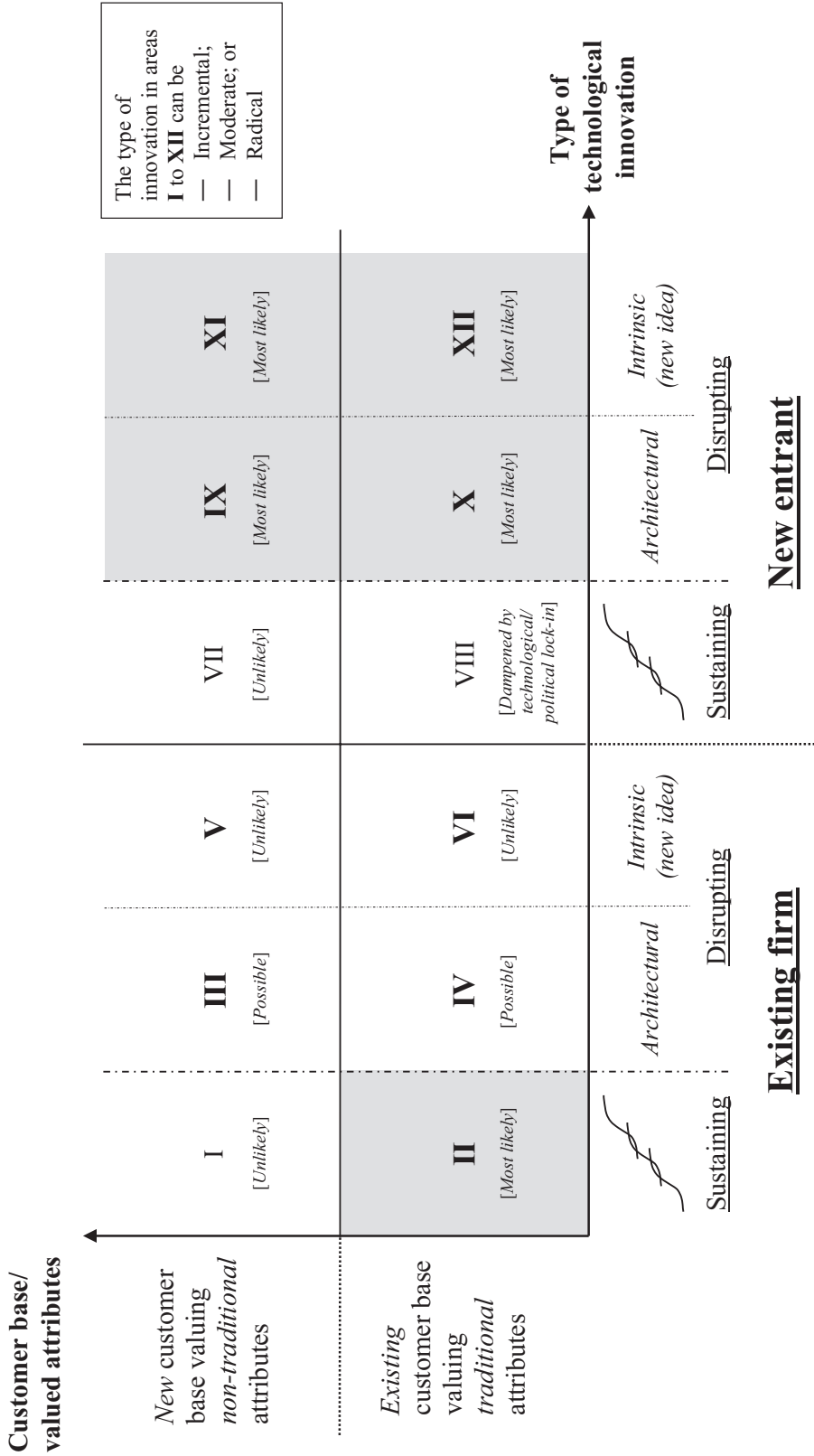


Figure 8.1 Matrix of potential outcomes of sustaining and disrupting product technology

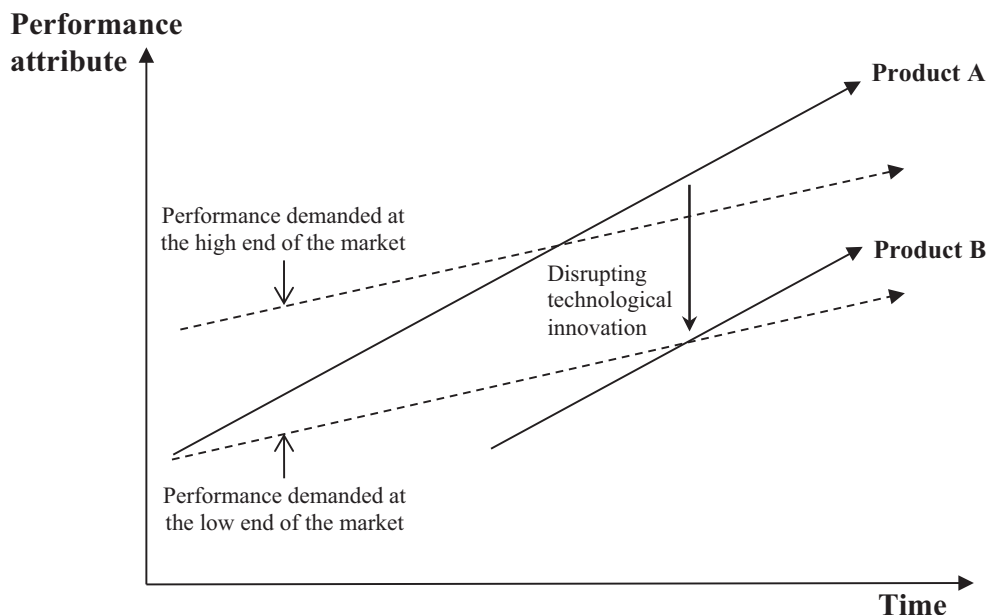


Figure 8.2 Intersecting trajectories of performance demanded (dashed lines) versus performance supplied (solid lines) in a generic product market

Source: Adapted from Christensen (1997, p. xix).

An incremental, moderate, or radical *sustaining innovation* is a technological change along the same lines that technology has been developing historically. The development of the internal combustion engine (ICE) provides a good example of sustaining innovation. Improvements in the performance of an ICE have been incremental, moderate, and radical. Sustaining innovations that originate from an existing firm fall into Category II of Figure 8.1 (which covers the vast majority of sustaining innovations), and those that originate from a new entrant fall into Category VIII. In both of these cases, the existing customer base that values the traditional attributes (or performance) offered by the technology is served.*

Sustaining innovations tend to follow the trajectory of Product A in Figure 8.2. This figure indicates that sustaining innovations may eventually improve the performance of an established technology beyond the actual market demand for the product. To remain competitive in mainstream markets, firms need to continually improve their product to retain and capture new customers. An improved product can generate higher returns (found in the upper right of Figure 8.2), because firms can charge

* Category II has been highlighted in Figure 8.1 because the majority of sustaining innovations are likely to originate from existing firms. The presence of technological and political lock-in (or entry barriers) makes it difficult for new firms to enter established markets. In addition, although Categories I and VII have been included in the matrix for completeness, it is unlikely that a sustaining innovation will develop a new customer base that previously did not see the value of the existing technology. However, such a situation might occur where a firm missed an opportunity to sell its product to a consumer base by not perceiving that consumers had a need for its product.

a premium for their product rather than being forced to compete on price.* However, the further an established technology progresses along a sustaining innovation trajectory, the more vulnerable it becomes (over time) to emerging disrupting technologies that can undermine its customer base. In effect, sustaining innovations can “overshoot” the performance requirements and/or budgets of customers, who will then switch to a cheaper product–service – even one (initially) with somewhat reduced performance – as one becomes available. These more suitable products/services are known as disrupting innovations. They are termed “disrupting” both because the technical development is not within the mainstream development trajectory† and because they have attributes that appeal to a new or emerging customer base (in Christensen’s conceptualization).

An incremental or radical *disrupting innovation* can take two forms: one that combines two or more prior developments in a new way, creating an “architectural” innovation; or one that stems from a new idea and is an “intrinsic” innovation. The former could but need not be supported by a significant research and development effort. Disrupting (architectural) innovations tend to be “cheaper, simpler, smaller, and, frequently, more easy to use” (Christensen 1997, p. xviii) and offer a lower level of performance, at least in some ways. Christensen (1997) makes a convincing case that because emerging disrupting technologies (both architectural and intrinsic) are not initially performance competitive (in the context of their traditional attributes) with mainstream technologies, they are initially sold to a niche element of the existing market and/or (more likely) to a new customer base. However, once the performance of a disrupting technology improves (along a sustaining innovation trajectory) to a point at which it becomes competitive with mainstream technologies (because it offers sufficient performance in the traditionally valued attributes and has other attractive attributes as well – see Product B in Figure 8.2), it can capture the market by displacing the established products/services.

It is important to recognize that the set of attributes valued by the customers of Product B is likely to be different from that valued by the customers of Product A. For example, a desktop computer (Product A) might be valued for its hard-disk capacity, whereas a laptop computer (Product B) might be valued for its sufficient capacity along with its size or portability. As the size, portability, and hard-disk capacity of the laptop computer improve along sustaining innovation trajectories, the laptop may eventually reach a point where it can both compete with desktop computers in hard-disk capacity and offer other attractive features. At this point, the laptop can begin to undermine the market share of desktops. This process of disruption is depicted in Figure 8.3.

The graph on the right of Figure 8.3 shows the home value network for the laptop (Product B), where the size/portability of the computer is assumed to be the important attribute. The rate at which the size of the laptop is reduced is represented by the S-curve. The graph on the left of Figure 8.3 shows the home value network for desktop computers (Product A), where hard-disk capacity is assumed to be the leading attribute. This graph also shows how one model of hard disk used in desktops (Product A₁) has been replaced by a more advanced model (Product A₂), which provides an example of a sustaining innovation. When the hard-disk capacity of the laptop – a secondary attribute in the home value network for Product B – reaches a level at which it can begin to approach the performance demanded by increasing number of desktop consumers, it can invade the desktop market and start to capture market share, ultimately displacing the sustaining innovations on the

* Firms that compete on price tend to rely on process innovation to reduce production costs and increase profit margins.

† Because the focus is on the technology itself rather than its market appeal, it might be more appropriate to describe disrupting innovations as disrupting technologies.

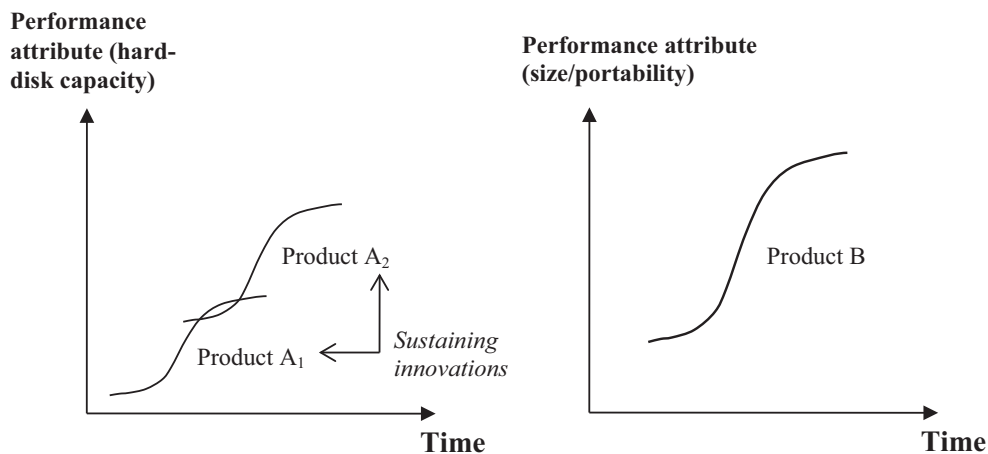


Figure 8.3 Disrupting-technology S-Curve

left side of the figure. One could argue that smartphones and tablets are now beginning to displace laptops. As more and more features become standard across these platforms, and as smartphones and tablets continue to match the performance of laptops in many areas, consumers are likely to switch technologies given the additional performance attributes offered by smartphones and tablets. It is interesting that the laptop could be displaced by the same type of performance attributes that enable it to displace desktops.

An example of a *disrupting* “architectural” innovation is the hybrid electric/internal-combustion engine (ECE) vehicle. This technology combines the ICE with battery technology to develop a new vehicle architecture. Although hybrid vehicles are fuel efficient and offer environmental benefits, they initially provided a lower level of performance compared with the power and acceleration of ICE vehicles.* Thus, the majority of customers of ICE vehicles (Product A in Figure 8.2) who value these specific traditional attributes were not initially likely to purchase a hybrid vehicle (Product B in Figure 8.2). Instead, hybrids were sold to customers who valued the attributes of a more environmentally sound and fuel-efficient vehicle. However, once the performance and cost of hybrid vehicles approached those of ICE vehicles, they had the potential to disrupt the ICE vehicle technology market if power and acceleration remain valued performance attributes.† If the hybrid vehicle technology is developed by a new entrant, it falls into Category X; if an existing firm develops the technology, it falls into Category IV (Figure 8.1). In the case of hybrid vehicles, Toyota’s system initially far exceeded those of other automobile producers from a performance perspective (an architectural innovation in Category IV). Now,

* As sustaining technological advancements occurred in hybrid vehicle platforms, their performance surpassed that of comparable ICE vehicles.

† In this example, it is assumed that the hybrid vehicle is competing directly with the ICE vehicle whose customer base values “traditional” performance attributes. However, one might argue that the hybrid vehicle is creating a new customer base that values “nontraditional” (i.e., environmental and fuel efficiency) attributes. In this case, the hybrid vehicle could displace the ICE vehicle market altogether because of an evolution in consumer preferences (which could be stimulated by environmental regulation or evolving consumer preferences).

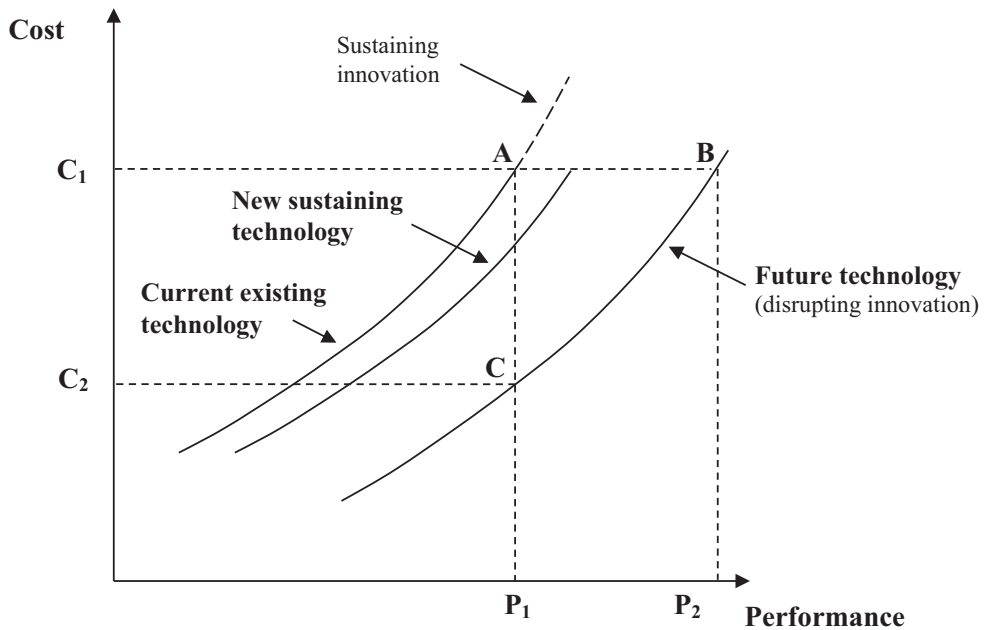


Figure 8.4 The efficient frontier for current and future technology, contrasting sustaining and disrupting innovation

another disrupting technology – that of an entirely electric vehicle – is emerging with the pioneering firm Tesla, which had not previously built automobiles (an intrinsic innovation in Category XII).

Another way of comparing sustaining and disrupting innovation is to depict three different pathways that innovation could take. In Figure 8.4, the various performance levels of an existing technology regime (for example, various ICEs with different fuel efficiencies) are shown as a function of cost. The most efficient *existing* engine is represented by point A at cost C_1 . New improvements (sustaining innovations) to internal combustion engines can be developed within the same technological regime in two different ways. First, improvements could be made that extend the capacity of existing technology, but at higher cost, as depicted by the dashed line extending above A. Second, a significant innovation could occur within the same technological regime, giving rise to new performance-cost relationships as depicted in the second curve shifted to the right in Figure 8.4. Third, a power system based on a different concept of innovation (a disrupting innovation) could be developed, represented by the “future-technology” curve, depicted by the rightmost curve (e.g., an all-electric vehicle). At some point, fuel-efficient engines can be developed that provide the best efficiency of older engines at a lower cost C_2 (represented by point C), or better efficiency can be achieved at the same cost C_1 (represented by point B). Any point between points C and B on the future technology curve represents a win-win situation over the sustaining innovations.

An example of a *disrupting “intrinsic” innovation* is Alexander Graham Bell’s telephone, which gradually undermined and then supplanted Western Union and its telegraph operators (Christensen et al. 2001). In this case, the disrupting technology came from a new entrant, which means that the innovation can be located in Category XI.

The all-electric vehicle provides another example of a disrupting “intrinsic” innovation, which holds the potential to displace ICE and hybrid vehicles in the market.

Christensen (1997) argues that disrupting (product) technologies are almost always developed by firms outside the prior market or business. This is why Categories IX to XII are highlighted in Figure 8.1. Firms in the existing market that develop disrupting technologies (Categories III to VI) might be described as highly innovative, with the capacity and willingness to reinvent themselves, given the opportunity. However, as Christensen’s (1997) research reveals, in general it is questionable whether a firm is able to displace its own product in the market with a new product.

It is important to recognize the evolutionary nature of technological innovation described above. Once an established technology has been displaced by a disrupting innovation, the disrupting innovation then becomes vulnerable to subsequent future disruption as it develops along a sustaining innovation pathway. Thus, the process of disruption is unrelenting and continuous. This phenomenon is what Schumpeter (1962, p. 84) famously referred to as the “perennial gale of creative destruction.”

Although the preceding discussion focuses on product innovation, we believe that Christensen’s ideas can be extended to include process, product-services, and system innovations (Ashford et al. 2002). However, relying on existing industries for sustainable transformations ignores evidence that firms must possess not only the *willingness* and the *opportunity* but also the *capacity* to change (Ashford 2000; see Section 7.6 in Chapter 7). It is questionable whether those industries and firms that are responsible for environmental problems are able – through the use of continuous institutional learning, the application of life-cycle analysis, dialogue with stakeholders, and implementation of environmental management systems – to transform themselves into sustainable industries and firms. “It is not marginal or incremental changes that are needed for sustainability but rather major product, process, and system transformations – often beyond the capacity of the dominant industries and firms” (Ashford 2002a, p. 1417). The same problems arise in considering change in government and societal institutions. Therefore, **creative interventionist policies are seen as essential in encouraging system innovation toward sustainable transformations**. Moving from improving pesticide safety and designing bioengineered crops to a reconceptualization of sustainable, perhaps decentralized, agricultural systems is one example where creative government policy would be essential. It is possible to visualize how Christensen’s (1997) ideas can be extended to include process, product-services, and system innovation by expanding Figure 8.1 to reflect these additional kinds of innovation (Figure 8.5). It is important to realize that the dominant mechanisms for change in each kind of innovation are likely to vary, meaning that different categories (I to XII) in the matrix are likely to be shaded. Further, who is – and who is not – likely to develop future technology under strong government directives or societal demand and the implications for *future* organizational changes (especially in the context of systems) are important issues to consider. Although product, process, product-services, and system changes are necessary to achieve sustainable development, it is likely that system innovations will be particularly important when one is focusing on large-scale sociotechnical systems, such as the transportation system or the agriculture/food system.

In conclusion, as a result of sustaining and disrupting innovations, existing technologies are likely to be improved or supplanted over time, provided that new competitors are able to enter existing markets or develop new ones without being held back by entry barriers. If it is possible to influence the dynamics of the evolutionary change process, it might be possible to place development onto a sustainable, potentially radically different trajectory. Thus, as Dorf (2001, p. 70) comments, “For good or ill the contemporary world is and will continue to be substantially shaped by technology.”

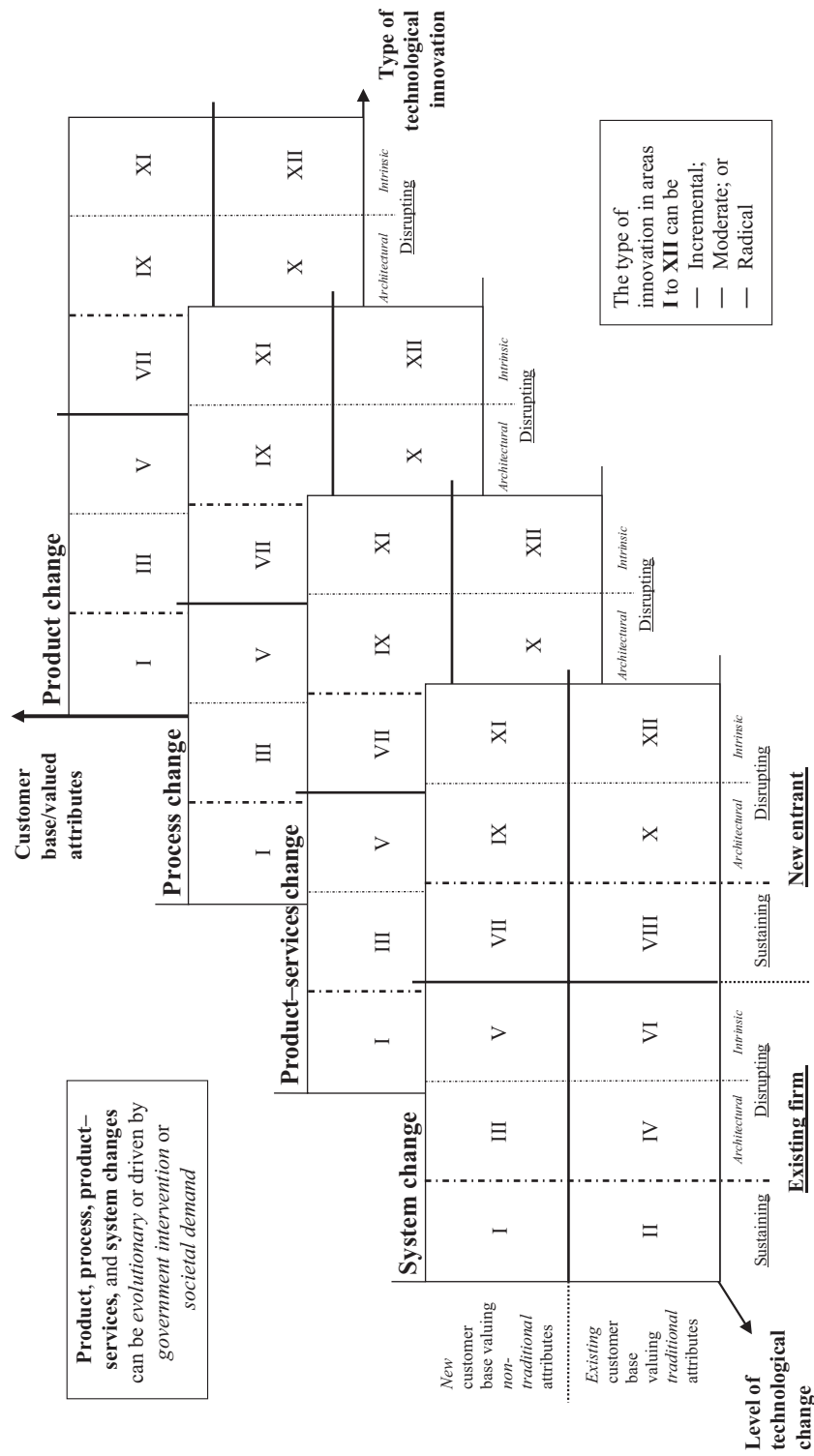


Figure 8.5 Matrix of potential outcomes of sustaining and disrupting technology for four different kinds of technological change or innovation

8.3 The role of government in promoting innovation in developed countries*

We argued earlier in this work that government has a trusteeship role in guiding the development of new technology. This argument becomes particularly important if the long-term development of the next generation of technology lies outside what existing firms are able or willing to pursue. If we consider the factor X concept (Reijnders 1998; see Section 1.3.3 in Chapter 1), the government is seen to have a critical role in assisting the development and adoption of products and processes with factor X improvements. An important point to recognize, though, is that factor X improvements might either result in advances in *existing* technology or be achieved through *disrupting* technology that displaces existing products, processes, and services from the market. These waves of creative destruction are not likely to be propagated by the dominant incumbent firms in the market (Christensen 1997; Ashford and Hall 2011a; Ashford and Hall 2015), which increases the importance of the role of government in guiding research and development from the initial stages to the final diffusion of the new technologies.[†]

The critical question, however, is how government should stimulate technological innovation/development to realize the factor X improvements. In this chapter, we first address traditional industrial policy for stimulating product and process innovations, then address the more complex challenge that system innovation represents, and finally focus on regulation-induced innovation. Government initiatives designed to stimulate technological innovation can come in numerous forms.[‡]

In Chapter 6, we addressed the importance of technological innovation in achieving sustainability, and in Chapter 7, we addressed the nexus between organizational and technological innovation. With that understanding, we here undertake an exploration of the tools and mechanisms available to government to influence the nature and direction of technological change in developed countries. From Chapter 6, we learned that the innovation process is embedded within an “innovation system” involving both institutional actors and individuals within and outside the firm itself. There we introduced the work of Tsamis (1999), who developed a model that focuses on the *process* of innovation and the *roles* that each major player has in the process in terms of providing an optimal climate

* Sections 8.3.1 to 8.3.6 are based on Ashford and Hall (2018).

† Luiten (2001) argues that during the 1960s and 1970s governments tried to stimulate technological development by generating knowledge through investments in R&D in both private firms and national public research institutes. The intention was to use the knowledge generated to improve the competitiveness of industry. In the early 1980s, the focus shifted from R&D funding to the under exploitation of the new knowledge and available technologies. Generating knowledge by itself was not seen as being adequate, and efforts were made to channel technology directly to firms that could use them (e.g., using demonstration projects). In the early 1990s, technological development became a more systemic and interactive process. Thus, government measures shifted toward the stimulation of learning and cooperation. Interaction among the actors involved in a research project was seen as being essential. Such action not only had the benefit of sharing the costs and risks of R&D over a greater number of actors but also prevented duplication of efforts and improved the public-sector return on R&D funding by increasing private-sector involvement.

‡ The ability of industry to influence government standard-setting and regulations often stifles technological innovation, enabling incumbent firms to focus on maximizing the production of existing, but less environmentally sound, technology (Wallace 1995). In such circumstances, firms seek the coercive power of government to establish regulations that restrict market entry, provide subsidies, and/or support prices (Becker 1983; Keohane et al. 1998; Peltzman 1976; Posner 1974; Stigler 1971). Changing the dynamics between government and industry to prevent regulatory capture will be extremely difficult, but not impossible. However, it has been argued that under some circumstances, regulatory capture and environmental performance go hand-in-hand (Oye and Foster 2002; White 1989).

for innovation to evolve. Before looking more closely at the role of government in innovation, we first briefly review the various theories of technological innovation, with a specific emphasis on system change/transformation.

8.3.1 *The innovation process: distinguishing singular product and process changes from systemic innovation*

Much faith and hope in transforming industrial systems has been placed on the concept of innovation. After all, the root of the word implies change. As discussed in Chapter 6, the innovation process is acknowledged to encompass three related and interactively connected activities: invention, innovation, and diffusion. Invention is the first working prototype of a technology; it can involve a product, a process, or a manufacturing/service system. Innovation is the first or new market application, while diffusion refers to proliferation of the innovation throughout an industry. When the innovation is then used in other industries, applications, or national contexts, we often also use the term technology transfer to describe diffusion. Finally, if significant adaptation is required in a new context, it is sometimes referred to as a separate innovation (for a full discussion of innovation, see Chapter 6).

While governments, as well as the private sector, generally devote significant resources to create innovations, especially in saleable products although process innovations also receive attention, it is important for our purposes to distinguish what motivates a particular innovation and who provides the financial capital to spur both innovation and diffusion (Ashford and Renda 2016, p. 36).

Innovation may be driven by technology push or market pull forces (see Figure 8.6) (Ashford and Renda 2016, p. 36). Industrial sectors routinely engage in the R&D necessary to develop saleable technologies with the hope that the market will absorb them, even in the absence of nascent market demand. This occurs naturally (as an evolutionary process) and can take decades. Traditional industrial policy providing government assistance is often said to “grease the wheels of innovation” in hopes of the nation enjoying financial rewards (see the discussion below).

The traditional role of the government in promoting innovation is presented in Figure 8.7, indicating all the traditional ways in which innovation might be stimulated (Ashford and Hall 2011b).

The interventions depicted in the figure are of course familiar to those involved with traditional industrial (or perhaps more accurately, innovation) policy that focuses on

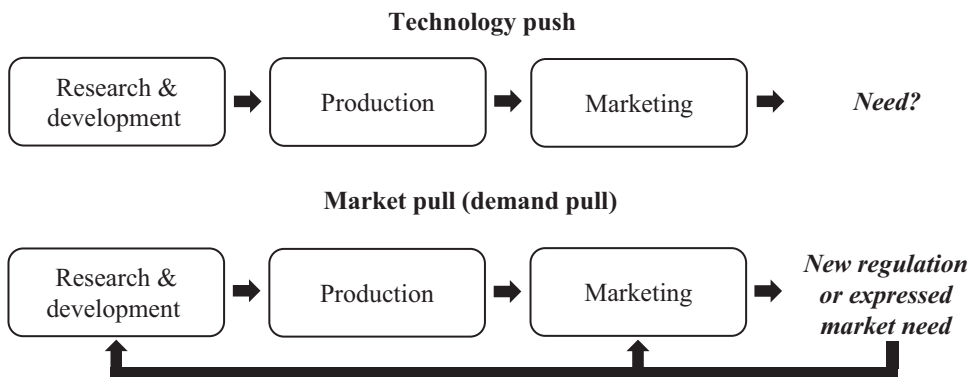


Figure 8.6 Technology push vs. market pull innovation

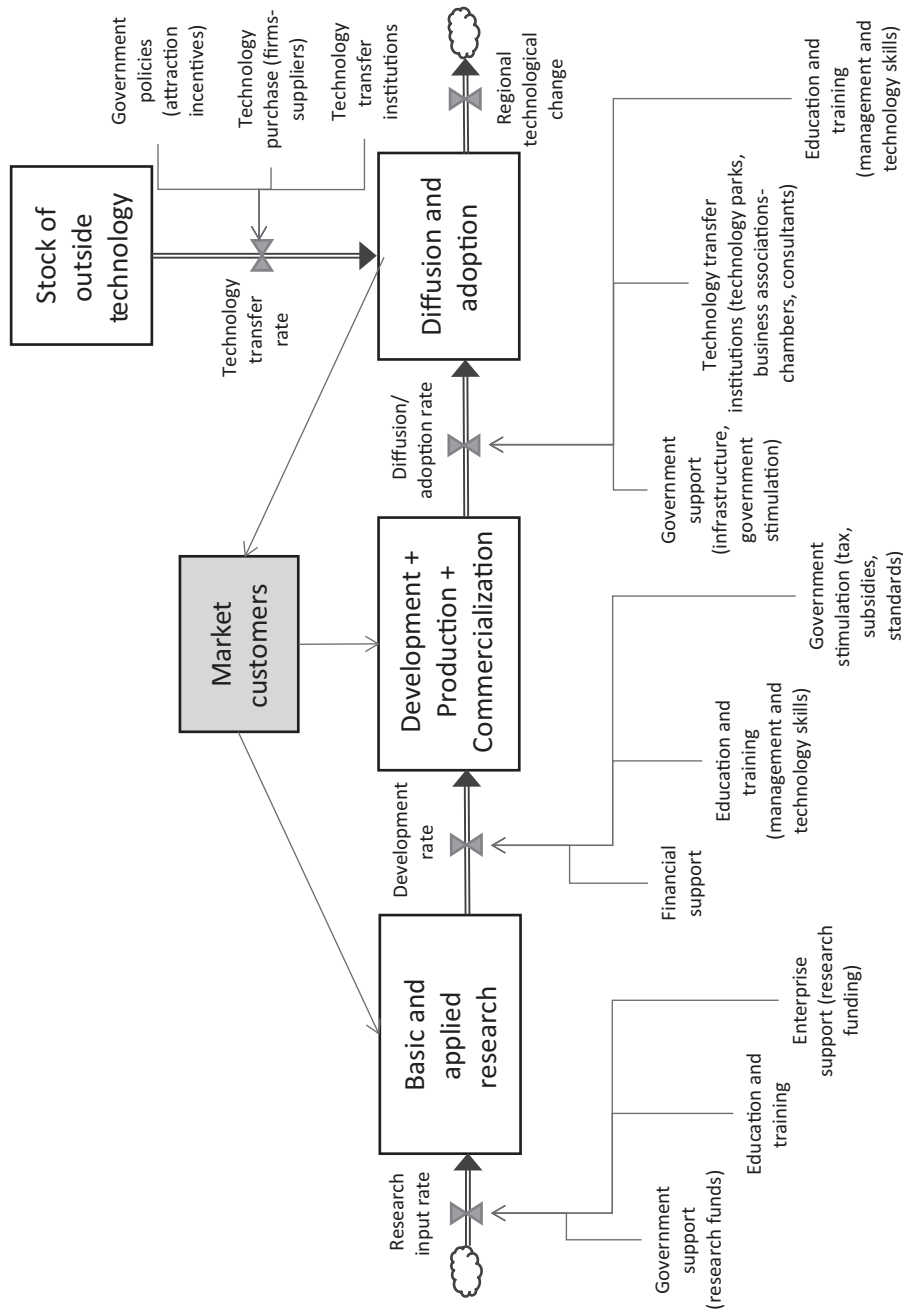


Figure 8.7 Traditional industrial policy interventions

singular product or process changes. System innovations, discussed below, such as the transportation system or the agricultural system, necessarily involve multiple economic actors interacting in larger venues, and this model does not adequately represent the complexity involved in system transformations. Technology-push innovations are pursued by profit-seeking firms and by countries seeking to enhance domestic and trade revenues.

In contrast, there are often nascent or expressed market needs demanding to be satisfied. Market-pull innovations can also be pioneered (Jänicke and Jacob 2005) by firms recognizing an unmet societal or market need and directing their innovative efforts towards that end. Often the demand is difficult to assess and can wane over time. An example is the need for a better chemotherapeutic approach to cancer, or increased concern for finding a cure for Alzheimer's Disease. Often, the R&D need is cutting-edge and financially risky. Governments often support the initial forays into research considered too risky by the private sector, as exemplified by the development of computers, aircraft, and the Internet (Mazzucato et al. 2015).

When it comes to stimulating innovation (and diffusion) of system transformations, there seems little doubt that government setting of specific medium- to long-term mandatory targets, plus economic support, is indispensable for achieving transformations within a reasonable period of time (Ashford et al. 1985; Pelkmans and Renda 2014). Regulation and mandated targets essentially collectivize public demand or needs through the setting of standards and requirements (Ashford et al. 1985). Costs are imposed on the private sector with cost-sharing achieved through business and R&D deductions. Sometimes direct subsidies are provided. Governments need to understand the different forces giving rise to innovation and diffusion and not succumb to traditional industrial policy if serious transformations – especially involving the displacement of incumbents or system changes involving many different economic actors – are what is needed. For a further discussion of industrial policies, see Andreoni (2017), Norman and Stiglitz (2017), and Stiglitz et al. (2013).

In the last decade, the concept of co-evolutionary innovation has been introduced by Dutch researchers injecting government and stakeholder guidance in the selection process entailing strategic niche management and transition management (Grin et al. 2010). This co-evolutionary process is advocated for system innovation, but its promoters admit the transformations can also take decades to achieve. A previous criticism of depending on these co-evolutionary processes to achieve systemic sustainable transformations can be found in Ashford and Hall (2015).

We certainly believe that system innovations are key to achieving system transformation involving technological, organizational, institutional, and societal innovations among a disparate collection of economic actors, but a much more directive role for government to meet the challenges is needed through an integrated approach utilizing a policy mix of regulations, mandatory targets, and appropriate economic signals (see for example, Rogge et al., 2017; Grubb et al., 2017; and Kivimaa and Kern, 2016). **The government must take on the role of trustee for the needed transformations – and trustee of the technologies and firms of the future, often not yet represented at the negotiation table – not of referee, teacher, or generator of consensus.***

Finally, one of the bottlenecks in commercialization of useful technologies may come late in the innovation cycle. The innovation literature emphasizes the importance of *deployment* – the step in which a technology moves from bench-top or lab to actual commercial use in practice. Semantic preferences differ as to whether this is described as the last step in the innovation activity or the first step in diffusion. Semantics aside, what is important is that the R&D to accomplish this transition is not basic research, but truly

* See Section 9.7 in Chapter 9 for a discussion of a proposed decision-support framework that can be used to help evaluate new technologies/innovations and their impacts on different groups/stakeholders and on sustainability more generally.

applied research, a distinction glossed over in discussions of innovation policy. Barriers to deployment are often influenced by incumbents whose technologies compete with the new technology and they seek to delay or prevent its entry. Strategic Niche Management (SNM) and Transition Management (TM) scholars are certainly correct that niches of outsiders could theoretically deploy the needed technologies that otherwise cannot penetrate the market to the benefit of society. The strategic question is whether SNM and TM approaches are the best way forward.

8.3.2 *Theories of system innovation*

When we move beyond product and process innovation into system changes, in addition to the wide range of instruments that can be used to guide technological development (in the product and process contexts), there are a number of theories that describe the process of technological innovation. Box 8.1 shows how the various schools of economic, historical, and sociological thought differ in their approaches to conceptualizing technological development. The description of these approaches draws on the work of Luiten (2001), Moors (2000), and Partidario (2003). In each description, the role of government is identified. Whether technologies from these niches go far enough in a particular context is an important question. Ashford and Renda (2016) have argued that rather than an innovation deficit, achieving serious reductions in GHG emissions suffers from a “diffusion” or “deployment deficit.” These authors argue that stringent mandatory targets are needed.

Box 8.1 Theories of technological innovation and the role of government

Neoclassical economic approach: Technological development is *exogenous*, and technology is treated as a black box. Using this approach, a rational actor will attempt to maximize the production function. Government intervention corrects underinvestment by stimulating fundamental R&D and supporting universities.

Evolutionary economic approach: Technological development is *endogenous* and is a path-dependent process of variation and selection. Technology is described as evolving from a firm’s knowledge base. Technological development tends to occur along known directions, favoring path dependency and lock-in. The role of the government is to generate variation within an entrepreneurial climate that enhances innovation.

Systems-of-innovation approach: Technological development is a process of interactive learning and includes not only R&D and knowledge production but also the transfer, exchange, and use of knowledge and the demand for knowledge. The aim of technological development is to optimize the use of knowledge generated by a system of related and linked actors. The role of the government is to maintain the institutional knowledge infrastructure of universities and research institutes.

Industrial-networks approach: Technological development takes place in a process of interactions between actors who perform activities and have access to different resources. Thus, technology (innovation) is the result of interactions between firms. No explicit attention is given to directing technological development. The role of the government is to build and renew local knowledge-intensive networks and to stimulate cooperation.

Social constructivism approaches: Technological development is led by a process of social interaction that is directed by the values and beliefs of interest groups and actors (including government). The role of the government is to understand and articulate specific positions during negotiations and to develop networks that support social interaction.

Quasi-evolutionary approach: Technological development is a process of co-evolution at different levels of analysis (micro, meso, and macro). Hence, technology is an object in a co-evolutionary learning process. The technological regime^a guides, but does not fix, R&D activities. The role of the government is to influence the rules of a technological regime to facilitate learning processes among the various actors and to establish niches of protected learning.

Large-technical-systems approach: Technological development is the process of solving critical problems of a technical (or engineering) system. Technology is seen as part of an expanding technical system. Critical problems – or *reverse salients* – of the technical system have to be solved before the system can expand. The role of the government is to avoid causing or strengthening reverse salients and to reinforce the capacities or possibilities of system builders.

- a Rip and Kemp (1998, p. 340) define a technological regime as “the rule-set or grammar embedded in a complex of engineering practices, production process technologies, product characteristics, skills and procedures, ways of handling relevant artifacts and persons, ways of defining problems – all of them embedded in institutions and infrastructures.” See also the related concept of “innovation systems” in Chapter 6.

Sources: Luiten (2001), Moors (2000), and Partidario (2003).

The theories of technological innovation shown in Box 8.1 provide an indication why focusing on government intervention in the process of technological innovation is important, even necessary. In addition, although the policy instruments above have been listed in a general form, we should recognize that the success of a particular instrument in directing or stimulating technological development is context sensitive (Wallace 1995).

Understanding the role of societal (or cultural) change and how new technology forms can regulate social behavior is essential (Winner 1977; 1986; 1992). If society is unwilling to accept (or buy) a new technology, then that technology will not be diffused sufficiently to affect the overall system (unless it is imposed by regulation). It is also important to consider whether new forms of technology are supporting the satisfaction of fundamental human needs for (1) safety, security, and sustenance; (2) competence, efficacy, and self-esteem; (3) autonomy and authenticity; and (4) connectedness (Kasser 2002). Indeed, because meeting human needs lies at the center of sustainable development (see Section 1.1 in Chapter 1), perhaps greater attention should be paid to the impact of technology on needs fulfillment.

Asking whether a new technology form is likely to be diffused sufficiently to affect the overall system is critical for sustainable development. In Europe, and more specifically in the Netherlands, there is a growing body of research that looks into how society can transition (that is, transform) to sustainable forms of development through a system innovation (Elzen 2002; Elzen et al. 2004; Kemp and Rotmans 2005; Grin et al. 2010).

A “transition” is described as “a long-term change process in an important sub-system encompassing various functional systems (for example, food production and consumption, mobility, energy supply and use, etc.) in which both the technical and the social/

cultural dimensions of such systems change drastically" (Elzen 2002, p. 1). A "system innovation" is described as "a set of innovations combined in order to provide a service in a novel way or offering new services. System innovations involve a new logic (guiding principle) and new types of practices" (Rennings et al. 2003, p. 14). Geels (2004, pp. 19–20) describes a system innovation as consisting of three important aspects: (1) technological substitution, which includes the emergence and diffusion of new technology that replaces existing technology; (2) the co-evolution of technological and social systems, where both types of systems are continually interacting and changing; and (3) the emergence of new functionalities, where a new product or service provides a new functional characteristic. It follows that a "sustainable" system innovation would provide economic, environmental, and social benefits with the offering of new products, processes, or services.

An important characteristic of research focusing on system innovation is the recognition that the relationships among sets of technologies are dynamic, complex, and nonlinear, and that these technologies are socially embedded. This focus supports the idea of dynamic, as opposed to static, efficiency and the importance of considering the fourfold co-evolution of technology, institutions, organizations, and society. Because the evolutionary economic and quasi-evolutionary approaches to technological innovation (Box 8.1) make technology and innovation explicit and adopt a systems approach, the frameworks developed to assess system innovation are built on these theories. Because neoclassical economic theory treats technology as exogenous, it does not provide fertile ground for considerations of system innovation.

Briefly, evolutionary economics focuses on the process of technological innovation from the perspective of the survival of the fittest – that is, its roots are Darwinian and Schumpeterian.* Nelson and Winter (1977, 1982) were the first to develop an economic theory in which the evolutionary theory of technological innovation was embedded. Their theory is based on two independent processes: variation and selection. In addition, because technology is treated as being socially embedded, the ideas of path dependency or lock-in and bounded rationality play important roles in the analysis of technological innovation. For a more recent treatment of lock-in in the context of a carbon economy, see Geels (2014) and Seto (2016). The evolutionary model of technological innovation was later extended by focusing on the sociological aspects of the evolutionary approach (van de Belt and Rip 1987, Rip 1992). The so-called evolutionary approach treats the variation and selection of technology as non-independent events (Moors 2000). Thus, the focus is on how technological variations are influenced by the selection environment.

The field of evolutionary economics has emerged as an important framework for understanding how modern economies work. Development is conceived as an evolutionary process. In general, evolutionary theory views innovation as a dynamic, interactive process of variation and selection where institutions and actors continually influence and learn from each other.

Within evolutionary theory, there are currently two important and related conceptual frameworks that can be used to develop initiatives to stimulate system innovation for sustainable transformations. Kemp (2002), Kemp et al. (2007), Kemp and Rotmans (2005), and Loorbach and Huffenreuter (2013) propose "strategic niche management" and "transition management" – a quasi-evolutionary approach – for achieving system changes necessary for sustainability. Ashford (2002b) and Ashford and Hall (2011b) argue for integrating rather than coordinating government interventions in order to bring about the needed technological, organizational, institutional, and social transformations to achieve significant sustainable system change. A role for government is anticipated by each group of commentators, but to different degrees and in different ways.

* For an excellent discussion of evolutionary economics, see Grin et al. (2010), Chapter I.3 and especially pp. 35–42. See also Geels (2010).

8.3.3 Strategic niche management and transition management

The concept of strategic niche management (SNM) emerged from the two opposing views of the *technological fix ideology* (or technological optimism) and the *cultural fix paradigm* (Hoogma et al. 2002). The former argues that the benefits associated with technological progress are likely to far outweigh costs and that a technological solution can be found to all problems. The latter suggests that the technology itself is actually part of the problem and that real solutions will have to come from *social* and *cultural* change. Therefore, SNM was created to “allow for working on both the technical and the social side in a simultaneous and coherent manner” (ibid., p. 3). The related concept of transition management (TM) is discussed later in this section. SNM and TM are only two of several possible theories of sustainable transitions/transformations we have chosen to discuss – see Feola (2015) – because they have captured the attention of Dutch and EU industrial policy, especially regarding energy, and because they heavily envision the involvement of incumbents and would (in our view, as explained more fully later) require too long a time to yield the necessary radical technological and social changes to be useful. A useful and thorough treatment of the history of SNM and TM is provided by Loorbach et al. (2017).

Kemp (2002, p. 10) describes SNM as the “creation and management of a niche for an innovation with the aim of promoting processes of co-evolution.” The idea is that a new product will be used by *real* users (by society, industry, or government), and its use will promote interactive learning and build a product constituency. The underlying notion is that new technologies will be introduced in a socially embedded manner. It is important to realize that SNM is primarily focused on product innovation, not process innovation. However, its proponents argue that process innovation will be part of technological regime transformations (see the discussion of regime change below). SNM also enables institutions and organizations to adjust the technological development and deployment process to stimulate the adoption and diffusion of a new product.

A key element of the SNM concept is that technological change occurs in a co-evolutionary manner – that is, technologies evolve within institutional networks. Saviotti (2005, p. 30) suggests that two important general points can be made about the co-evolution of technologies and institutions:

First, the emergence of new technologies increases the division of labor in the economy, but in the meantime creates new coordination problems. One of the roles of co-evolving institutions is to provide coordination. Second, although the firms producing and using the new technologies compete, other co-evolving institutions are in a complementary relationship with the main technology.

Saviotti’s comments highlight the complexity that surrounds the introduction of a new technology and provide weight to Kemp’s arguments for the creation of protective niches in which promising technology can be tested and developed. The ability to experiment with new technology through demonstration projects that help users and suppliers learn about new possibilities is a vital component of SNM.

The process of experimentation is likely to achieve one of two outcomes: regime optimization* or regime shifts.† These two outcomes can be described as sustaining or

* An example of regime optimization is the development/deployment of highly efficient vehicles that use the improved internal combustion engine as a base.

† Hoogma et al. (2002) provide the following examples of innovations that have regime-shift potential: battery-powered vehicles, telematics for traffic management, car sharing, smart cards, individualized self-service rental systems, dial-a-ride services, and bicycle pools. Virtually all of these innovations are currently reshaping the transportation system, pointing to their regime-shift potential.

disrupting changes, respectively. A technological regime is defined as “the whole complex of scientific knowledge, engineering practices, production process technologies, product characteristics, skills and procedures, established user needs, regulatory requirements, institutions and infrastructures” (Hoogma et al. 2002, p. 19). In general, the type of technologies that are suitable for experimentation should be ones that hold the potential to bridge the gap between existing and new (sustainable) technological regimes (Kemp 2002). This type of technology is referred to as “pathway technology.” In essence, SNM is a bottom-up, initially non-disruptive process where, once the niche for experimentation has been established by government policy, the new technology form evolves from interactions among society, government, nongovernmental organizations, and industry. The emphasis is on multi-stakeholder governance rather than on government as the dominant actor.

Transition management (TM) is a model of co-evolutionary management of transformative change in societal systems through a process of searching, learning, and experimenting (Rotmans and Kemp 2008).^{*} Managing means adjusting, adapting, and influencing rather than using a command-and-control approach. There are persistent problems for which there are no immediate solutions. By transforming a persistent problem into a visionary challenge, TM explores a range of possible options and pathways through carrying out a diversity of small-scale experiments. Based on what is learned from these, the vision, agenda, and pathways are adjusted. Successful experiments are continued and can be scaled up, and failed experiments are abandoned, until convergence is reached. Rather than focusing on a single, available solution, TM explores various options and is aimed at guiding variation-selection processes into more sustainable directions, with the long-term aim of selecting the most sustainable option(s) and paths based on learning experiences. TM is meant to be a mutually supportive vehicle for both sociotechnical and policy changes.

It is debatable whether Kemp’s description of the latter strategy will result in disrupting innovation. Kemp (2008, p. 374) acknowledges that “faced with sustainability problems, [incumbent] regime actors will opt for change that is non-disruptive from the industry point of view, which leads them to focus their attention on system improvement instead of system innovation.” Whether the concept could hold particular merit for system innovation in a specific context remains to be seen. If revolutionary change – or a technological regime shift – can occur via a stepwise system innovation process, SNM can be a useful tool that can be applied to large-scale engineering systems, such as the transportation system (Hoogma et al. 2001, Hoogma et al. 2002), but that is a big “if.” It depends on, among other things, the extent to which incumbents dominate the process. A more optimistic set of scenarios incorporating disrupting changes for energy transformations is discussed by Wilson and Tyfield (2018).

Critics of SNM argue that one of the shortcomings of the technique is that at some point the “probe and learn” ideology needs to become action and transformation, and Kemp’s

^{*} Kemp (2008, p. 375) comments: “The management of institutions can be done through the [...] use of three coordinating mechanisms: markets, hierarchy, and structure.” “The basic steering mechanism is modulation, not dictatorship or planning and control” (ibid., p. 377), and “The long-term goals for functional systems are chosen by society either through the political process or in a more direct way through a consultative process” (ibid.). Kemp endorses market-based instruments, and although he does not explicitly mention regulation, it is clear that he rejects regulation as the main steering approach; this is in line with his commitment to evolutionary approaches and strong commitment to markets. This parallels the recent contribution of ecological economists Beddoo et al. (2009, p. 2488), who also ignore regulation as a mechanism to achieve sustainable transformations and instead rely on cultural evolution to “push our society toward the adoption of institutions that best fit the new circumstances.” “Creating a sustainable future will require an integrated, systems level redesign of our socio-ecological regime focused explicitly and directly on the goal of sustainable quality of life rather than the proxy of unlimited material growth” (ibid., p. 2483).

theory is unclear on how transformation will occur (Smith 2003). Further, if niches grow within or alongside existing regimes, they are unlikely to have radically different practices and rules, which raises the question whether the new products, processes, or services will offer significant benefits. A final point raised by Smith (2003) is the fact that the localization of niches may run against the nationalization or globalization ideology of mainstream government and business institutions. Thus, an important question is whether the “transformative potential” of SNM will be inhibited by these powerful forces (*ibid.*).

Vergragt (2005) raises a slightly different concern from that of Smith (2003). He argues that if the role of government is to legitimize the transition process – including its own reform and the abolition of existing institutional and economic barriers to sustainable development – then a quandary exists because the national government may in fact be part of the problem rather than part of the solution. Therefore, an important question is who will manage the transition process. Quist and Vergragt (2004) also question whether an emerging niche market will survive once its protection mechanisms are removed. On the other hand, Grin et al. (2010, p. 83), in stating that “much of the cited research focuses on explaining the limited success of the [SNM] experiments studied,” references Hommels et al. (2007, p. 85), who are described as arguing that “part of the problem might be that SNM focuses too much on providing protection.”

In critiquing the TM approach, Tukker et al. (2008) comment that transition management of innovation neglects the role of the consumer and the importance of demand-side policies influencing consumption. It should be noted that regulation is both a supply-side and demand-side policy intervention; it defines the allowable characteristics and places constraints on the nature of products and on their manufacturing, use, and disposal (Ashford and Hall, 2011a, p. 280).

Dewulf et al. (2009), in analyzing transition management in the context of other theories of change management – especially intervention by government – question whether transition management is the “only model in town.” Dewulf et al. (2009, p. 12) observe that

a distinctive trait of transition management appears to be the assumption of an overarching position of (governmental) transition managers who can apply management tools, niche-building machinery, and engineering devices from a privileged, knowledgeable and external position [...] towards a clear and one-dimensional target.

The government participates along with other stakeholders, rather than taking a more directive role reminiscent of command-and-control regulatory involvement. The process is characteristically Dutch, using the so-called polder consensus-seeking model. Dewulf et al. (2009, p. 4) argue that transition management can take a relatively long time – twenty-five to fifty years – whereas collaboration theory in practice focuses on reaching an agreement and effectuating change in a few years’ time. Given the existence of relatively short-term “tipping points” in sustainability challenges, e.g., global climate disruption, endocrine disruption, and rapidly changing financial landscapes, the benefits of transition management may come far too late. Collaborative processes, of course, have their own drawbacks.

Recent transition scholarship has directly addressed the acknowledgment that evolutionary or co-evolutionary developments may take far too long given the challenges presented, particularly in energy and climate change (Sovacool 2016; Sovacool and Geels 2016; Kern and Rogge 2016). Kern and Rogge (2016, p. 13) argue “that quicker transitions have happened in the past and may therefore also be possible in the future globally.” They offer three main reasons “for the possibility of low-carbon transitions of the energy system occurring faster than was the case for historical transitions” (*ibid.*, p. 13). First, historic energy transitions have not been consciously governed, whereas today a wide variety of actors is engaged in active attempts to govern the transition towards low carbon energy

systems. Second, and in addition to the first point, international innovation dynamics can work in favor of speeding up the global low-carbon transition. Finally, the 2015 Paris Agreement demonstrates a global commitment to move towards a low carbon economy for the first time. Of course, the Paris Agreement is a quasi-regulatory, though voluntary, set of commitments, and Ashford and Renda (2016) have argued that we need to heed the warnings of Jeffrey Sachs that picking the long-hanging fruit to meet those commitments may herald the wrong kind of technological responses (Sachs et al. 2015).

Although Kemp acknowledges that regulation can be a useful tool to stimulate radical (system) changes, his faith in the formation of strategic niches and stepwise change *within* the original technology regime is not likely to result in disrupting forms of technology that are necessary for sustainable development (Ashford 2002b, Ashford and Hall 2011b). The problem is that firms are likely to resist initiatives or regulations that threaten their market position and focus instead on activities that maintain the status quo. Thus, a reliance on evolutionary or even co-evolutionary change rather than revolutionary change is not likely to support the emergence of new market entrants who play an important role in introducing radically different (and potentially more sustainable) forms of technology (Reinhardt 1999).

Berkhout et al. (2004) make a case similar to that of Ashford (2002b). They argue that the tendency of critical social groups to target the “incumbent regime, rather than its potential successor, [...] represents a direct antithesis of the bottom-up niche-based model” (ibid., p. 61). They continue (ibid., pp. 61–62),

the lesson appears to be that attempts at normatively-driven sociotechnical transitions (that is those forms most pertinent to the transition management project) do not follow exclusively the pattern described by the niche-based model, but instead imply much greater attention to macro-level processes (public opinion, government policy, and the structure and scope of markets) and their capacity to influence and induce innovation at the micro- and meso-level. Here the landscape is actively seeking to act on and influence the regime, not the other way around.

Jacob (2005), while generally supportive of decoupling economic growth from environmental degradation through ecological modernization, raises questions similar to those of Ashford and Berkhout et al. and asks whether SNM’s experimental arena is likely to capture and maintain the necessary political (and financial) support for a real transition. Further, Jacob (2005) argues that although “discourse and persuasion” are useful tools, they are unlikely to resolve any opposing core beliefs held by the actors. Thus, bargaining and making trade-offs are likely to play an inevitable role in any decision-making and transition process.

Finally, continuing from Smith’s (2003) earlier reservations about the ability of SNM to bring about the needed transformations, Smith and Kern (2007) comment on its limited success in energy policy in the Netherlands. They describe how Kemp and Rotmans persuaded the Dutch government to adopt SNM as a central strategy in its Fourth National Environmental Policy Plan (NMP4) in 2001. It should be noted, however, that the environmental successes of earlier Dutch National Environmental Policy Plans (NEPPs) were premised on the government setting clear future targets but negotiating ways of achieving those targets with stakeholders. The approach later adopted in its NEPP was to negotiate both targets and pathways with stakeholders. Existing industrial stakeholders may not represent the interests or capacity of future technology providers who are likely to displace them.

The NMP4 focuses on restructuring production and consumption systems over a thirty-year period to achieve a reduction of one-twentieth in both resource and energy use. Some challenged whether such a change can be achieved through SNM (Smith and Kern 2007) and TM (Shove and Walker 2007). The latter critique stimulated a response by

Rotmans and Kemp (2008) and a counter-response by Shove and Walker (2008), illustrating just how important the issue of transition management is becoming in the sustainability debate.

In spite of initial reservations about the success of TM-inspired reincarnation of long-term policy design, some of its critics are cautiously optimistic about its future use (Voss et al. 2009; and Shove 2010). We, however, remain skeptical because (1) the time framework for success is far too long given the challenges of sustainable development, (2) there is too much potential for capture of future agendas by incumbents, even if they change somewhat, and (3) without clear and certain long-term targets characteristic of backcasting, long-term investments by new entrants leading to discontinuous change necessary for radical technological change are unlikely to be made. Backcasting in incremental steps is not long-term backcasting, and while it introduces flexibility and mid-term corrections, it does not provide certain targets toward which to innovate. Again, we find it difficult to be optimistic that step-wise changes made toward uncertain futures involving incumbents will lead to radical, disrupting changes. Ecological modernization or reflexive governance arose historically because governments were not willing to exercise courage at setting long-term goals that challenge incumbent forces and agendas. Second generation policy design, represented by SNM and TM, operating under the soft euphemism of accommodation and learning has similar serious weaknesses.

In an earlier critique of the policy implications of SNM, Grin et al. (2010, p. 91) offer:

The research discussed indicates that SNM is not a silver-bullet solution that will bring about transitions towards sustainable development, if only because experimenting will not be sufficient. SNM should be seen as a useful addition to existing policy instruments that have neglected the value of experiments. Other more traditional instruments for inducing sustainable innovation, such as market incentives, various forms of regulation and technology forcing also have to play a role.

Grin et al. (2010, p. 84) distinguish the potential effectiveness of TM and SNM:

we acknowledge that TM addresses some factors that SNM underplays. While SNM develops an evolutionary approach that builds on and leverages the dynamic forces of market competition, aimed at overcoming lock-in and promoting socio-technical diversity, TM suggests a more ambitious approach of goal-oriented modulation that places more emphasis on the role of strategic envisioning. In that respect, TM introduces the notion of “transition experiment” which is supposed to be different from regular innovation experiments (van den Bosch and Taanman 2006).

In more recent work, Smith and Raven (2012) offer an extensive analysis of niches as protected spaces for which the important dynamics are shielding, nurturing, and empowerment. They distinguish incumbents (perhaps dominant incumbents) seeking to continue innovating on proven technology development (mainstream pathways) from others seeking more innovative changes, but a distinction is not made between those “others” who are incumbents and non-incumbents. While a distinction is made between insiders and outsiders, the implication is that both seem to be within the incumbent category, and not the distinction that van de Poel (2000) has made in his work on “outsiders.”

Further, while mainstream selection environments hinder path-breaking innovations, the fact that some incumbents seek the protection offered by strategic niche management does not mean the innovations that come forth are significant or sufficiently disruptive. For a contrary view, see Wilson and Tyfield (2018). New innovations nurtured by SNM/

TM may take decades to penetrate markets, which may be too long to meet many of the significant challenges to sustainability discussed in this work. Smith (2017) comments that

strategic dilemmas confront more radical, path-breaking innovators [. . .] Nevertheless, niche spaces [. . .] to develop alternatives and to explore what kinds of new institutions are needed for the innovation to flourish are an important ingredient, and have the potential to link with other forms of transformational agency, such as social movements or progressive business and investment.

See also the work of Sovacool (2016), Sovacool and Geels (2016), and Kern and Rogge (2016).

Addressing the possibility that innovation in the context of energy might be stimulated by the “grassroots” in the UK, Smith et al. (2016, p. 412) observe that “all grassroots developments soon encounter impediments arising from social structures inherent to regimes” and “it is the spread of critical insight, and transformative politics, that becomes the indicator of success.” These observations are in line with our own, which are circumspect about the sufficiency of “bottom-up” approaches to chart adequate pathways to sustainable development, except perhaps in the local or regional context – see Hansen and Coenen (2015) on this point.

A potentially significant barrier to transformative change is political. Transition processes tend to be “inherently political, and as encompassing, long-term processes of multiple changes in sociotechnical systems, they require broad understandings of the political,” including the notion of intended capture in system transition, the role of disruptors, path dependency, and incumbents (Avelino et al. 2016 p. 563). For a further discussion of regime resistance, disruption by outsiders, and the political challenge of governance, see Geels (2014), Kungl (2015), Markard et al. (2016), Meadowcroft (2009; 2011), and Stirling (2014). See also Avelino (2017), who analyzes power and empowerment in the context of sustainability transitions and transition governance.

Many scholars acknowledge the importance and difficulties of incumbents in fostering transitions towards sustainability - for a comprehensive treatment, see Johnstone and Newell (2018) and Turnheim et al. (2015). Relying on a deep review of the literature, Smink (2015) in particular explores the many ways in which incumbents guide and influence government policies and put new entrants at a disadvantage, including what amounts to regulatory capture. There is precious little discussion of the role that stringent regulation can play to “make a market for innovation” (Ashford et al. 1985), where what is being demanded cannot easily be satisfied or developed by the incumbents’ technology and requires radical innovation which is less likely to come from the incumbents than outsiders or new entrants. This omission demonstrates a blind spot on the part of these scholars who see change as coming not from government technology-forcing, but via predominantly evolutionary or co-evolutionary pathways. **Stringent regulation can turn the tide towards the advantage of outsiders (Ashford et al. 1985; Ashford and Hall 2011a). Modest regulation gives incumbents the advantage.**

Johnstone and Newell (2018, p. 1) comment that the role of the state (government) is underdeveloped in the transition management literature and “the range and depth of powers that only the state can call upon will be required if radical and rapid transitions are to be achieved” in order that economic systems operate within planetary boundaries. Referencing, among others Mazzucato (2015), Aiginger (2014), and Stiglitz et al. (2013), the authors emphasize the importance of government beyond nurturing niches in influencing industrial policy. They observe that

it has been recognized for some time that there has been an overemphasis on niche development, and that accelerated transitions will have to tackle the dynamics which sustain the stability of unsustainable social-technical systems” and that “regime stability [...] slows the pace of [the needed] transitions [...] through the strategies of incumbents.

(Johnstone and Newell 2018, p. 3)

They conclude “the state in varying ways plays a variety of roles in sustainability transitions, both acting as an enabler and a barrier to transformations to sustainability” (ibid., p. 9), depending on whose interests the state serves.

8.3.4 A stronger role for government

Government has an important role to play in creating winning forces and visions for sustainable transformations (Ashford 2000, Ashford 2002b, Ashford 2005). Depending on the type of transformation required, the roles of government should encompass the following (Ashford 2002b, pp. 18–19):

- The direct support of R&D and incentives for innovation through appropriate tax treatment of investment;
- the creation and dissemination of knowledge through experimentation and demonstration projects;
- the creation of markets through government purchasing;
- the removal of perverse incentives of regulations in some instances and the deliberate design and use of regulation to stimulate change in others;
- the training of owners, workers, and entrepreneurs, and educating consumers; and
- the direct creation of meaningful, rewarding, and satisfying jobs.

It should be clear how these roles relate to the ideas embedded in SNM and TM approaches, but we envision a much stronger role for government in stimulating technological innovation.

Much has been written about “policy mixes” addressing both technology-push and market/demand-pull strategies. They involve research and development undertaken by the government itself (Mazzucato et al. 2015), government funding of research and development at universities and research institutions, economic or market instruments, and regulatory standards to harmonize industrial practices. They are generally focused on greasing the industrial development process, rather than stimulating radical technology that falls under the rubric of “technology-forcing.”

A review of papers on policy mixes is provided by Rogge et al. (2017), who draw conclusions from analyzing fifteen papers with different analytical perspectives based on a range of social science disciplines, such as environmental economics, innovation studies, and policy sciences. These papers present a different understanding of policy mixes, and offer key definitions of policy mix components: policy instruments, policy design features, instrument interactions, policy strategy, policy process, and consistency, coherence, or credibility.

Notable articles (all focusing on energy) provide the following insights on the role policy and regulation can play in inducing innovation:*

- Cantner et al. (2016, p. 1165): “policies and environmental regulations are important drivers [for both development and diffusion] in environmental technologies especially, in renewable energies”;

* See also Johnstone et al. (2017), Kern et al. (2017), Kivimaa et al. (2017), and Kivimaa and Kern (2016).

- Constantini et al. (2017, p. 799): “a variety of factors drive eco-innovation, but also highlight the primary role played by public policies (environmental regulation, energy and technology policies) that are increasingly used to foster the rate of introduction and diffusion of new environmental technologies to meet sustainable development goals” and “strict regulations on vehicle emissions in the US spurred innovation in foreign countries such as Germany and Japan” (ibid., p. 801);
- Grubb et al. (2017, p. 25): “many big energy sector investments are in sectors (like electricity), which if not directly conducted by state entities, are nevertheless strongly influenced by the rules and regulations that shape the market structure and related terms of investment”; and
- Jacobsson et al. (2017, p. 18): “the Commission’s focus on market failures, static efficiency and technology neutrality does not cover all possible obstacles and leads it to neglect the centrality of dynamic efficiency and the structural build-up of innovation systems around new technologies.” The paper scrutinizes “the analytical base of the EU Commission, contrast[s] it with the work of classical economists and recent innovation scholars, and draw[s] lessons for how effective mixes of policy instruments may be identified.”

Government should go beyond simply creating a favorable investment climate. “Without deliberate design, significant changes – even system changes – are unlikely to improve competitiveness, environment, and employment at the same time” (Ashford 2002b, p. 18). As discussed in the next section, *stringent regulation* (focusing on environmental, health, and safety issues) is essential to stimulate significant technological changes, and such regulation may in fact be necessary to create niches that facilitate the entry of new firms and organizations into a new market.

Others who support the view that stringent regulation is necessary for environmental innovation include Foxon et al. (2004), Huber (2004b), Jänicke (1990), Pelkmans and Renda (2014), Botta and Koźluk (2014), and Ghisetti and Pontoni (2015). For instance, Huber (2004a, p. 447) comments that “strict environmental performance standards [. . . remain] by far the most effective controls instrument for environment and innovation alike (which is not astonishing given the fact that environmental standards are, or immediately translate into, technical standards).” Perhaps what is astonishing is the largely absent mention of government regulation in the early SNM and TM literature. In later scholarship, regulation appears to be increasingly addressed – see Geels et al. (2016), Hoppmann et al. (2014), Markard et al. (2012), Normann (2017), Quitzow (2015), Smith et al. (2005), and Smith and Raven (2012). It is mentioned as one of four interventions in later literature focused on a dual policy focus on destabilizing incumbents and creating new niches (Kivimä and Kern 2016, p. 215).

Ashford et al. (1985) have long argued that an *evolutionary* (or incremental) pathway is insufficient to achieve factor ten or greater improvement in a system’s performance. Further, because changes in sociotechnical systems (such as the transportation or energy system) are difficult, the “creative use of government intervention is a more promising strategic approach for achieving sustainable industrial transformations than the reliance on the more neoliberal policies relying on firms’ more short-term economic self-interest” (Ashford 2002b, p. 10). Hence, relying on Christensen’s (1997) approach to radical disrupting innovation is seen as being unlikely to result in “system” transitions toward sustainable development; however, disrupting forms of technological change are likely to continue.

In addition, Ashford (2002b, p. 19) state that governments should work with stakeholders to define future targets – while ensuring that their agendas are not captured by incumbent firms – and then use their position as trustee to “represent the future generations and the future technologies to ‘backcast’ what specific policies are necessary to produce the required technical, organizational, and social transformations.” More recent work on

the importance of targets includes: Johnstone et al. (2010) on Kyoto targets; Schmidt et al. (2012) on 2020 climate targets; Reichardt et al. (2016) on technology-specific renewables targets; and Nemet et al. (2014) on the credibility of energy policy targets. See also Loorbach et al. (2017).

We have already argued that an evolutionary pathway is insufficient to achieve factor ten or greater improvements in eco- and energy efficiency and reductions in the production and use of, and exposure to, toxic substances. Such improvements require more systemic, multidimensional, and disruptive changes. We have already asserted that the capacity to change can be the limiting factor, and that this is often a crucial missing factor in optimistic scenarios.

Successful management of disruptive product innovation requires initiatives and input from outsiders to produce the expansion of the design space that limits the dominant technology firms. Especially in sectors with an important public or collective involvement, like transportation, construction, and agriculture, this means that new government-led approaches may be needed to bring about necessary change. If there is sufficient societal demand, as appears to be the case for electric cars, industry may be well ahead of the curve and innovate without regulatory fiats, as in the case of Tesla.

Rigid industries whose processes have remained stagnant also face considerable difficulties in becoming significantly more sustainable. Shifts from products to product-services rely on changes in the use, location, and ownership of products in which mature product manufacturers may participate, but this requires significant changes involving both managerial and social (customer) innovations. Changes in sociotechnical systems, such as transportation or agriculture, are even more difficult. **This is why the creative use of government intervention to stimulate the needed changes may be critical.**

This is not to say that enhanced analytic and technical capabilities on the part of firms and cooperative efforts and improved communication with suppliers, customers, workers, other industries, and environmental/consumer/community groups are not valuable adjuncts in the transformation process. But in most cases, these means and strategies are unlikely to be sufficient by themselves for significant transformations, and they will not work without clear mandated targets to enhance the triple goals of competitiveness, environmental quality, and enhancement of employment/labor concerns.

Government has a significant role to play, but the government cannot simply serve as a referee or arbiter of existing competing interests, because neither future generations nor future technologies are adequately represented by the existing stakeholders. And new stakeholders are only marginally likely to be brought into development by incumbents, notwithstanding the wishful thinking of SNM and TM advocates.

Government should work with stakeholders to define far-future targets, but without allowing the incumbents to capture the agenda. It has to go beyond its historical focus on coordinating public- and private-sector policies. It must be multidimensional and directly address the present fragmentation of governmental functions. This means that the various policies must be mutually reinforcing and the targets must be clear.

In a recent report intended for the EU Commission by Ashford and Renda (2016), the authors address the likelihood of the EU achieving deep decarbonization by pursuing traditional industrial policy. They argue that the key is in properly designed and executed regulation.

Beyond energy and climate change challenges, Loorbach and Huffenreuter (2013) address the economic crisis and explore whether TM might contribute to mitigating or overcoming its effects. They provide a lucid analysis of the origin of the crises, the contribution of incumbents to perpetuating an economic development model that is “broken” and focused on GDP-led growth (resulting in systemic lock-in), and question whether “going green” is sufficient to address the needed development reforms because being dependent on GDP is not a “fundamental systemic solution.” (See the related discussion

on green growth in Section 3.7 in Chapter 3.) The authors focus on currencies, resources, and governance, and they argue for a combined “bottom-up” and “top-down” approach,” which they term “glocal governance” that aims to avoid economic growth that results in unequal distribution of resources and increased levels of ecological damage. Also see Loorbach et al. (2017) on the importance of setting targets to escape lock-in in the context of incumbent transformations through transition management in order to stimulate radical innovation. Here, although lock-in is explicitly recognized as a problem, specific policies are lacking. The authors state that “although technologies might play an important role in understanding transitional change, the emphasis is rather on how incumbent routines, powers, interests, discourses, and regulations create path dependencies and how these are challenged by (transformative) social innovations” (ibid, p. 610). In other words, regulations are mentioned in the context of their creating lock-in, but not their use in breaking lock-in. Yet the authors comment (Loorbach et al. 2017, p. 600):

it has been only over the past decade or so that real progress is being made with the diffusion of renewable technologies. It coincides with increasing disruptions in markets for oil and gas, sharp declines in the use of coal, and struggling fossil energy companies. The current dynamics are only partly driven by incumbent actors and are heavily influenced by “outsiders” to the fossil energy system such as cooperatives and cities; companies such as Tesla, Siemens, Ikea, and Google; and social movements such as the divestment movement and the LINGO (“Leave It in the Ground”) campaign. The energy transition is thus much more than merely a technological shift; it is a power struggle and a socio-cultural change having a deep effect on incumbent institutions, routines, and beliefs.

While the analysis of Loorbach and Huffenreuter (2013) is insightful, we believe their faith in TM offering a solution is more wishful thinking – by providing opportunities for transition pathways – than backed up by evidence. Examples of community-based economic activity and alternative currencies do not have enough traction on which to base a revolution. In fact, they leave to future research the means to bring this transformation about.

As with so much of the early writing on TM and SNM, the focus was curiously on only influencing and destabilizing incumbents, rather than replacing them, and government regulation was only vaguely discussed in the context of creating effective and timely stimuli for change. Later writing – for example, see Kivimaa and Kern (2016) – departed from this myopia and recognized the need of creating or propelling niches to replace the incumbents using regulation but without emphasizing the importance of mandatory targets that demand performance beyond current capabilities.

8.3.5 Regulation-induced innovation as an alternative pathway to achieving sustainable development

In a longer article the authors have argued that **regulation – properly fashioned – can transform products and processes which confers both economic and health, safety, and environmental benefits as well as costs** (Ashford and Hall 2011a). In contrast, classical economic analysis of the relationship between health, safety, and environmental regulation and competitiveness maintains that stringent regulation increases production costs, diverts resources from R&D, and consequently hinders innovation. This assumption was challenged first in the late 1970s at MIT and made popular in 1991 by the so-called Porter hypothesis (Porter 1991, Porter and van den Linde 1995).

The Porter hypothesis and the relevant literature indicate that environmental, health, and safety regulation can induce dramatic innovations, not only by spurring the

development of new products or services by incumbent producers, but also by creating conditions in which new producers can enter the field. Regulation can do this when firms have, or are induced to have, the willingness, opportunity, and capacity to innovate (Ashford and Hall 2011a). This literature, and the insights gleaned from it, provides an important set of clues for how regulation can be used to foster sustainability.

Based upon his research into the competitive advantage of nations, Porter (1991, p. 168) claimed that “strict environmental regulations do not inevitably hinder competitive advantage against foreign rivals; indeed, they often enhance it. Tough standards trigger innovation and upgrading.” He observes (*ibid.*),

Properly constructed regulatory standards, which aim at outcomes and not methods, will encourage companies to re-engineer their technology. The result in many cases is a process that not only pollutes less but lowers costs or improves quality. [...] Strict product regulations can also prod companies into innovating to produce less polluting or more resource-efficient products that will be highly valued internationally.

Porter’s hypothesis is that [incumbent] firms which respond to stringent regulation by developing new technologies have a “first mover” advantage and can capture the market for their products/services. Comparison of national competitiveness with good environmental governance and private sector responsiveness supports the Porter hypothesis. Good economic management and good environmental management are related and firms which succeed in developing innovative responses to environmental challenges benefit both environmentally and economically.

Earlier empirically based work on this concept dates back twelve years before Porter’s work to research undertaken at MIT (Ashford et al. 1979, Ashford and Heaton 1983, Ashford et al. 1985, Ashford 1993). This earlier work showed how stringent and focused regulations in the U.S. chemical producing and using industries had the effect of stimulating fundamental product and process innovations. **The MIT studies revealed that *environmental and health and safety regulation* – if appropriately designed, implemented, and complemented by economic incentives – can lead to radical technological developments that can significantly reduce exposure to toxic chemicals in the natural and working environments, and in consumer products.** Examples include regulation-induced replacement of polychlorinated biphenyls used in transformers by a silicone-based fluid, a new polymerization process for polyvinylchloride, and textile weaving innovation eliminating the need for a formaldehyde-containing resin that imparted permanent press properties to cloth.

A limitation of Porter’s hypothesis is that it focuses on how *incumbent firms* respond to more stringent regulations, but it ignores the important dynamics of *new entrants* (van de Poel 2000). Porter and van den Linde (1995) argue that regulation, properly designed, can cause a regulated firm to undertake innovations that not only reduce pollution – which is a hallmark of production inefficiency – but also save on materials, water, and energy costs, conferring what Porter calls “innovation offsets” to the innovating firm (and what Ashford and his MIT colleagues called ancillary benefits). This can occur because the firm, at any point in time, is suboptimal. If the firm is the first to comply with regulation in an intelligent way, other firms will later have to rush to comply and do so in a less thoughtful and more expensive way. Thus, there are “learning curve” advantages to being first and early.

Given Porter’s focus on “innovation offsets” – i.e., the cost savings due to induced innovation that could exceed the cost of the regulation (Porter and van den Linde 1995) – he is mainly concerned with the costs to incumbent firms. However, it is possible to differentiate between “weak” and “strong” forms of the regulation-induced innovation hypothesis – a distinction that Porter does not make. In its weak form, as Porter observes, firms subject to more stringent regulation respond with product and process innovations.

However, while environmental and worker health and safety improvements may be realized, the offending products and processes tend to only be incrementally changed.

In contrast, in the strong form of the regulation-induced innovation hypothesis, stringent regulation can stimulate the entrance of entirely new products and processes into the market, thereby displacing dominant technologies. In this situation, unless incumbent firms have both the willingness and the capability to produce and compete with the new forms of technology, they too are likely to be displaced from the market (Christensen 1997). Figure 8.8 provides a simple diagram of the likely technological responses to the strong and weak forms of the regulation-induced innovation hypothesis. Empirically based examples were researched by Ashford and his colleagues in their work.

While some question whether environmental regulation does generate a positive effect on innovation (Walley and Whitehead 1994, Robinson 1995, Jaffe and Palmer 1997), their analyses tends to miss the essence of the ‘strong’ form of the regulation-induced innovation hypothesis. Although it is likely that stringent regulation will not stimulate technological innovation in most firms, some firms are likely to rise to the challenge and become technological leaders in the process. Hence, the “evidence is necessarily anecdotal” (Ashford 1999, p. 3). The Schumpeterian notion of “waves of creative destruction” leading to succeeding advances in technological development describes the process by which dominant technologies are being continually displaced as new technologies become available.

The design challenge facing government is how existing undesirable technologies can be retired (or displaced) through a combination of regulation and market incentives. **These ideas thus challenge the notion that incumbent firms will reinvent themselves in a significant way and should have a major role in setting the targets for future regulation. Incumbents will not set targets they do not expect that they can meet.**

With regard to the “weak” form of the regulation-induced innovation hypothesis, ambitious environmental policies in developed nations can lead to the formation of “lead markets” for environmental technologies (Jänicke and Jacob 2005). However, the evidence suggests that “the international diffusion of environmental innovations must be accompanied by international policy diffusion, or the adoption by other countries of the induced innovation must be economically reasonable” (Beise et al. 2003, p. 1). Both of these factors make it difficult to predict with certainty whether an ambitious environmental policy is likely to create a lead market for the international diffusion of innovations. The uncertainty surrounding the likely impacts on national industries of more stringent

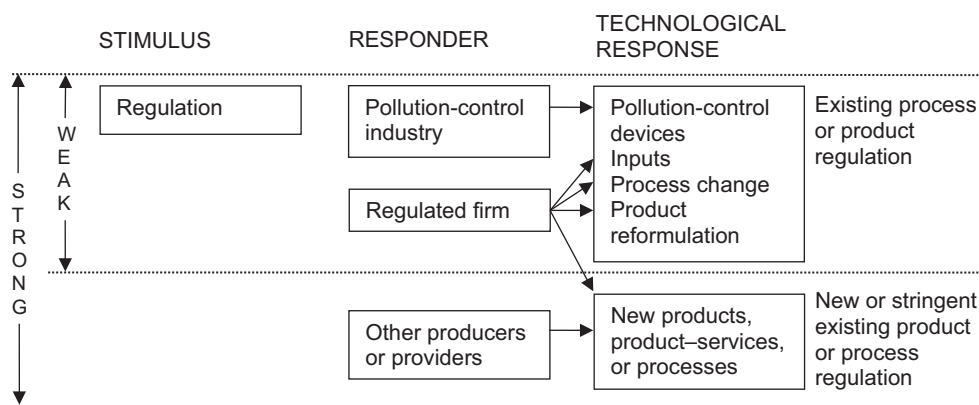


Figure 8.8 A model for regulation-induced technological change for “weak” (Porter) and “strong” (Ashford/MIT) forms of the regulation-induced innovation hypothesis

environmental [and health and safety] regulation is seen as one reason why governments hesitate to implement such policies (Blazejczak and Edler 2004).

Stringent regulation can stimulate new entrants to introduce *entirely new products and processes* into the market – products and processes that will displace dominant technologies. One of several vivid examples is the displacement of Monsanto's PCBs in transformers and capacitors by an entirely different dielectric fluid pioneered by Dow Silicone. Regulation can thus encourage disrupting innovations by giving more influence to new customer bases, in which demands for improvements in both environmental quality and energy use and efficiency are more sharply defined and articulated. Of course, industries that would fear being displaced by new entrants would not be expected to welcome this regulation. This explains in part their resistance to regulation and their propensity to try to capture regulatory regimes, surreptitiously or through direct negotiation with government (Caldart and Ashford 1999). For a later discussion of resistance from incumbents, see Geels (2014) and Hess (2014).

In principle, regulation can be an effective and proper instrument for government to guide the innovation process. Well-designed regulation that sets new rules changes the institutional framework of the market. It can thus be an important element in creating favorable conditions for innovation that will enhance environmental sustainability and create incentives for the development of powerful lead-markets, which pull innovation towards sustainability (Jänicke and Jacob 2004). With regard to regulation, what seems to matter is not only the stringency, mode (specification versus performance standards), timing, uncertainty, focus (inputs versus product versus process) of the regulation, and the existence of complementary economic incentives, but also the inherent innovativeness (usually in new entrants) or lack of it (usually in the regulated firms) that the regulation engenders.

In order for innovation to occur, the firm (or government itself) must have the *willingness, opportunity/motivation, and capability/capacity to innovate* (Ashford 2000). These three factors affect each other, of course, but each is determined by more fundamental factors.

Willingness is determined by (1) attitudes towards changes in production in general, (2) an understanding of the problem, (3) knowledge of possible options and solutions, and (4) the ability to evaluate alternatives. Improving (3) involves aspects of capacity building through the diffusion of information, through trade associations, government-sponsored education programs, inter-firm contacts, and the like. Changing attitudes towards changes in production (1) often depends on the attitudes of managers and on the larger culture and structure of the organization, which may either stifle or encourage innovation and risk taking. Factors (2) and (4) depend on internal intellectual or knowledge-based capacities. In the context of disrupting innovation by firms representing the dominant technology, willingness is also shaped by the rare commitment of management to nurture new approaches that are at odds with its traditional value network or customer base.

Opportunity and motivation involve both supply-side and demand-side factors. On the supply side, technological gaps can exist between the technology currently used in a particular firm and the already-available technology that could be adopted or adapted (known as diffusion or incremental innovation, respectively), or alternatively the technology that could be developed (i.e., significant sustaining or disrupting innovation). Consciousness of these gaps can prompt firms to change their technology, as can the opportunity for cost savings. Regulatory requirements can also define the changes that would be necessary to remain in the market. On the demand side, three factors could push firms towards technological change. These are (1) regulatory requirements, (2) public demand for more environmentally sound, eco-efficient, and safer industry, products, and services, and (3) worker demands and pressures arising from industrial relations concerns. The first factor

could result from changes in customer value networks. However, all these factors may stimulate change too late in the dominant technology firms, if new entrants have already seized the opportunity to engage in developing disrupting innovations.

Capability or capacity may actually be the most important and limiting factor and can be enhanced by (1) an understanding of the problem, (2) knowledge of possible options and solutions, (3) the ability to evaluate alternatives, (4) resident/available skills and capabilities to innovate, and (5) access to, and interaction with, outsiders. Knowledge enhancement/learning (2) can be facilitated through deliberate or serendipitous transfer of knowledge from suppliers, customers, trade associations, unions, workers, and other firms, and the available literature. The skill base of the firm (4) can be enhanced through educating and training operators, workers, and managers, on both a formal and informal basis, and by deliberate creation of networks and strategic alliances not necessarily confined to a geographical area, nation, or technological regime.

Interaction with outsiders can stimulate more radical and disrupting changes. This last method of enhancing the capacity of firms to undertake technological change involves new “outsider” firms and stakeholders with which the firm has not traditionally been involved. Capacity to change may also be influenced by the innovativeness (or lack thereof) of the firm as determined by the maturity and technological rigidity of a particular product or production line (Ashford et al. 1985, Ashford 2000). Some firms find it easier to innovate than others. The heavy, basic industries, which are also sometimes the most polluting, unsafe, and resource-intensive industries, change with great difficulty, especially when it comes to core processes. New industries, such as computer manufacturing, can also be polluting, unsafe (for workers), and resource and energy intensive, although they may find it easier to meet environmental demands. Government should not miss the opportunity to loosen the creative forces that bring about innovative changes that can simultaneously benefit the economy, the natural and working environment, and the general welfare.

8.3.6 The importance of diffusion in achieving sustainable development

Although technological innovation is crucial to achieve long-term sustainable development and fosters adaptive transformations, the preoccupation of scholars with innovation, in contrast with diffusion, may contribute to underdeployment or lack of development of policies that promote diffusion. The diffusion of technology is essential for enhancing sectoral and national revenues, as well as promoting more sustainable industrial, agricultural, transportation, and construction practices. There are many existing technologies that could contribute to the reduction of health, safety, and environmental problems and improve labor productiveness, but they either encroach on vested interests in maintaining current practices or may impose costs on firms, on consumers, or on both. In many cases, “environmental technologies” are process technologies rather than products and may confer proprietary benefits on their designers, who may not want others to have them. Environmental technologies are also difficult to organize into a market.

The slow pace of widespread technology adoption (diffusion) that could contribute significantly to more sustainable industrial systems is not due to the fact that the “discovery” of solutions to health, safety, and environmental challenges is lacking, nor is there a need for slow co-evolutionary approaches. Rather, what is missing is the political and private-sector will for technology adoption. This may be as true for cleaner technologies as for so-called end-of-pipe technologies. After all, if the health, safety, and environmental harms that come from a technology are not internalized in the price of a manufacturer’s activities, products, or services, why should they care if it is “cleaner”? **Technology-diffusion forcing by government supported by significant demand by consumers, citizens, or workers through the tools of regulation, taxes, legislation, and stakeholder participation is likely to speed up the pace of change towards sustainable development. In summary,**

government needs to play a strong role in stimulating both radical disrupting innovation and the diffusion of technology. Otherwise, evolutionary or co-evolutionary processes by themselves are likely to be too little and too late.

The challenges of market failure and lock-in particularly apply to radical systemic changes, which require changes in the institutional environment and long periods of sustained policy support (Kemp 1994; Foxon and Pearson 2007; McDowall and Ekins 2014). Developing countries face the additional challenges of more limited resources (financial, institutional, skill, etc.) and fewer experiences with state-driven technology development and phase-in. While lock-in effects may be weaker in some cases where hardly any technologies exist yet, market failures may be more pronounced in others due to stronger information asymmetries and cost barriers (Kemp and Never 2017).

The promotion of a green industrial policy for developing countries was explored by Kemp and Never (2017). The lock-in to unsustainable technologies and resistance to change on the part of incumbents was underscored. The authors observe that “challenges of market failures and lock-in particularly apply to radical system changes, which require changes in the institutional environment and long periods of sustained policy support” (ibid., p. 67). What is revealing about this conclusion is that no mention is made of discontinuous, radical change that might be exacted on the application of stringent regulation. Instead, what the authors are describing is the slow process of evolutionary change that delivers needed change with great difficulty.

Though a recent paper, the authors rely on the older literature on transition management to explain the recommended approaches in the context of developing countries. Since developing countries are not likely to have mature regulatory systems, and certainly are not wedded to technology-forcing that stringent regulation can elicit, the authors may well be correct in investing their faith instead in transition management. This begs the question of whether some developed economies who are reluctant to adopt stringent technology-forcing regulatory approaches will utilize evolutionary or co-evolutionary strategies to achieve more sustainable development in a timely manner. If not, this does not bode well for the needed progress. The Paris Agreement on Global Climate Change, while eliciting voluntary commitments from its many signatories, is premised on the belief that sufficient pressure for rapid enough change has been created and changes will emerge soon enough. This remains to be seen.

8.4 Stakeholder involvement in the context of sustainable development

Public and stakeholder participation lies at the heart of the democratic process and has been an important part of decision-making for millennia. During the eighteenth century, Jean-Jacques Rousseau introduced the idea of the social contract between the governed and the government, which has since become the cornerstone of many political philosophies of government (see Section 1.2 in Chapter 1).

The rationale for public/stakeholder involvement in decision-making has been well documented (Ashford and Rest 2001; NRC 1996; Renn et al. 1995; Shepherd and Bowler 1997; Söderbaum 1973, 2004; Yosie and Herbst 1998), along with the mechanisms through which this involvement can occur (Arnstein 1969; Hale 1993; Nagy et al. 1994; van Gunsteren and van Loon 2000). Not only is public/stakeholder participation likely to lead to more democratic and informed decision-making that addresses the needs of citizens and affected stakeholders, but it may be essential if radically new initiatives are to succeed.

In the United States, the demand for public involvement in decision-making can be traced back to the social activism and environmental movements of the 1960s and 1970s (Shepherd and Bowler 1997). With the passage of the National Environmental Policy Act (NEPA) in 1969 came the requirement that federal agencies undertake environmental

impact assessments (EIAs) for all major projects. In addition to identifying and informing the public of the likely impacts of a project, the NEPA stipulated that the public must be able to participate in the development and review of the EIA. The NEPA also gave the public the right to challenge final rulings in the courts. These requirements have led to the institutionalization of public participation in the federal government's environmental decision-making process (ibid.).

Although the terms "public" and "stakeholder" participation are often used interchangeably, there is an important distinction between them (English et al. 1993). The former does not differentiate between stakeholders, whereas the latter seeks to identify only those groups affected by a specific policy or regulation. Although public participation is necessary to ensure that government is responsive to its citizens, our interest here lies with stakeholder participation (also known as stakeholder "involvement" or "engagement"). Identifying stakeholder groups is important because it can reveal distributive inequalities that occur as a result of government decisions.

Ensuring that stakeholders are included in the decision-making process is critical to sustainable development. As rapid technological change and globalization continue to affect our lives in unforeseen ways, establishing a democratic political philosophy to guide the development of social and technological systems becomes increasingly important.* Moreover, governance of sustainable development is a complex process, and the outcome of existing participatory approaches designed to promote or (at a minimum) consider environmental concerns/sustainability is difficult to ascertain (Adger and Jordan 2009). Moving toward sustainability requires technological, organizational, institutional, and social transformations, each of which in turn depends on the willingness, opportunity/motivation, and capacity of key actors and institutions to change (see Chapter 13 for discussion of strategic options).†

In practice, the process of stakeholder involvement can be challenging. For example, decisions about when to involve stakeholders, how to identify and include affected groups, and which engagement mechanism to use are not trivial (Adger and Jordan 2009). However, our intent here is not to explore each and every nuance of stakeholder participation, but to focus on how stakeholders can be involved in identifying desirable *system transformations* (or system innovations) toward sustainable development. Two somewhat related but different techniques that lend themselves to such tasks are *scenario planning* and *backcasting*.

Scenario planning was pioneered during the late 1960s and early 1970s by Royal Dutch Shell as a strategic planning tool (Wack 1985a, 1985b). By using scenarios to create a series of stories about future environments, Shell's strategic planning team was able to inform the perceptions of its managers and key decision-makers about how their decisions might play out in the future. Thus, the technique goes beyond the provision of scenarios and attempts to change "the image of reality in the heads of critical decisionmakers" (Wack 1985b, p. 84). By allowing decision-makers to "perceive reality," Shell has been able to respond more effectively to major events such as the oil shocks of the 1970s. The value of scenario planning is that it allows decision-makers (1) to anticipate and better understand risk and (2) to develop strategic options that were previously concealed by incomplete perceptions of reality (Wack 1985a).

Hughes (2009a, 2009b) insists that in building images of the future, they must be grounded in reality and therefore in the present, especially with regard to likely technological change. In that sense, the focus is "evolutionary," which make the approach relevant to transition or strategic niche management. Although this perspective may garner a stronger

* See Section 9.7.2.1 in Chapter 9 for a discussion of utilitarian versus Rawlsian/communitarian approaches to citizen involvement in governmental decisions.

† See Section 7.6 in Chapter 7 for a discussion of the importance of willingness, opportunity/motivation, and capacity for organizational learning in the context of the industrial firm.

basis for consensus in planning, it smacks of technology-push policies and is to be contrasted with an alternative activity, that of “backcasting,” which is much closer to demand or technology-pull strategies. In our view, backcasting is also more likely to result in radical innovations and avoid lock-in and path dependency. The limitations of scenario planning are acknowledged by Hughes (2009b, p. 13):

With technologies that are still at the research stage, and require radical breakthroughs to bring them into wider use, it is not guaranteed that particular [existing and involved] actor actions will result in such breakthroughs being achieved. [. . .] In general, it might be argued that what is considered incremental technological change would usually fall under [existing] actor contingent elements whereas radical technological breakthroughs, and unplanned technological failures, would usually fall within non-actor contingent elements [that is, outsiders].

(See also the discussion of the crucial role of outsiders in van de Poel 2000, 2003.)

Like scenario planning, the roots of backcasting can be traced back to the 1970s. The technique was first proposed by Lovins (1976), who suggested that a better approach to predicting energy futures might be to describe a desirable future (or long-term goal) and then work backward to develop a set of policies to realize that future. Figure 8.9 provides a simple example of how a subgoal and a long-term goal could inform the development of policies/strategies a, b, and c and d, e, and f, respectively, to reach the desired future state. The basic idea is that the future is a function of prevailing policies and choices. Thus, a strategic change in policy today is likely to influence the future by guiding political, economic, and social systems in a certain direction.

Interestingly, scenario planning and backcasting approach the notion of system transformations/innovation from quite different perspectives. Scenario planning accepts that system transformations are likely to occur, but it does not attempt to influence them

Target achievement?

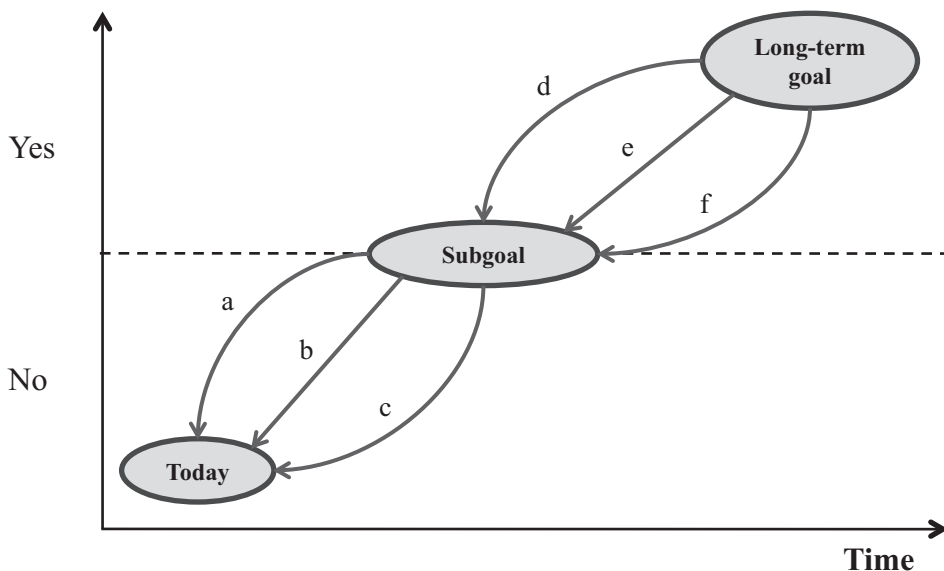


Figure 8.9 The backcasting process

directly. Instead, it focuses on developing strategies today that will perform well under a range of potential scenarios (or transformations). Backcasting is more proactive in that it purposefully tries to shape system transformations. Given its focus on guiding change, it can be argued that backcasting is a more useful technique for decision-making for sustainable development. To a certain extent, backcasting rejects the “invisible hand” of a laissez-faire economy as an appropriate means through which sustainable development can be achieved (Anderson 2001). Instead, it places importance on the role of government and stakeholders in guiding system transformations. The form of guidance selected will depend on the roles adopted by government and stakeholders and on the expected timescale of the transformation.*

Although the “traditional” use of scenario planning does not directly attempt to influence the future, there is evidence to suggest that if scenarios are developed by a representative group of leaders from within a nation, the scenarios can have a significant influence on how the future of that nation unfolds (Kahane 2001). In addition to creating a series of stories about how their nation might develop, leaders of government, business, and civil society have a direct interest in shaping the future they desire. Thus, the process of building a scenario can be an important learning experience where leaders can explore how their actions might support a particular future. The end result is that the collective group of decision-makers can take steps to ensure that the more desirable scenarios are supported by their present-day actions. In this regard, the distinction between “participatory” scenario planning and backcasting becomes blurred. Because backcasting focuses explicitly on shaping the future, the following text looks more closely at this technique.

During the 1990s, the idea of backcasting was used in Sweden and the Netherlands to explore potential pathways for achieving more sustainable development (Quist and Vergragt 2004). As Anderson (2001, p. 622) comments,

The structure and characteristics of the backcasting process are, in many respects, a natural complement to the inclusive and conciliatory ethos of sustainable development. While sustainable development provides a strategic framing of environmental reform, backcasting provides the procedural vehicle for translating subsequent objectives into practical policy initiatives. Or, put another way, the objectives arising from sustainable development provide the macrotargets to be achieved through the evolution of micropolicy initiatives developed within the backcast.

Although backcasting was not originally designed as a participatory approach to decision-making, Quist and Vergragt (2004, p. 429) make a convincing case that

participatory backcasting [. . . is] a novel, innovative and promising approach for long-term strategizing for sustainability, based on stakeholder involvement, construction of normative sustainable futures, [and] stakeholder learning, in combination with design and analysis activities and construction of follow-up agendas meant for guiding implementation.

* The timescale of a transformation is important because it will indicate whether industry or government should be responsible for guiding the pathway toward sustainable development. It is argued that as the timescale increases, the role of government in guiding the transformation becomes greater – even “indispensable” (Vergragt 2005, p. 313).

Quist (2007, p. 135, 2009b, p. 6) summarizes the findings from the literature regarding backcasting as follows:

- Broad stakeholder participation can help increase legitimacy and accountability, structure complex unstructured problems like sustainability problems, broaden issues with a range of aspects and values and increase support and involvement (also in follow-up).
- New emerging future visions can become guiding images shared by groups of stakeholders that provide guidance and orientation to the supporting stakeholders in line with the future vision in a process of diffusion and further elaboration of the vision.
- Emerging visions face competition from other emerging visions and their supporters, as well as from the regular dominant vision supported by vested interests and actors.
- Visions may have strong normative and ethical assumptions and be generated deliberately by groups of stakeholders.
- (Higher order) learning may encourage actors to reformulate problem definitions and shift their preferred ways and approaches to dealing with a certain problem. Increased insight into the values and views of other stakeholders may be another result.
- Both the way the backcasting has been applied and the organisational settings of the backcasting experiment are likely to affect the nature and degree of follow-up.
- Network theories* provide a promising way for analysing follow-up and spin-off activities.
- Successful networks around follow-up and spinoff activities may lead to instances of institutionalisation in which institutions change, as well as to instances of institutional resistance from vested interests and backing actors who feel threatened.

In a review of ten years of backcasting experience in three case studies in the Netherlands, Quist (2009a) finds that stakeholders had no or very limited influence on the process, although “higher-order learning” could be observed (*ibid.*, p. 12), and that the process “does not automatically lead to follow-up, spin-off, and implementation in line with the vision and the follow-up agenda” – depending on various internal and external factors that could be enabling or constraining (*ibid.*, p. 14). Spin-off or follow-up activities occur within the context of niches in research, business, government, or public interest groups and the general public (*ibid.*, p. 15). He concludes that “careful network management and theories of network management may be more relevant than theories of stakeholder participation in (public) decision-making and science” (*ibid.*, p. 15).

The concept of participatory backcasting also provides a way in which technological development can become more responsive to the concerns of stakeholders (or citizens). Some advocates of stakeholder involvement have called for the creation of a democratic decision-making process to guide the development of technological systems (Sclove 1995; Winner 1977, 1986). Their concern is that the rate of technological change is outpacing the ability of government to monitor and guide its progress – meaning that technology is changing without a plan. Further, as technology plays a more dominant role in our lives,

* See the discussion of social networks in Section 7.4.4 in Chapter 7.

it is argued that our freedoms are in some way being inadvertently “regulated” by technology (Lessig 2000; Sclove 1995; Winner 1977, 1986).*

The links among democratic decision-making for technological development, participatory backcasting, and sustainable development seem relatively clear. Participatory backcasting is one mechanism through which technological development can be democratized by the interaction of decision-makers, technology developers, and stakeholder groups. Further, the process of looking back from a shared vision of a sustainable future can be a catalyst for the creation of more sustainable technological systems. “Participatory backcasting has potential for planning in sustainable development, for identification and exploration of promising sustainable technologies, sustainable system innovations and transitions, for guiding technology choices and for generating alternative more sustainable trajectories for present dominant trends and developments” (Quist and Vergragt 2004, p. 429). See also Cohen et al. (2017) for an extensive discussion of consumption and social change.

In conclusion, public/stakeholder participation is an essential component of sustainable development. Although public/stakeholder participation in the environmental decision-making process is now institutionalized in the U.S. federal government, the philosophy of government and the stakeholder posture adopted by society can have a significant influence on whether it is able to move toward sustainable development. Further, given the ethical and intergenerational importance of protecting species and the environment, either government or stakeholder groups must represent the interests of these groups in the decision-making process. Finally, participatory backcasting presents a novel way to focus decision-making on sustainable development and include stakeholders in the process of technological development. We return to these ideas in Section 9.7 in Chapter 9, where we present an integrated approach to decision-making for sustainable development.

8.5 Innovation, industrial, and technology policy in the context of a globalized economy

Earlier we emphasized that the term “competitiveness” as it relates to a national economy has two different meanings: (1) the ability of the nation-state to provide needed goods and services to its people and (2) a synonym for “competition,” meaning the extent to which a country (or a sector) is able to garner greater profits and market share. Traditional industrial policy focuses on the second meaning as a goal, often with an inherent “trickle-down” assumption that a rising tide raises all boats, and hence the poorer parts of the society will benefit. In the industrial nation context, the focus is on increasing trade as a source of revenue, especially if the existing domestic market is “saturated” because either the consumption of a particular good (or service) is already widespread or because the non-consuming part of society does not have the purchasing power to buy the domestic product. In either case, we speak of “excess capacity” or “overcapacity” in the producing sector.

In both the industrialized world and the developing world, industrial policy has sometimes taken the form of producing “national champions” to compete in world trade. Industrialized nations have attempted this in high-technology sectors, focusing on policies

* Sclove (1995) presents a set of recommendations that focus on designing technologies that support democracy in communities, employment, and politics. In addition, he highlights the importance of creating technologies that support sustainable development. Interestingly, Sclove’s (1995) focus on developing technologies that support local economic self-reliance, maintain environmental/social harms within political boundaries, and support ecological sustainability leans heavily toward the notion of “ecodevelopment.” For a discussion of ecodevelopment, see Section 2.3 in Chapter 2.

to encourage innovation,* while developing countries have sought to capture larger shares of global markets in areas where they perceive that they have comparative advantages, such as cheaper labor or commodity goods.

In the United States, the issue of cheaper wages in developing countries led to flexible wage policies, which are partially credited with generating greater labor productivity in the 1990s by allowing wages to fall in line with reduced demand and the isolation of trade unions. Inclinations to emulate this policy in Europe were met with strong resistance, partly because of the greater extent of unionization in many (especially northern) European countries and partly because of objections on theoretical grounds. Kleinknecht (1998, 2015), a German-born Dutch economist, argues along Schumpeterian lines that lowering wages should not be adopted as a policy in Europe because it would reward those firms (and industries) that do not know how to use labor effectively. These firms should be allowed to exit the market in favor of firms that do.†

Weiss (1997) provides an overview of changes in the industrial policies of the Northern economies over the previous decade. In the context of globalization, he is pessimistic about selective “governmental attempts to foster national high-technology ‘champions’” and instead advocates *general* policies for facilitating innovation (ibid., p. 82). This debate between “picking winners” and “general policies” is the central one in the area of industrial policy. He cynically argues that the “winners are good at picking governments” (ibid., p. 82), but there are examples where the opposite is the case, such as the Japanese and French high-speed trains and the creation of national champions by the Asian tigers. Mowery and Rosenberg (1989) argue that globalization is driving a convergence of technology and trade issues, although trade policy models and instruments have lagged far behind.

Globalization has indeed changed the economic landscape. It connects national economies in new ways and denationalizes access to information, technology, knowledge, markets, and financial capital. It has also opened up two distinct pathways by which a national sector or economy can compete in international markets: (1) by producing more innovative and superior technology that may or may not be first deployed in niche markets (Kemp 1994; 1997); and (2) by adopting cost-cutting measures that involve increased economies of scale, by shedding labor, and by ignoring health, safety, and environmental hazards. Although some proponents of globalization have argued that globalization also increases the demand for more protective measures worldwide (Bhagwati 1997; Vogel 1995), others have cautioned about a “race to the bottom” and an ever-increasing tendency to trade on environmental (and labor) externalities (Ekins et al. 1994). Thus, we see that not only are there two drivers of economic growth, technology and trade, but that trade itself can take two diametrically opposed directions, innovation-driven competition and traditional cost-cutting competition (Charles and Lehner 1998).

8.6 Modernization, globalization, and employment in the industrialized economies

Charles and Lehner (1998, p. 223) argue that “the type of innovation which is the key to new employment is one which develops markets in new directions and creates new

* See the EU’s Lisbon Strategy, Europe 2020, and 1994 white paper Growth, Competitiveness, Employment: The Challenges and Ways Forward into the 21st Century (European Commission 1994), in which a multifaceted strategy was suggested in which environmentally sound growth to create jobs promised to deliver a “double dividend.” This strategy was never implemented.

† Interestingly, Kleinknecht (1998) observes in the same article that environmental standards should also not be relaxed for similar reasons. Such action would reward firms that do not address environmental problems efficiently.

markets and thus enhances a strong leading edge economy.” (One can make the same observation for the enhancement of the environment.) As Schumpeter has pointed out, companies in the leading-edge economy can exploit a temporary monopoly resulting from their superior products and services (Schumpeter 1939, 1962). Charles and Lehner (1998) observed that advanced-industry economies in their innovative sectors had already shifted in the previous ten to fifteen years from technocentric to anthropocentric production systems – those that capitalize on human intelligence and are designed for continuous improvement and learning. Instead of a cost-driven strategy that calls for reduced labor costs, Charles and Lehner recommend that industrial economies aim for an innovation-driven strategy, which depends on a large number of human interfaces in the company that are likely to produce organizational learning, creativity, new ideas, and well-paying jobs. An innovation-driven strategy also affords an opportunity to modernize and improve products, processes, and services.

In Section 7.7 in Chapter 7, we discussed the tendency for innovations in products, processes, and services to affect employment in dramatically different ways, with product innovation generally creating employment and process innovation destroying employment (Edquist et al. 2001). When new products replace old ones, because there is a tendency for new production to be more capital intensive (that is, more labor saving), there could easily be a net loss of jobs. Even where the immediate effect of new products may be to increase employment, there may be a loss of jobs from the product(s) they replace. Because globalization seems to be dominated by trade in products, net job gains are at best uncertain. See Hurley Fernández-Macías (2008) for an analysis of job gains and losses in different sectors and countries in Europe. Of particular significance is the increase in the length of the working week in the EU, with the exception of Greece and Ireland (Eurofound 2008). See also the discussion in Section 1.1.3 in Chapter 1 of concerns about income and wage inequality and Section 5.2 in Chapter 5 on the effects of technological and skill changes on employment.

Job loss of unskilled labor in the North is not new, although with the emergence of China (as a major location for manufacturing jobs) and India (for service jobs), this issue takes on new currency. Without a specific focus on enhancing one kind of technological change over another (for example, more labor intensive production of products, shifts from products to product-services, or services over products), Wood (1994, p. 347) offered the following policy interventions:

- 1 Raising barriers against manufactured goods from the South;
- 2 Reducing the relative supply of unskilled labor by education and training (to offset the reduction in demand);
- 3 Boosting the relative demand for unskilled labor by public works programs or employment subsidies; and
- 4 Using taxes and transfers to redistribute income from skilled to unskilled workers.

President Trump’s nation-first agenda has elevated the first option as a way to protect American jobs. However, it is likely that any action taken to increase trade barriers will be met by legitimate trade dispute claims from developing countries that would be heard by the WTO’s dispute settlement system. The second option is problematic. Decreasing the share of unskilled labor in favor of increasing training and education of skilled workers does little (in fact, it alone may decrease the wages of skilled workers overall because their supply will be increased) unless high-skilled jobs are actually created as well.* The third option could be linked with President Trump’s infrastructure plan, but until a clear policy

* In this regard, Robert Reich’s (1992) now-old implicit view that education alone will solve the U.S. unemployment or underemployment problem is naïve at best.

emerges it is unclear how the plan will impact unskilled workers. The plan looks more like tax relief for construction and other firms. The fourth redistributive option is not likely to be implemented by the current administration.

We believe that employment and slowing economic growth, along with energy and the environment, will be the leading political concerns in the next decade, especially because the financial-system crisis has left increasing numbers of people without sufficient purchasing power to obtain the necessary goods for a healthy and secure life, as well as stimulating economic activity. If the government wants to create jobs, it must do so with deliberation while focusing on designing specific technological changes that increase the labor content of product manufacturing as well as services, shift from products to product-services, and stimulate whole system changes. New industry creation (with new jobs) displaces existing industries (with job losses) with an unjustified optimism based on a “trickle-down” logic that these changes will result in net job gains (see the work of Autor and Acemoglu discussed in Chapter 3). **Just as it is now accepted that products and processes need to be designed with environmental effects in mind from the beginning, trickle-down improvements in employment are no more likely to succeed than trickle-down approaches to environmental improvement.**

8.7 Industrial and employment policy in emerging economies

As noted earlier, *innovation* of new technologies is widely seen as the source of competitive advantage for industrialized economies. The corollary of this view is that late-developing economies do not have this advantage. In describing the success of the so called Asian tigers – Taiwan, South Korea, Singapore, and others – Amsden (1992) articulates this view and argues that even when markets are working, state intervention is required in the industrialization process in the form of subsidies (to keep wages low) and import protectionism. Contrary to the neoclassical economic view, low wages alone do not impart a sufficiently large comparative advantage to developing countries to guarantee economic advance over the productivity advances in the developed nations (see the discussion in Chapter 3). In addition to the interventions mentioned above, Amsden (1992) recommends that the government set high performance standards for production volume and keep wage disparity among workers and between managers and workers low to motivate workers.

In a classic article, Lall (1992) argues that the case for market intervention depends on (1) the nature and economic cost of market failures, (2) the availability of market-based solutions, and (3) the ability of the government to design and implement correct solutions. She is less sanguine than Amsden about the ability of the government to adopt the correct policies and emphasizes the importance of capacity building and organizational learning, especially in product markets, for transformation in developing economies. Lall concludes that success ultimately depends on incentives, capabilities, and institutions and on minimizing both market and government failures, both of which need correcting.

Rodrik (2007, p. 100) takes an intermediate position between those who emphasize market fundamentalism and those who advocate government intervention, arguing that

market forces and private entrepreneurship should be in the driving seat of [the development] agenda, but governments should also perform a strategic and coordinating role in the productive sphere beyond simply ensuring property rights, contract enforcement, and macroeconomic stability. [. . .] The task of industrial policy is as much about eliciting information from the private sector on significant externalities and their remedies as it is about implementing appropriate policies.

Rodrik (2007) observes that the theory of comparative advantage does not seem to operate to the benefit of the developing world. The challenge government faces is to get the *policy process* right rather than focus on the *outcomes*. What is needed is *institutional*

innovation. In this regard, the developing world suffers more from the demand-side faults than the supply-side deficiencies, such as a lack of trained scientists and engineers, R&D institutions, or inadequate protection of intellectual property. Thus, the problem is the low demand for schooling – or a low propensity to acquire learning – rather than the failure of the state to provide education.

In Rodrik's (2007) view, the government should focus on addressing *information externalities* rather than on picking winning sectors. Specifically, government needs to (1) engage in a self-discovery process to identify opportunities and deficiencies and coordinate information and learning on the part of strategic actors, and (2) encourage the willingness of government to deploy an industrial policy. The private sector is key to discovering what areas a particular nation should invest in and develop. Government export subsidies should be linked to demanding trade performance requirements.

Rodrik (2007, pp. 114–117) recommends ten design principles:

- 1 Incentives should be provided only to new activities in order to diversify the economy and establish new areas of comparative advantage (not to be confused with sector promotion).
- 2 Establish clear benchmarks for success and failure.
- 3 Establish sunset clauses.
- 4 Support public activities, not sectors.
- 5 Subsidize activities that have spillover and demonstration effects.
- 6 Vest authority in agencies with demonstrated competence.
- 7 Insist on politically accountable monitoring.
- 8 Establish clear channels of communication between agencies and private sector.
- 9 Tolerate failures.
- 10 Ensure that activities renew (and rediscover) themselves.

Even though these suggestions might be regarded as dated, they seem as valid today as when they were first suggested. In recognizing that adjustments are needed to mitigate or prevent global climate disruption, the 2015 Paris Climate Agreement called on developed economies to assist less developed nations, both financially and technologically.

A major goal of state intervention in industrializing economies is argued to be the acquisition of *technological capabilities*. In a classic article, Dahlman et al. (1987) outline what this task entails and what incentives need to be created to achieve it. Ernst and O'Connor (1989) describe policy issues and options facing newly industrializing economies (NIEs), given the need to acquire technological capabilities in a globalizing international economy. Armed with the advantages of a more modern history and the failure of market fundamentalism to deliver on its promise of development for the South – especially in South America, where it had been most extensively embraced – the observations of Rodrik (2007) deserve special attention.

The standard recommendation to improve employment in the south is to focus on supply-side interventions to improve education and skill development. Rodrik (2007) offers a more comprehensive perspective, focusing on developing the needed political and institutional infrastructure to promote, as well, demand-side entrepreneurship appropriate to the specific developing nation.

8.8 Additional readings

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Part IV

National, regional, and international efforts to advance health, safety, and the environment

There are several types of environmental problems which have been exacerbated by increased industrial throughput (driven by increased demand) of energy and materials that consume natural and physical resources and energy, and that adversely impact public and worker health and the environment. These problems have already been discussed in prior chapters and include (1) toxic substance exposure that directly affects human health and the environment, (2) global climate change, (3) the compromise of ecosystem integrity and its indirect effects on human health, and (4) the depletion of natural resources and energy.

In the preceding Part III of this work, we explored government intervention designed to enhance economic welfare and the economy. In Part IV of this work, Chapter 9 on “Regulatory Regimes to Protect Health, Safety, and the Environment: The United States Experience” explores one of the earliest and most comprehensive national regulatory systems to address health, safety, and environmental concerns.

Environmental problems are not bounded by geopolitical borders, but rather have international as well as global consequences that must be managed through both domestic and international legal instruments, agreements, and principles. Inherent in the concept of sustainable development is the necessity to have the fundamental tools and instruments to effectively manage environment, health, and safety issues for the well-being of both the present and the future generations.

Chapter 10 on “Regional and International Regimes to Protect Health, Safety, and the Environment” explores the policy tools and instruments to improve health, safety, and the environment that function across, as well as within, national economies. This includes efforts to harmonize national environmental legislation for nations that are members of a federated or politically integrated entity such as the European Union where member-wide regional law is evolving, and for nations operating independently, but often within the context of multilateral environmental, health, and safety agreements.

There are two different policy models for addressing health, safety, and environmental concerns. One approach focuses on *environmental policy* controlling and preventing pollution in various media (air, water, waste, and the workplace), product safety, and industrial chemical production, use, and disposal. An alternative approach focuses on developing an *industrial policy for the environment* which encourages or requires environmentally sustainable production, products, and energy-related activities through the tools of environmental policy and regulation. Both approaches are explored in Part IV. Whether and how technology development might be utilized for improving the environment, employment, and economic welfare is reserved for the concluding Chapter 13.



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9 Regulatory regimes to protect health, safety, and the environment

The United States experience

Coauthored with Charles C. Caldart

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9.1 Introduction

The previous three chapters addressed the two pillars of sustainable development related to economic development: (1) the economic welfare of a nation's population; and (2) that population's earning capacity achieved through employment and ownership of productive capital. This chapter and the next address a third pillar of sustainable development – the environment and public health and safety – which is directly affected by environmental pollution, worker and consumer exposure to toxic substances, global climate disruption from the emissions of greenhouse gases such as CO₂ and methane, and the destruction of the ozone layer that limits the amount of stratospheric high-UV radiation reaching the surface of the earth.

9.2 The nature of pollution and justification for government intervention

It has long been recognized that health, safety, and environmental hazards are by-products of industrialization, and that they are manifested as exposures leading to harmful effects on workers, consumers, and ordinary citizens, as well as harm ecosystems and the planet. These hazards – which we collectively term “pollution” – represent classic examples of externalities not included in the costs or prices of products, processes, or services. Not accounting for these externalities leads to excess production, geographical and international variations, near-termism in investments, and asymmetric knowledge (about problems and solutions) as between producers/providers and consumers and the general public.

As a result, markets for products and services fail to create sufficient demand on the part of society for pollution control or elimination and create free-rider problems and distance (both in time and in geography) between cause and effect. For all these reasons, unregulated markets are unlikely to deliver adequate pollution control or elimination.

The nature of pollution, externalities, and markets presents a logical opportunity for government intervention, such as the provision of informal guidelines, mandatory standards, and/or economic instruments (such as pollution or energy taxes).

The earliest and most comprehensive national system for controlling pollution was developed in the United States and was later emulated in Europe, where the regulatory stringency now sometimes exceeds that of the U.S. For this reason, we have selected the U.S. system as the baseline example for this chapter, and in the following chapter we compare it to the regional system adopted in the European Union. International environmental law, manifested as multilateral environmental agreements, has been influenced by both the U.S. and the EU regulatory approaches, and is also addressed in the next chapter.

9.3 Approaches to the pollution problem

There are three generic ways for society to address the pollution problem. In increasingly stringent order of market intervention, these are: (1) **provide relevant information** about both hazards and the options for their control to the would-be affected/victims, polluters, and potential developers of substitute technology, resulting in the creation of demand, pressure, and opportunities for pollution reduction or elimination; (2) **control/eliminate the hazard through government regulation and/or government-imposed economic instruments**; or (3) **fashion an industrial policy for the environment and public health** that promotes the development and application of inherently safer and environmentally sounder technologies (substitute products, processes, practices, and systems). National differences in culture and political systems in different countries render these different approaches differentially effective.

The effectiveness of these various approaches can be greatly influenced by whether one has a focus on law or a focus on economics as a lens through which to view the pollution problem. The importance of the differences in focus makes itself known when considering two fundamental decisions: (1) in deciding whether and to what extent to intervene (the decision outcome algorithm - see Section 9.7.1); and (2) if intervention is deemed warranted, in deciding whether to control (or eliminate) the hazard through government regulation or through government-imposed economic incentives/disincentives (the choice of instruments).

In general, society's approach to addressing environmental problems is an evolving one and can be conceptualized as encompassing four stages in the evolution of technological thinking:

- **Pollution control:** the development of end-of-pipe technologies to capture and reduce emissions/waste;
- **Pollution and accident prevention** (otherwise known as **cleaner and inherently safer production**): the creation of better, more environmentally sound products, processes, and services. Gradual pollution, sudden and accidental releases of chemicals, and the production of inherently dangerous products are reduced or eliminated;
- **Shifts from products to product-services:** the establishment of services to replace the need to purchase products. For example, washing services replace the need to buy a washer and dryer; photocopying services replace the need to buy expensive photocopying machinery; and innovative car-sharing programs in cities replace the need to buy an automobile; and
- **System changes:** the achievement of broad, systemic innovation, in contrast to the narrow use of innovation in relation to advances in specific products, processes, and services, e.g., transportation systems, agricultural systems, etc. A system innovation changes not only technology but also institutional, organizational, and social structures. Because traditional policies focusing on these different kinds of innovation tend to be somewhat fragmented, there is a need to formally integrate transformative initiatives. This is why, if we are to realize the "natural capitalism" vision espoused by Hawken et al. (2000), government needs to play an active role in encouraging change.* Existing barriers need to be removed, and an integrated systems approach to planning needs to be introduced.

* See Ashford and Caldart (2008) and the discussion in Chapter 13.

9.4 Choosing the instruments of intervention

Government intervention might be classified into five categories: (1) direct controls (often called command-and-control regulation); (2) indirect controls (often called market-based approaches); (3) “cooperative” policy instruments, such as information sharing, technical assistance, and government purchasing practices; (4) statutory and common-law liability for harm; and (5) encouragement of so-called voluntary initiatives. Government programs coming within this last category tend to be premised on either industry’s presumed interest in meeting social demands for a cleaner environment, or industry’s desire to avoid more stringent regulation. While perhaps not strictly governmental policies, voluntary approaches of this nature often require government acquiescence and encouragement to succeed.

9.4.1 *Direct controls*

Direct controls are legal commands – or mandated standards – imposed by a government agency, requiring firms to take some action (e.g., reduce emissions to meet environmental objectives, or provide specified information to government, the community, or the public). In the United States, firms usually do not have the choice of not complying with direct controls if they wish to operate within the confines of legal behavior. Noncompliance would be a violation of the law and could subject a firm to legal sanctions, including civil (and possibly criminal) penalties.

Consequently, noncompliance tends to carry with it a stigma of wrongdoing. This form of government intervention is sometimes called command-and-control regulation because it is characterized by legal compulsion. In some European countries, standards may take the form of recommended guidelines – called indicative standards – rather than mandates. In either case, the extent of compliance is dependent on a strong regulatory presence and emphasis.

Standards can be classified in a number of ways. A performance standard is one that specifies a particular outcome, such as a specified emission level above which it is illegal to emit a specified air or water pollutant, or a concentration limit specifying the amount of a particular pollutant allowed to be in a cubic meter of air or liter of water. Performance standards may also be expressed as limits on the degree of lifetime, annual, weekly, daily, or hourly exposure to a harmful substance, or on its flammability or explosive potential. A performance standard does not specify how the required limit is to be achieved.

A design or specification standard, on the other hand, may specify that a particular production or control technology, such as a catalytic converter on an internal combustion automobile engine, must be used to obtain pollution reduction. A ban on the use of a particular chemical in production (or on chemicals that cause a specific kind of damage, such as carcinogens or endocrine disruptors) is a design or specification standard, though it may effectively correspond to an emission standard of zero for that chemical. Similarly, a mandate for the use of cleaner (or inherently safer) technology, or for the reduction of chemical use at the source, is a form of design or specification standard.

In either case, the standard can be based on (1) a desired level of protection for human health or environmental quality, (2) some level of presumed technological feasibility, (3) some level of presumed economic feasibility, or (4) some balancing of social costs and social benefits. Within each of these options, there is a wide spectrum of possible approaches. A human health-based standard, for example, might choose to protect only the average member of the population, or it might choose to protect the most sensitive individual. A technology-based standard might be based on what is deemed feasible for the industry as a whole or alternatively on what is deemed feasible for each firm within the industry. Moreover, some standards might be based on a combination of these factors.

Many standards based on technological feasibility, for example, are also based on some concept of economic feasibility.

Beyond standards are a variety of information-based obligations that can also influence industrial behavior, such as (1) the required disclosure of (and provision of public access to) exposure, toxicity, chemical-content, and production data, and (2) requirements to conduct testing or screening of chemical products, and in the case of products (such as pharmaceuticals) to conduct clinical trials for safety and effectiveness.

9.4.2 Indirect controls

Indirect controls provide incentives whose purpose is to induce firms to take some action to improve environmental quality. However, firms are not required by law to take the desired action, and normally no sense of wrongdoing accompanies a failure to do so.

An emissions fee or “tax” that is imposed on firms according to the units of pollution they emit – or units of waste they create – is a type of “negative” indirect control, while tax deductions and credits made available to firms that take pollution reduction measures are types of “positive” indirect controls. Because indirect controls generally take the form of an economic charge or subsidy or some other type of financial incentive, they are often referred to as economic instruments or market-based instruments.

There are other “positive” (or “cooperative”) policy instruments that also are designed to indirectly stimulate industry to reduce pollution. Broadly speaking, these programs involve government provision of goods or services that private industry has been unable or unwilling to provide or develop. Examples are the creation of pollution and waste control and prevention information databases and clearinghouses, the establishment of a state office of technical assistance, the sponsoring of technical conferences, the creation of a waste recovery facility to separate out recyclable materials, government projects to demonstrate the feasibility and effectiveness of new pollution-reducing technologies, and the use of government purchasing power to promote cleaner production. Although these programs are conceptually linked to positive market-based incentives such as subsidies and tax credits, they typically involve a greater level of government involvement in the process.

9.4.3 Liability statutes and common law suits

Liability statutes and common law suits that result in damage awards for health or environmental consequences can, under some circumstances, be incentives to reduce pollution and waste. By creating financial liability for future harms that may be caused by pollution or waste, these mechanisms can create an incentive for firms to reduce or eliminate these externalities, and thus to reduce or eliminate the future liability. In the United States, the so-called Superfund statute (CERCLA, the Comprehensive Environmental Response, Compensation, and Liability Act) is perhaps the most prominent of such liability statutes on the federal level. Also included in this category are financial responsibility requirements that mandate firms, or their agents, to provide collateral (such as financial bonds) to guarantee that there will be funds available to pay for future environmental damage resulting from their operations.

9.4.4 Voluntary initiatives

The types of voluntary initiatives that can be encouraged by governmental programs include: so-called industrial ecology practices (involving exchange of wastes and materials among commercial and industrial firms with resulting efficiency gains in collectivizing waste treatment); industry self-enforcement, encouraged by industry codes of practice;

and voluntary programs or covenants between industry and governments to go beyond legally mandated standards. It should be noted that “voluntary” is a relative term in this context, as many of these programs are conducted against the backdrop of an evolving system of mandatory standards. Moreover, the term “voluntary” is a misnomer when it is applied to programs designed to bring firms into compliance with existing standards.

9.4.5 Encouraging the adoption of cleaner and inherently safer technology

If the system of health and environmental protection is to be instrumental in moving society to a more sustainable structure, it should be focused on eliminating pollution (and chemical accidents) at the source, which requires the substitution of inputs and starting materials, changes in the final product, and/or changes in the production process. There are a number of approaches that may help stimulate such changes. For example, adjusting the governmental subsidies associated with industrial production and taxing inputs as well as pollution and waste can be useful in encouraging the development and application of inherently safer and environmentally sound technology. Similarly, enforcement of regulatory standards requiring the adoption of best available technologies, imposition of financial liability for harm to health or the environment, and the implementation of a system of tradable emissions permits subject to an overall “cap” on collective emissions may help the diffusion (and even spark the innovation) of cleaner production technologies and practices.

9.5 Principles of environmental, health, and safety law

As environmental, health, and safety law has evolved, certain policy principles have become established as potential guides to the development of legislation and its implementation through regulation. As explored in this chapter and the next, the degree to which these principles are incorporated into the law varies both among the institutional regimes (i.e., the U.S., the EU, and international law) and, within those regimes, among the various subjects of regulation.

9.5.1 The polluter pays principle

The polluter pays notion holds that polluting enterprises should assume the liability for correcting the harmful consequences of these activities. In other words, this principle aims to compel polluters to be responsible for their externalities. In the United States, the principle has been applied to liability for environmental, but not health, damage in the Superfund legislation, which imposes liability for the remediation of leaking hazardous waste sites on the generators of that waste. Under that statute, the courts have imposed joint, several, and retroactive liability on waste generators, and federal taxes on current chemical, petroleum, and gas industries were levied to pay for abandoned hazardous waste sites. The upstream cost of the minimization and treatment of waste is imposed on polluters by another law, the Resource Conservation and Recovery Act (RCRA). See Section 9.6.2.4.1 for a more detailed discussion of Superfund liability.

In contrast to the polluter pays principle, an alternative perspective, known as the Coasean view, is advocated, especially by neoclassical economists. To use an illustrative example, imagine that industrial producers of a certain product freely use the air or water to dispose of a noxious substance (rather than control or treat it), which imposes costs on individuals who live downstream or downwind from the site at which the noxious substance is produced. The lower cost offered by this method of disposal may benefit consumers through lower prices for the product, may benefit the producers through higher

profits, or some combination of the two. In either case, neither the producers nor the consumers have an incentive to account for the externality costs that the production of the product imposes on persons living downstream or downwind from the site of production.

In his Nobel Prize-winning work, *The Theory of Social Cost*, Coase (1960) argues that the problem of environmental externalities can be solved by market-like transactions involving negotiations between polluters and citizens. Coase (1960, p. 2) analyzes the issue as being one in which there is a “reciprocal nature of the problem.” Were it not for the polluter, there would be no problem. If the citizens did not live downstream, there would likewise be no problem. Coase argues that, in the absence of transaction costs, it makes no sense for the government to impose a solution. Through negotiation, no matter which group initially has property rights in the air or water, the same outcome would result. The resource (air or water) would be put to its most valued use.

Instead of the government regulating the polluter, those individuals affected by the externalities could band together and pay the producers to use different methods of pollution disposal. Alternatively, the producers could pay the affected individuals for the continued convenience and commercial value to them of polluting the air or water. Depending on which is most valuable, the outcome will be the same. However, in assuming that transaction costs are low, what Coase neglects is that, in reality, coordinating collective action among affected individuals is often fraught with difficulty (transaction costs are high) and would require, among other things, the formation of, and agreement within, community-based organizations (Congleton and Sweetser 1992) and avoidance of the “free rider” phenomenon, in which some individuals choose to avoid contributing to the negotiated cost while still enjoying the fruits of the group efforts. In practice, both affected parties would look to the next most valuable alternative or substitute activity in deciding what the value of using the resource is.

Even if a Coasean negotiation of this nature were successful in achieving an agreement between the polluters and those affected by the pollution, there is the substantial question of who, as a matter of *equity*, should bear the cost of pollution. Alternatively, rather than depending on successful organizing to negotiate with polluters and consumers, those affected could pressure government to regulate or tax the harmful product or activity.*

9.5.2 *The precautionary principle*

The precautionary principle, which is more subtle and less clearly defined than the polluter pays principle, incorporates the notion that one should err on the side of caution where evidence of harm is not well-characterized. In many cases, the timescales and consequences of the environmental, health, and safety impacts of pollution are unknown and difficult to define in scientific or quantitative terms. Impacts from activities carried out

* It bears noting that prospects for “[Coasean] solutions are also affected by a variety of government policies and may require changing those policies. The initial assignment of rights determine[s] what course of action is necessary. Within governments characterized by an aggressive tort law, those living downstream or downwind could launch a class action suit against the producers for damages imposed by the use of the air or water systems to dispose of waste products. In the absence of such legal remedies, a new organization would have to be created to collect money in order to compensate producers and consumers of X. Such organizations would require some process of collective choice to determine negotiation strategies, assign cost shares to members, and design methods for punishing those who fail to contribute.

In the end, the [Coasean] result reflects a variety of government policies that affect organizational costs, contract enforcement, and liability under tort law. Government policies may affect such internal arrangements of such groups or special service districts insofar as its policies [... discourage] interest group formation (as within dictatorships), is neutral toward them, or actively encourages them” (Congleton 2003, p. 1).

today may not be seen for many generations and certainly may have implications beyond current political terms and agendas. The precautionary principle can be incorporated into legislation and regulation as a means of addressing the various uncertainties regarding the ultimate effects of anthropogenic activities. It is an embodiment of the duty to prevent pollution or harm even if the evidence is weak.

In the United States, a precautionary approach has been applied in various ways in decisions about health, safety, and the environment since at least the 1970s, much longer than more recent commentaries would have us believe, and earlier than the formal appearance of the “precautionary principle” in European law (Ashford 2007). For example, the Clean Air Act of 1970 requires the ambient air (concentration) standards for certain air pollutants to be set at the level that will protect public health with an “adequate margin of safety.” In interpreting this provision when reviewing the ambient lead standard issued by the Environmental Protection Agency (EPA), the U.S. Court of Appeals for the District of Columbia noted that

Congress provided that the Administrator is to use his judgment in setting air quality standards precisely to permit him to act in the face of uncertainty. And as we read the statutory provisions and the legislative history, Congress directed the Administrator to err on the side of caution in making the necessary decisions.

(*Lead Industries Assoc., Inc. v. EPA*, 647 F.2d 1130 (D.C. Cir. 1980))

What this means is that where there are possibilities of large or irreversible serious effects, action must be taken, even if there is considerable scientific uncertainty (Ashford 2007, p. 354). This is an influential and fairly precise formulation of the mandatory version of the precautionary principle. Alternative permissive, rather than mandatory formulations, also exist, allowing, but not requiring, precaution to be exercised (Ashford 2007, pp. 354–355). The U.S. courts authorized the Department of Labor to move forward in the face of sparse data on the toxicity of workplace chemicals when setting worker protection standards under the feasibility-based mandate of the Occupational Safety and Health Act, noting that Congress intended regulatory action even where existing methodology or research is deficient (Ashford 2007, pp. 361–363).

From approximately 1980 onwards, however, with increasingly industry-oriented presidential administrations and/or Congresses, the political appointees in leadership positions in the regulatory agencies became less willing to regulate without clear and unequivocal evidence of environmental or health harm, and the newly appointed federal judges made it increasingly difficult for health, safety, and environmental standards to survive court review/challenge (Ashford and Caldart 2008).

In today’s political climate, the burden of scientific proof often poses a difficult barrier to overcome in any effort to protect health, safety, and the environment in the United States. Actions to prevent harm are often taken only after strong scientific proof of harm has been established, at which point it may be too late to prevent significant damage. To see this, one need look no further than the current political debate over global climate change (although that could also be characterized as an unwillingness to accept the proof of harm that has been scientifically established). Moreover, hazards typically are addressed by industry and government agencies one at a time, in terms of a single pesticide or chemical, rather than as broader issues such as the need to promote organic agriculture and nontoxic products or to phase out whole classes of dangerous chemicals.

This is not to say, however, that a precautionary approach is no longer an important part of U.S. health, safety, and environmental law. The judicial precedents established in the 1970s still retain power, especially where, as with the Clean Air Act, the statute itself incorporates strong precautionary language. Further, for certain classes of products, such as pharmaceuticals, food additives, and pesticides, the manufacturer bears

the initial statutory burden of proving the safety of its products. Indeed, since 1958 the Delaney Clause of the Federal Food, Drug, and Cosmetic Act has banned food additives found to cause cancer in humans or in animals, thus making the precautionary determination that substances that are carcinogenic in animals are also carcinogenic in humans, and making the further determination that any risk of cancer from food additives should be avoided. Although this provision has been softened somewhat by more recent legislation (it no longer applies to pesticide residues that concentrate in processed foods), it has been upheld by the federal courts. Moreover, arguments over the strength of the scientific data on harm and causation can be avoided (or, at least, minimized) when Congress specifies protective standards be set according to technological and/or economic feasibility – that is, when firms (or industries) are told to reduce pollution to the extent that they can.

Congress took this approach in 1972 and 1977 in specifying national effluent standards for water pollution under the Clean Water Act, and in 1990 in specifying national emission standards for hazardous air pollutants under the Clean Air Act. And the EPA adopted this approach in implementing the 1984 amendments to the Solid Waste Disposal Act (also known as the Resource Conservation and Recovery Act, or RCRA), which specified national standards for the land disposal of hazardous wastes. In each of these instances, Congress specified a large group of chemicals or wastes for which such standards must be set, thus effectively removing from the discussion the question of whether, and to what extent, those substances cause harm to health or the environment when they are discharged to the water, emitted to the air, or disposed in the ground. In other words, Congress itself made the (implicit) determination that these substances are harmful and should be regulated; although, perhaps not a clear articulation of the precautionary principle, this nonetheless is an application of a precautionary approach. Indeed, the Clean Water Act sets as a “national goal” the *elimination* of all discharges of pollutants to the waters of the United States (regardless of whether clear data demonstrates that all such discharges would be harmful), and specifies that discharge standards for most pollutants be set at zero if it is technologically and economically feasible for the regulated industry to meet that standard – see generally, Ashford and Caldart (2008). The country is nowhere near these statutory goals at this point, but the persistence of this language in the statute provides a principled basis for the advocacy of a precautionary approach before both the EPA and the federal courts.

What brings the precautionary principle into sharp political focus in the U.S. today are (1) the fact that the nature of scientific uncertainty is changing, as more and more kinds of damage mechanisms from chemicals are identified and the complexity of the influences on global climate change becomes clearer, (2) the increasing pressure to base governmental action on more “rational” schemes, such as cost–benefit analysis (an embodiment of “rational choice theory” promoted by the Chicago school of law and economics) and/or quantitative risk assessment, and (3) the increasing prominence and importance of the precautionary principle in European and international environmental law.

The precautionary principle has been criticized as being both too vague and too arbitrary to form a basis for rational decision-making. The assumption underlying this criticism is that any scheme not based on cost–benefit analysis and risk assessment is both irrational and without secure foundation in either science or economics. We contest that view and argue that the tenets of the precautionary principle are rational within an analytical framework that is as rigorous as uncertainties permit, and one that mirrors democratic values embodied in statutes (regulatory and compensatory) and common law (see Section 9.6).

On closer examination, the precautionary principle is not in conflict with science, but rather with cost–benefit analysis. What becomes important is not the most likely or best estimate of costs and benefits of interventions, but rather how society considers what kinds

of errors a government should make in deciding what, whether, and to what extent to regulate environmental hazards.

Policy-makers must address both uncertainty about the nature and extent of health, safety, or environmental risks, and about the performance of an alternative technology in controlling or eliminating the risk. First, they must choose whether to err on the side of caution or risk. With regard to the first type of uncertainty – scientific uncertainty – two mistakes can be made. A “type I” error is committed if society regulates an activity that appears to be hazardous, but turns out later to be less harmful or even harmless (a “false positive” in the parlance of experimental findings) and resources are needlessly expended. Another error, a “type II” error, is committed if society fails to regulate an activity because the evidence is not initially thought to be strong enough, but that finally turns out to be harmful (a “false negative”). A “type III” error is said to occur when one provides an accurate (or precise) answer to the wrong problem. For example, not taking into account opportunities to change technology restricts the decision-maker to “static solutions” and thus gives rise to the further error of considering options within “bounded rationality.”

Where uncertainty exists on the technology side, type I errors can be said to be committed when society mandates the development or adoption of a technology that turns out to be much more expensive or less able to reduce risks than anticipated, and when resources are needlessly or foolishly expended. Type II errors might be said to be committed when, because of insufficient commitment of resources or political will, a significant missed opportunity is created by which society fails to force or stimulate significant risk-reducing technology. An important distinction between a cost-benefit approach and one based on precaution is that the former is “risk neutral” in the balancing of costs and benefits with their attendant uncertainties, and the latter reflects “risk averseness” for some kinds of errors.

Value judgments clearly affect decisions on whether to tolerate type I or type II errors with regard to *both* risk and technology choices. This is because the cost of being wrong in one instance may be vastly different from the cost of being wrong in another. For example, banning a chemical essential to a beneficial activity, such as the use of radio nuclides in medicine, has potentially more drastic consequences than banning a nonessential chemical for which there is a close, cost-comparable substitute. It may be perfectly appropriate to rely on “most likely estimates” of risk in the first case and on “worst-case analysis” in the second.

A type II error on the technology choice side was committed in the case of the Montreal Protocol banning chlorofluorocarbons (CFCs) by creating a scheme through which DuPont and ICI, the producers of CFCs, were allowed to promote the use of their own substitute, hydrochlorofluorocarbons (HCFCs), rather than adopt a more stringent protocol that would have stimulated still better substitutes.

Evaluating errors and deciding which way to lean is not a precise science. However, making those evaluations and valuations explicit within a trade-off analysis that acknowledges distributional effects, accounts for uncertainties in risk assessments, and considers opportunities for technological change will reveal the preferences upon which policies are based and may suggest priorities (see Section 9.7 for a discussion of a trade-off analysis framework).

9.5.3 The preference for pollution prevention and inherently safer production

End-of-pipe pollution control focuses on treating or collecting the harmful emissions, effluents, or waste from industrial processes (or, in the case of workers’ exposure, on ventilating the workplace or providing personal protective equipment), usually without altering inputs, feed stocks, processes, or final products. Early preoccupation with minimizing air and water pollution often shifted the problem to the hazardous waste stream and/or

increased workplace exposure, resulting in what is popularly known as a “media shift.” It also often changed the nature of the hazard by increasing the potential for chemical accidents (sudden and unexpected chemical releases, sometimes with accompanying fires and explosions), thus resulting in what is popularly known as a “problem shift.”

Pollution prevention – what the Europeans call “cleaner” production or technology – received its first political push in the United States with the mid-1980s pursuit of “waste minimization,” an economically driven movement that grew out of a recognition that the best way to avoid the rising costs of treatment and disposal of hazardous wastes often is simply to generate less waste. Depending on the context and the time period, pollution prevention has also been known as elimination of pollution “at the source,” “source reduction,” and “toxics use reduction.” This approach (whatever its name) entails fundamental changes to the means and/or outputs of production.

Pollution prevention is not a refined version of pollution control. It involves fundamental changes in production technology: substitution of inputs, redesign and reengineering of processes, and/or reformulation of the final product. It may require organizational and institutional changes as well.

“Inherent safety” – also known as “primary” accident prevention – is the analogous concept for the prevention of sudden and accidental chemical releases. Inherent safety is a concept similar to – and often is a natural extension of – pollution prevention. The common thread linking the two concepts is that they both attempt to prevent the possibility of harm, rather than to reduce the probability of harm, by eliminating the problem (chemical accidents and chemical pollution, respectively) at its source. The changes necessary for pollution prevention often are associated with improvements in eco-efficiency and energy efficiency. In the context of chemical production, they often involve the exploration of alternative synthetic pathways and green chemistry initiatives. The search for and identification of alternative production methods may also promote the development and use of inherently safer production technology, although minimizing accident potential may require a somewhat different (though not necessarily inconsistent) set of changes.

9.5.4 The principle of extended producer responsibility for products and chemicals, and lifecycle considerations

In a real sense, developing policies focusing only on the consumer safety aspects of products is out of date. Environmental and safety risks from the extraction of materials, from the transformation of these materials into feed-stocks and starting materials for product manufacturing to the manufacturing, transportation, use, and disposal of the ultimate product, are all part of a product’s life cycle. If sustainability is to be achieved, these various health, safety, and environmental concerns need to be taken into account at the design stage, where the choice of materials, manufacturing methods, and safety and disposal consequences may all be considered. The design of sustainable products is a critical part of sustainable development.

While the EU Integrated Product Policy (discussed in Section 10.2.4 in Chapter 10) focuses mostly on environmental impact, it does pay some attention to consumer safety. Partial attempts to integrate various stages of a product’s life into product regulation are reflected in the developing European laws implementing extended producer responsibility, whereby producers of industrial chemicals have an obligation to ensure safe use by their industrial customers and/or to buy back products from consumers once the products have reached the end of their useful life (such as the buyback programs for used motor-oil in Germany and for some electronics EU-wide). Such laws establish a more complex system linking producers and users.

Until recently, U.S. regulatory law did not incorporate extended producer responsibility for chemicals. However, the 2016 reform of the Toxic Substances Control Act did

articulate the principle that all participants in the supply chain of chemicals (producers, formulators, users, and disposers) have concurrent responsibility for chemical safety (see Section 9.6.3). In addition, some states have take-back laws for certain electronic products (such as flat-screen televisions).

9.6 The U.S. regulatory system

9.6.1 Introduction to the U.S. system

Although federal laws intended to protect the environment and ensure food and pharmaceutical safety had existed in some form earlier in the twentieth century, the start of the “modern” U.S. regulatory system for pollution control came in 1969, with the passage of the National Environmental Policy Act, which was designed to imbue the federal government with an environmental consciousness. This was followed in fairly rapid succession over the next six years by four “media-based” initiatives intended to control the release of pollution into, respectively, the workplace, the air, the surface waters, and the ground and groundwater. Rather than craft these initiatives as a comprehensive and coordinated effort to reduce pollution, however, Congress designed them as largely separate regulatory systems, each with its own standards and permitting requirements. The 1970s also saw the passage of the Toxic Substances Control Act, which gives the EPA the authority and opportunity to adopt a more coordinated approach and to address the pollution problem on a chemical-by-chemical basis. Both by design and because of inertia, however, that law has taken a back seat to the far more prominent media-based statutes.

In the 1980s and 1990s, Congress took steps to strengthen the laws protecting the three environmental media – though it left workplace protections largely unchanged – and passed the Superfund legislation to hasten the remediation of sites contaminated by hazardous substances. Congress also used this period to fashion new legislation designed to reduce the likelihood and severity of chemical accidents, to grant the public access to information regarding the chemicals used and released by industrial facilities, and to encourage the EPA to prioritize pollution prevention in its administration of environmental laws.

Since the mid-1990s, Congress has done little to change this regulatory system, and most major policy changes regarding pollution control have come through the regulatory system, and through federal court decisions interpreting the various statutes, as the EPA and other agencies do battle with industry and environmental groups over the extent of the agency’s statutory authority and responsibility. But in two instances during this period, a bipartisan majority in Congress passed fundamental amendments to an existing law. In 2006, the Consumer Product Safety Act was amended to place increased emphasis on removing lead and certain phthalates from consumer products, while in 2016 the Toxic Substances Control Act was amended in ways that are likely to weaken that already peripheral statute.

9.6.2 Media-based initiatives

We address the media-based statutes in rough chronological order. There are a number of similarities among the various statutes, but one key difference is that all of the laws addressing pollution of environmental media give the affected public the right to file suits in federal court to enforce applicable standards when the government does not do so. Workers, however, are not given a comparable right to enforce workplace standards.

9.6.2.1 The workplace: the Occupational Safety and Health Act (1970)

The Occupational Safety and Health Act (OSH Act) of 1970 established the Occupational Safety and Health Administration (OSHA) in the Department of Labor to implement

and enforce compliance with the act, and the National Institute for Occupational Safety and Health (NIOSH) in the Department of Health and Human Services (under the Centers for Disease Control and Prevention) to perform research and conduct health hazard evaluations. The act requires OSHA to (1) encourage employers and employees to reduce hazards in the workplace and to implement new or improved safety and health programs, (2) develop mandatory job safety and health standards and enforce them effectively, (3) establish separate but dependent responsibilities and rights for employers and employees for the achievement of better safety and health conditions, (4) establish reporting and record-keeping procedures to monitor job-related injuries and illnesses, and (5) encourage states to assume the fullest responsibility for establishing and administering their own occupational safety and health programs, which must be at least as effective as the federal program.

9.6.2.1.1 KEY OSHA STANDARDS

The OSH Act provides two general means of protection for workers. First, the act imposes on virtually every employer in the private sector a *general duty* “to furnish to each of his employees employment and a place of employment which are free from recognized hazards that are causing or are likely to cause death or serious physical harm” (OSH Act, Section 5(a)(1)). A recognized hazard may, for example, be a workplace chemical which research has indicated is likely to harm humans. The burden of proving that a particular substance is a recognized hazard and that industrial exposure to it results in serious harm is placed on OSHA. Because standard setting is a slow process, protection of workers through the employer’s general duty obligation could be especially important for newly discovered harms. Nonetheless, the successful use of the general duty clause depends both on the existence of reliable health effects data and on the willingness of a particular OSHA administration to use it as a vehicle for protection.

The OSH Act’s second means of protection is the promulgation of specific standards to which specified categories of employers must adhere, and OSHA is given specific authority to address workplace exposure to toxic substances. OSHA standards for workplace exposures are expressed as permissible exposure levels (PELs). Section 6(b)(5) directs OSHA to set standards for “toxic materials” and “harmful physical agents” that

most adequately assure [. . .], to the extent feasible, on the basis of the best available evidence, that no employee will suffer material impairment of health or functional capacity even if such employee has a regular exposure to the hazard dealt with by such standard for the period of his working life.

With this language, the act indicates that exposures to toxic materials that have long latency periods (such as carcinogens) and exposures to reproductive hazards need to both be specifically addressed. Nonetheless, the burden of proving the hazardous nature of a substance under Section 6(b)(5) is placed on OSHA, as is the burden of proving that the proposed controls are technologically feasible.

In 1971, OSHA invoked Section 6(a) of the act, which allowed for the adoption without critical review of 450 threshold limit values (TLVs) recommended by the American Conference of Governmental Industrial Hygienists (ACGIH) as guidelines for protection against the toxic effects of these materials. These TLVs, which had been recommended by ACGIH in 1969, thus became formal OSHA standards. The inadequacy of these 450 TLVs as a means of worker protection has become widely known. They were designed to protect the average worker from either recognized acute effects or easily recognized chronic effects and were based on animal toxicity data or the limited epidemiologic evidence available at the time. They do not address sensitive populations within the workforce or those

with prior exposure or existing disease; nor do they address carcinogenicity, mutagenicity, or teratogenicity.

After adopting these TLVs, OSHA began the slow process of setting updated standards under Section 6(b)(5). In the 1970s, OSHA set updated standards for asbestos, vinyl chloride, arsenic, dibromochloropropane, coke oven emissions, acrylonitrile, lead, cotton dust, and a group of fourteen carcinogens. In the 1980s, OSHA set 6(b)(5) standards for benzene, ethylene oxide, and formaldehyde as carcinogens, and strengthened the standard for asbestos (down to 0.2 fibers per cm^3) to reflect its carcinogenic properties. In the early 1990s, OSHA regulated cadmium, blood-borne pathogens, glycol ethers, and confined spaces. OSHA also lowered the PEL for formaldehyde from 1 to 0.75 parts per million (ppm; averaged over an 8-hour period). In 2016, after decades of delay, OSHA issued a new PEL of 50 mg per m^3 (averaged over an 8-hour period) for silica dust, which replaces the 1971 PEL of 250 mg per m^3 , and should provide further protection against silicosis, lung cancer, other respiratory diseases, and kidney disease.

9.6.2.1.2 REGULATORY CHALLENGES AND THE ROLE OF THE FEDERAL COURTS

The evolution of case law associated with the handful of standards that OSHA promulgated under Section 6 is worth considering in detail. The courts addressed the difficult issue of what is adequate scientific information necessary to sustain the statutory requirement that the standards be supported by “substantial evidence on the record as a whole.” The cases also addressed the extent to which economic factors were permitted or required to be considered in the setting of the standards, the meaning of feasibility, OSHA’s technology-forcing authority, the question of whether a cost–benefit analysis was required or permitted, and the extent of OSHA’s jurisdiction in addressing different degrees of risk. Although much of this jurisprudence is supportive of a precautionary approach to workplace risk, there are notable exceptions. In its review of OSHA’s benzene standard, the U.S. Supreme Court held that a 6(b)(5) standard may be issued only where the exposure in question poses a “significant risk” of harm. The court did not define that term but did note that a lifetime risk of 1 in 1,000 of developing a serious disease (or death) certainly poses a “significant” risk, while 1 in 1 billion did not. This led business-friendly OSHA administrations to invoke 1 in 1,000 as a necessary threshold for regulation.

The necessarily slow and arduous task of setting standards substance by substance makes it impossible for OSHA to deal realistically with the estimated 13,000 toxic substances or approximately 250 suspect carcinogens on NIOSH lists. Efforts were made to streamline the process by (1) proposing generic standards for carcinogens and (2) proposing a generic standard updating the ACGIH PRLs. Neither of these efforts was successful. The generic standards were not adopted, and the attempt to update the ACGIH standards *en masse* was struck down by the U.S. Court of Appeals for the Eleventh Circuit, which held that OSHA could not take such action unless it first made a credible “significant risk” determination for each of the chemicals under regulation. However, the courts gave their blessing to another of OSHA’s generic toxic substance regulations, the Hazard Communication Standard. That standard, promulgated under Section 6(b)(5) in 1983, requires employers to notify their workers about chemical hazards in their workplaces and to supply them with Material Safety Data Sheets on those chemicals if requested. Although this standard does not directly regulate workplace exposures, it supplies workers (and, where applicable, their unions) with information that can be used to press for chemical substitution and other measures to reduce chemical exposures, and it makes it difficult for employers to argue that harmful conditions do not exist.

9.6.2.2 *The ambient air: the Clean Air Act (1970, 1977, 1990)*

The modern Clean Air Act (CAA) came into being in 1970, and although significant changes were made in 1977 and 1990, the basic structure of the act has remained the same, with the addition of provisions for authority over acid rain, chlorofluorocarbons (CFCs), indoor air, and chemical safety. The CAA regulates both stationary and mobile sources of pollution, taking into account the relative contributions of each to specific air pollution problems, and the relative capacity of different kinds of sources within each category to reduce their emissions. The recognition that sources using newer technology might be able to achieve greater emission reductions than older sources with older technology led to the act's distinction – both in the stationary and mobile source provisions – between new and existing sources. Driven by equity considerations regarding the relative financial and technical burdens of pollution reduction, this approach unwittingly discouraged modernization or replacement of facilities and resulted in the operation of older (especially energy) facilities beyond their expected useful life. For new sources within each industrial sector, there was a general recognition of the need for uniformity and also for encouraging technological innovation through technology-forcing inherent in stringent standards. The court decisions upholding the EPA's technology-forcing authority were influenced by the cases affirming OSHA's early technology-forcing approach to worker protection.

9.6.2.2.1 NATIONAL AMBIENT AIR QUALITY STANDARDS FOR CRITERIA POLLUTANTS

Section 109 of the CAA directs the EPA to establish ambient air quality standards (maximum allowable concentrations in the ambient air) for certain substances designated by the EPA as “criteria” air pollutants. The *primary* standards for these pollutants are to protect public health with “an adequate margin of safety.” As interpreted by the courts and supported by congressional history, these standards were to be established without consideration of economic or technological feasibility. In addition, *secondary* ambient air quality standards for the same pollutants are to be established to protect “the public welfare [. . .] within a reasonable time.” Thus far, these national ambient air quality standards (NAAQS) have been established (and subsequently revised) for eight criteria pollutants: carbon monoxide (CO); sulfur dioxide (SO₂); oxides of nitrogen (NO_x); coarse particulate matter (PM₁₀), defined as “inhalable” particulates up to 10 µm in diameter; smaller particulate matter (PM_{2.5}), defined as “respirable” particles of less than 2.5 µm in diameter; photochemical oxidants, measured as ground-level ozone; and lead. The NAAQS are expressed as a specified maximum concentration in a specified area over a specified period of time. The 2010 primary standard for SO₂, for example, is no more than 75 parts per billion (75 ppb).

The CAA contemplates a federal/state partnership to achieve and maintain the national primary and secondary ambient standards. On the federal side, Section 111 directs the EPA to set national New Source Performance Standards for new stationary sources of air pollution (those built or substantially modified after the issuance of the standard). These are technology-based emission limits, set on an industry-by-industry basis. (Emission standards, in contrast with ambient concentration standards, are expressed as an emissions rate – milligrams emitted per 100 kg of product, per hour, per day, per week, per quarter, per year, per BTU, per passenger mile, or other unit of measurement.) Further, the act specifies federal tailpipe emission standards for new mobile sources and contains a number of other programs designed to reduce air pollution from motor vehicles. The states' obligation emanates from Section 110 of the act, which directs each state to develop a State Implementation Plan (SIP), subject to approval by the EPA, designed to attain the

NAAQS within that state. These SIPs include state emission limitations placed on existing stationary sources of air pollution, and inspection and maintenance programs designed to ensure that on-the-road vehicles are meeting federal tailpipe emission standards.

9.6.2.2.2 NATIONAL EMISSION STANDARDS FOR HAZARDOUS AIR POLLUTANTS

In contrast to its approach to the criteria pollutants, Congress has required uniform national emission standards for hazardous air pollutants. Hazardous air pollutants are those recognized as extraordinarily toxic and eventually regarded as non- or low-threshold pollutants. These pollutants, Congress determined, are sufficiently dangerous to preclude any reliance on atmospheric dispersion and mixing as a means of reducing their ambient concentrations. Because of their extraordinary toxicity, “hot spots” of these pollutants were to be avoided, and because ambient standards were considered impractical and of little relevance for sporadic and idiosyncratic sources, uniform federal emission standards were considered necessary. In specifying compliance with federal emission standards, Congress expressed concern with possible hot spots of localized intense pollution and also with intermittent versus continuous versus sudden and accidental releases of harmful substances.

Initially, Section 112 of the CAA specified that the federal emission standards for hazardous air pollutants were to be established solely with reference to public health and were to assure “an ample margin of safety,” without regard to cost or technological feasibility. It is likely that this phraseology reflected an early assumption that, though very dangerous, hazardous pollutants did exhibit a finite threshold (a nonzero level of exposure below which no harm would occur). As the 1970s progressed, however, there was a growing recognition that this assumption might be wrong, and that for many hazardous pollutants there was no level of exposure (at least at levels within the limits of detection) below which one could confidently predict that no harmful or irreversible effects (especially cancer or birth defects) would occur. Seeking to avoid promulgating zero emission standards – which would effectively have banned the use of the regulated chemicals in many industries – the EPA instead set standards for hazardous air pollutants based on technological and economic feasibility. Using this approach, the EPA set finite (nonzero) standards for a handful of substances: arsenic, asbestos, benzene, beryllium, coke oven emissions, mercury, vinyl chloride, and radionuclides. This process was slow, often had to be forced by litigation, and basically came to a halt during the anti-regulatory administration of President Ronald Reagan.

Congress transformed the regulatory process for hazardous air pollutants as part of the 1990 amendments to the CAA. The revised Section 112 lists 189 substances and directs EPA to set national technology-based emission limits for those substances, on an industry-by-industry basis, according to a specified timetable. Standards for major sources of these pollutants are to reflect the EPA’s assessment of the Maximum Achievable Control Technology (MACT), which is to be based on the emission levels attained by the best-performing facilities within the particular industry (considering cost), with new sources subjected to more stringent limits than existing sources. Standards for small (“area”) sources are to be based on Generally Achievable Control Technology (GACT), or specified management practices, and generally are less stringent than the MACT standards. This specific congressional directive effectively jump-started the issuance of scores of national, industry-specific emission standards, based on technological and economic feasibility, for hazardous air pollutants. (See Section 9.7 for a discussion the trade-off (or technology options) analysis framework that could be used as an alternative to MACT.)

For substances with an identifiable nonzero threshold, the EPA may at its discretion instead set a health-based standard that assures an “ample margin of safety.” In addition, the EPA is directed to eventually set more stringent health-based standards, as necessary,

for other substances; these standards are to ensure no greater than a 1 in 1 million lifetime risk of cancer from the exposure. Finally, EPA is directed, “where appropriate,” to add other pollutants to the statutory list

which present or may present [...] a threat of adverse human effects (including, but not limited to, substances which are known to be or may be reasonably anticipated to be, carcinogenic, mutagenic, teratogenic, neurotoxic, which cause reproductive dysfunction, or which are acutely or chronically toxic) or adverse environmental effects whether through ambient concentration, bioaccumulation, deposition or otherwise.
(42 U.S. Code § 7412 (b) (2))

9.6.2.2.3 PREVENTION OF CHEMICAL ACCIDENTS

The 1990 amendments to the CAA also added a lengthy new subsection (r) to section 112 addressing the release of chemicals to the air (and/or workplace) through accidents. Section 112(r) directs EPA to develop regulations regarding the prevention and detection of accidental chemical releases and to publish a list of at least 100 chemical substances (with associated threshold quantities) to be covered by the regulations. The regulations must include requirements for the development of risk-management plans (RMPs) by facilities using any of the regulated substances in amounts above the relevant threshold. These RMPs must include a hazard assessment, an accident prevention program, and an emergency release program. The 1990 amendments also direct OSHA to promulgate a Process Safety Management (PSM) standard under the OSH Act.

The OSHA workplace PSM standard, promulgated in 1992, is designed to protect employees (1) working in facilities that use “highly hazardous chemicals” (a list of acutely toxic, highly flammable, and reactive substances), and/or (2) working in facilities with more than 10,000 pounds of flammable liquids or gases present in one location. The PSM standard requires employers to compile safety information (including process flow information) on chemicals and processes used in the workplace, complete a workplace process hazard analysis every five years, conduct triennial compliance safety audits, develop and implement written operating procedures, conduct extensive worker training, develop and implement plans to maintain the integrity of process equipment, perform pre-startup reviews for new (and significantly modified) facilities, develop and implement written procedures to manage changes in production methods, establish an emergency action plan, and investigate accidents and near-misses at their facilities.

EPA’s RMP rule, promulgated in 1996 and modeled on the OSHA PSM standard, is estimated to affect some 66,000 facilities. The rule requires a hazard assessment (involving an offsite consequence analysis – including worst-case risk scenarios – and compilation of a five-year accident history), a prevention program to address the hazards identified, and an emergency response program. Worst-case chemical accident scenarios – called “onsite consequence analyses” (OCA) – are available for reading, but not for copying, in locally designated reading rooms.

In addition, CAA section 112(r) imposes a “general duty” on all “owners and operators of stationary sources,” regardless of the particular identity or quantity of the chemicals used on site, to: (1) identify hazards that may result from (accidental chemical) releases using appropriate hazard assessment techniques; (2) design and maintain a safe facility, taking such steps as are necessary to prevent releases; and (3) minimize the consequences of accidental releases which do occur. The act specifies that this obligation to anticipate, prevent, and mitigate accidental releases is “a general duty in the same manner and to the same extent as” that imposed by the OSH Act. Thus, as under the OSH Act, compliance with other regulatory standards should not relieve a firm of its general duty to ensure chemical safety. Arguably, this imposes a continuing duty on employers to seek

out technological improvements that would improve safety. Further, the requirement that owners and operators “design and maintain” a safe facility would seem to extend the obligation into the area of primary prevention, rather than merely hazard control. In general, however, this potential for a direct focus on primary accident prevention has yet to be realized by the EPA and OSHA.

9.6.2.2.4 REGULATION OF GREENHOUSE GASES

Perhaps, the most contentious issue to arise under the CAA since the turn of the century has been the regulation of carbon dioxide (CO₂) and other “greenhouse gases” (GHGs). After the EPA took the position that CO₂ is not an “air pollutant” within the meaning of the CAA, a coalition of states and environmental groups took to the courts to compel the agency to regulate the chemical. In 2007, a closely divided U.S. Supreme Court ruled that CO₂ meets the CAA’s definition of pollutant, and ordered the EPA to determine, under the act’s mobile source provisions, whether CO₂ emissions “endanger” public health or welfare. In 2009, the EPA made a formal finding that GHG emissions from motor vehicles pose an endangerment to public health and welfare by contributing to global warming, and the agency subsequently set tailpipe GHG emission standards for cars and light duty trucks. The endangerment finding also triggered a requirement that GHG emissions from major stationary facilities be subject to technology-based limits, and the EPA imposed a set of limits that began to take effect in 2011. These GHG regulations, which thus far have been largely upheld by the courts, extend to six substances, which are measured in carbon dioxide-equivalent (CO₂ e) units for regulatory purposes. As this book goes to press, however, the administration of President Donald Trump has indicated its intent to weaken or extinguish these regulations, and the issue is once again in the courts.

9.6.2.3 *Surface waters and drinking water*

The two most important federal statutes regulating water pollution are the Clean Water Act (CWA) and the Safe Drinking Water Act (SDWA). The CWA regulates the discharge of pollutants into navigable surface waters (and into smaller waterways and wetlands that are hydrologically connected to navigable waters), and the SDWA regulates the level of contaminants in public drinking water.

9.6.2.3.1 THE CLEAN WATER ACT (1972, 1977, 1987)

The modern Clean Water Act has its origins in the Federal Water Pollution Control Act Amendments of 1972. The basic structure of the act was established at that time, although it was refined and refocused by the Clean Water Act Amendments of 1977 (from which it also took its name) and by the Water Quality Act Amendments of 1987. The regulatory focus of the CWA is the discharge of pollutants to surface waters from “point sources,” principally industrial facilities and municipal sewage treatment plants (known under the act as publicly owned treatment works, or POTWs). The CWA flatly prohibits any discharge of a pollutant from a point source to surface waters unless it is done in conformance with the requirements of the act, and the statute has since 1972 retained as an explicit “national goal” the elimination of all point-source discharges to surface waters by 1985. Although this goal may never be attainable in practical terms, it has helped focus the act’s implementation on gradual – but inexorable – pollution reduction, as discharge limits are made more stringent over time.

The centerpiece of this pollution reduction scheme is the National Pollutant Discharge Elimination System (NPDES) permit. In theory, all point sources must have an NPDES

permit before discharging pollutants to surface waters. In practice, however, many dischargers (mostly smaller ones) still do not. The NPDES permit, which is issued after public notice and an opportunity for comment, is to incorporate all of the various requirements of the act – including discharge limits – that are applicable to the point source in question. Point sources are subject both to technology-based and water quality-based limits and to the more stringent of the two when they overlap.

In addition, the act created an oil and hazardous substance spill program that served as a model for the 1980 Superfund hazardous waste remediation statute. Under the CWA program, point sources (including vessels) that spill significant quantities of oil or other hazardous substances onto the surface waters may be held liable for the cost of cleanup and also be subjected to monetary penalties. This application of the polluter pays principle had perhaps its most famous use in compelling British Petroleum to finance a cleanup of the Gulf of Mexico after the 2010 Deepwater Horizon oil spill. In 1990, Congress added a complementary oil spill program under the separate (but related) Oil Pollution Act (OPA), which was enacted in response to the 1989 Exxon Valdez oil spill in Prince William Sound, Alaska. The OPA was intended to streamline federal oil spill response law so as to provide quick and efficient cleanup of oil spills, to compensate victims of such spills, and to internalize the costs of spills within the petroleum industry. The OPA imposes strict liability on parties responsible for the discharge of oil.

National technology-based effluent limitations The technology-based limits are established by the EPA as national standards. To set these standards for industrial dischargers, the EPA first divided industry into various industry categories and then established effluent limits for each category based on its assessment of what was technologically and economically feasible for the point sources within that category. Further, as required by the act, the EPA set different standards within each industrial category for conventional pollutants (biochemical oxygen demand, fecal coliform, oil and grease, pH, and total suspended solids), toxic pollutants (currently a list of 129 designated chemical compounds), and nonconventional pollutants (which simply are other pollutants, such as total phenols, which are listed under neither the conventional nor the toxic designation).

In recognition of the fact that conventional pollutants usually are amenable to treatment by the types of pollution control equipment that have long been in use at conventional sewage treatment facilities, the standards for conventional pollutants are set according to what can be obtained through the use of the Best Conventional Pollution Control Technology (BCT), taking into account the reasonableness of the cost. The standards for toxic and nonconventional pollutants, on the other hand, are set according to the EPA's determination of the level of pollution reduction that can be achieved through the application of the Best Available Technology Economically Achievable (BAT). (See Section 9.7 for a discussion the trade-off (or technology options) analysis framework that could be used as an alternative to BCT and BAT.)

Originally, Congress had directed the EPA to set health-based standards for toxic pollutants, on a pollutant-by-pollutant basis, but this resulted in only a handful of standards (mostly for pesticide chemicals). The political difficulty of establishing national health-based standards for toxic chemicals led environmental groups, in a suit against the EPA to compel regulation, to agree to a schedule for setting technology-based standards for a list of 129 designated toxic pollutants. Congress formally endorsed this approach in 1977 by amending the act to require the EPA to set BAT standards for all of the toxic pollutants on that list.

Under the CWA, the EPA is to consider both control and process technology in setting BAT standards, which are to “result in reasonable further progress toward the national goal of eliminating the discharge of all pollutants” and are to require “the elimination of discharges of all pollutants [where] such elimination is technologically and economically

achievable." An individual discharger may obtain a cost waiver from BAT standards for nonconventional pollutants if it cannot afford to comply, but no cost waiver is available from the standards for toxic pollutants. For new industrial sources within an industry category, the EPA is to set standards based on Best Available Demonstrated Technology (BADT), which can be more stringent than BAT or BCT because of the greater technological flexibility inherent in the design and construction of a new facility. Although industry-wide costs are to be considered by the EPA in establishing BADT standards, no waivers are available to individual applicants once the standards are set.

The CWA also imposes technology-based standards on POTWs, based on the limitations that can be met through the application of secondary sewage treatment technology. In essence, this requires an 85 percent reduction in biochemical oxygen demand and total suspended solids. In addition, the act imposes limitations on discharges by industrial sources into POTWs. Such discharges are known under the act as indirect discharges (because the pollutants are not discharged directly to surface waters but rather are discharged indirectly to surface waters through a public sewer system). Limitations on indirect discharges are known under the act as pretreatment standards, because they have the effect of requiring the indirect discharger to treat its wastewater before discharging it to the POTW for further treatment. The EPA has set national technology-based limitations (known as the categorical pretreatment standards) on indirect discharges of toxic pollutants by firms in certain industrial categories. In addition, the act requires the POTW to set such additional pretreatment limits and requirements as is necessary both to ensure the integrity of the sewage treatment process and to prevent the indirectly discharged pollutants from passing through the sewer system and causing a violation of the POTW's discharge permit.

Ambient water quality standards and water quality-based effluent limitations For the first 15–20 years of the act's implementation, the primary focus was the establishment and implementation of the technology-based limits discussed above. More recently, however, considerably more attention has been given to the act's system of water quality-based limits, which is equally applicable to industrial sources and POTWs. Since 1972, the CWA has directed the states to establish, and periodically revise, ambient (in-stream) water quality standards for all of the lakes, rivers, streams, bays, and other waterways within their borders and has required the EPA to set and revise these standards to the extent that a state declines to do so. Further, the act has required since 1977 that NPDES permits include such additional discharge limits – beyond the national technology-based limits – as may be necessary to meet the ambient water quality standards of the waterway in question.

To help call attention to these water quality requirements, Congress in 1987 added what became known as the toxic hot spot provision of the CWA, which directed the EPA and the states to identify those waters that were in violation of ambient water quality standards because of toxic pollution, to identify those point sources whose discharges of toxic pollutants were contributing to those violations, and to develop an "individual control strategy" for that source (which almost always meant a revision of the source's NPDES permit to add or tighten limits on toxic pollutants). Another provision of the act that has prompted the addition or tightening of water quality-based discharge limits has been the requirement that the states (and, if they decline, the EPA) calculate a total maximum daily load (TMDL) for all waters that are in violation of ambient water quality standards. For any particular body of water, the TMDL for a particular pollutant is the total amount of that pollutant that may be discharged to the water body in a day without violating the relevant ambient water quality standard. When a TMDL is set, it often leads inexorably to a tightening of the NPDES permits of those point sources whose discharges are contributing to the particular violation of water quality standards. Although the TMDL requirement has been in the act since 1972, the states and the EPA were slow to implement it. Over the

past twenty years or so, however, as a result of several successful suits by environmental groups seeking to compel the EPA to set TMDLs in the face of state inaction, the TMDL requirement has come considerably more to the fore. Consequently, the inclusion of water quality-based limits in NPDES permits has become more commonplace.

9.6.2.3.2 THE SAFE DRINKING WATER ACT (1974, 1986, 1996)

Although many sources of drinking water are regulated as surface waters under the CWA, the legislation specifically designed to protect the safety of the drinking water actually delivered to the public from public water systems is the Safe Drinking Water Act (SDWA). Passed in 1974 after a series of well-publicized stories about the number of potential carcinogens in the Mississippi River water used as drinking water by the City of New Orleans, it contains very little that is designed to address the sources of drinking water pollution. Instead, the SDWA directs the EPA to set national health-based goals – known as maximum contaminant level goals (MCL goals) – for various drinking water contaminants and to set MCLs that are as close to the MCL goals as is technologically and economically feasible. All public water systems, defined as those with at least fifteen service connections or that serve at least twenty-five people, are required to meet the MCLs.

Over the act's first eight years, the EPA set only twenty-three federal drinking water standards. Dissatisfied with the pace of implementation, Congress amended the act in 1986 to spur the agency into action. It directed the EPA to set standards (MCLs and MCL goals) for eighty-three specified contaminants within three years and to set standards for twenty-five additional contaminants every three years thereafter. Ten years later, with scores of MCLs and MCL goals now on the books, Congress scaled back. In a 1996 compromise endorsed by environmental groups and water suppliers alike, Congress eliminated the requirement for twenty-five new standards every three years. At the same time, it added provisions that effectively ensured both that the standards that had been set would largely be allowed to remain in place and that new standards would be far slower in coming (and likely would be relatively weaker because of the addition of a cost-benefit requirement).

Since then, the primary focus of the SDWA program has been bringing public water systems throughout the country into compliance with the existing standards. Although the MCLs are set at a level deemed to be technologically and economically feasible, many water systems have had difficulty affording the cost of meeting, and monitoring compliance with, the MCLs. To attempt to ameliorate the financial burden on municipal water systems, the SDWA has periodically made federal funds available for technology upgrades and infrastructure improvements. The task, however, remains a daunting one. In 2013, the EPA (2013) estimated that approximately \$384.2 billion would be needed over the next twenty years to upgrade the nation's 52,000 community water systems. These water systems serve just under 300 million people (ACSE 2017). Around one-fifth (17 percent) of these systems supply water to 92 percent of the total population, with the remaining population being served by small systems that face technical, managerial, and financial challenges and frequently violate the SWDA (*ibid.*).

9.6.2.4 *The land and subsurface waters*

Broadly speaking, the disposal of hazardous wastes on or into the ground, and thus directly or potentially into groundwater, is regulated by the interaction of two federal statutes. The primary federal law regulating the generation, handling, and disposal of hazardous wastes is officially known as the Solid Waste Disposal Act. In 1970, Congress amended that statute with the Resource Conservation and Recovery Act (RCRA), and the law has come to be popularly known by that name. In 1980, Congress added a separate

statute – popularly known as the federal Superfund law – to compel the remediation of sites that have become contaminated with hazardous waste. Together, these statutes have tended to make the generation of hazardous waste increasingly expensive.

9.6.2.4.1 THE RESOURCE CONSERVATION AND RECOVERY ACT (1976, 1984)

RCRA was given regulatory teeth in 1976 with a set of amendments under which the EPA, in 1980, promulgated regulations establishing a cradle-to-grave system for hazardous wastes that tracks the generation, transportation, and disposal of such wastes and establishes standards for their disposal. Initially, however, the EPA's disposal standards were minimal to nonexistent and did little to discourage the landfilling of chemical wastes. This led Congress, in 1984, to pass sweeping amendments to RCRA that (1) established a clear federal policy against the landfilling of hazardous wastes unless they have first been treated to reduce their toxicity, and (2) gave the EPA a specific timetable by which it had to either set treatment standards for various categories of waste or ban the landfilling of such waste altogether. Consequently, the EPA has set treatment standards – which are commonly known as the land disposal restrictions (LDRs) – for hundreds of types of hazardous wastes. These standards are based on the EPA's assessment of the Best Demonstrated Available Technology for treating the waste in question.

Thus, RCRA *directly* regulates the handling and disposal of hazardous wastes. And by establishing a set of requirements that must be followed once hazardous waste is generated, it also *indirectly* regulates the generation of hazardous wastes. RCRA regulations have increased the cost of disposing of most types of waste by two orders of magnitude over the past twenty-five years. In this sense, RCRA operates as a *de facto* tax on the generation of hazardous waste.

However, RCRA does not extend full regulatory coverage to all harmful industrial wastes. For example, a range of oil and gas exploration and production wastes are exempted from regulation as hazardous waste. This serves to exclude many wastes from hydraulic fracturing (commonly known as fracking) operations seeking to extract underground quantities of natural gas or oil. Such wastes are still subject to RCRA regulation under the less comprehensive provisions applicable to solid wastes, however. Moreover, the disposal of such wastes in subsurface storage wells – as well as the use of diesel in the fracking process – is subject to regulation under an underground injection control program administered by the EPA under the Safe Drinking Water Act.

9.6.2.4.2 THE COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION, AND LIABILITY ACT (1980, 1986)

Another statute that acts as an indirect check on hazardous waste generation (and that provides additional incentive to ensure that one's waste is safely disposed) is the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA, also known as the federal Superfund law). The primary focus of this law is the remediation (cleanup) of hazardous waste contamination resulting from imprudent handling and disposal practices of the past and the recovery of remediation costs from those designated as "responsible parties" under the act. CERCLA imposes liability for the costs of remediating a hazardous waste site both on the owners and operators of the site and on those generators of hazardous waste that sent waste to the site.

Because the owners and operators are often business entities that are no longer financially viable, CERCLA liability often falls most heavily on the hazardous waste generators. CERCLA liability is also strict liability, meaning that the exercise of reasonable care by the generator is not a defense. Further, unless the generator can establish a convincing factual basis for distinguishing its waste from all or part of the contamination being remediated,

CERCLA liability is joint and several, meaning that each responsible party is potentially liable for the full cost of remediation. As a practical matter, this means that the cost of remediation will be borne by those among the responsible parties who are financially solvent. The prudent business entity, then, has a strong financial incentive to take such actions as will minimize the likelihood that it will face CERCLA liability in the future. As the only certain way to avoid such liability is to refrain from generating the waste in the first instance, CERCLA does provide a rationale for pollution prevention. Further, it provides firms with an incentive to meet – or perhaps to go beyond – RCRA regulations in dealing with such wastes that they do generate.

This is not to say, of course, that substantial amounts of hazardous waste are no longer generated in the United States, that all hazardous wastes are adequately treated and safely disposed, or that all instances of hazardous waste contamination are being adequately addressed (or addressed at all). RCRA and CERCLA both contain what might reasonably be called loopholes and gaps in coverage, and hazardous waste contamination remains an ongoing issue. Further, the most common treatment methodology incorporated into the EPA's RCRA treatment standards is incineration, which has brought with it a release of airborne contaminants that is only partially addressed by regulation. There is no question, however, that the country has made considerable progress from the late 1970s, when disposal of chemical wastes in unlined landfills – at a cost of roughly \$15 per ton – was the common practice.

9.6.3 *Chemical-based statutes*

Other federal anti-pollution statutes have been directed at protecting humans and/or the environment from exposure to particular chemicals or to chemicals put to particular uses. We briefly discuss some of the major examples below.

9.6.3.1 *The Emergency Planning and Community Right to Know Act (1986)*

In 1986, two years after a deadly industrial chemical accident in Bhopal, India, Congress passed the Emergency Planning and Community Right to Know Act (EPCRA), a comprehensive federal community right-to-know program implemented by the states under guidelines promulgated by the EPA. The central feature of this federal program is broad public dissemination of information pertaining to the nature and identity of chemicals used at commercial facilities. In essence, the statute attempts to make far more transparent the use and release of potentially dangerous chemicals by industry, with a primary goal of creating community pressure for reducing the release of these chemicals into each of the media discussed above, and a secondary goal of providing communities with information that should assist them in minimizing harm should a chemical accident occur at a nearby facility.

The implementation of EPCRA began with the creation of state and local bodies to implement this community right-to-know program. The governor of each state was directed to appoint a “state emergency response commission” (SERC), to be staffed by “persons who have technical expertise in the emergency response field.” In practice, these state commissions have tended to include representatives from the various environmental and public health and safety agencies in the state. Each state commission in turn was required to divide the state into various “local emergency planning districts” and to appoint a “local emergency planning committee” (LEPC) for each of these districts. These state and local entities are responsible for receiving, coordinating, maintaining, and providing access to the various types of information required to be disclosed under the act.

EPCRA established four principal chemical reporting requirements. All facilities that manufacture, process, use, or store certain “extremely hazardous substances” in excess of certain quantities are to provide “emergency” notification to the SERC and the LEPC of an unexpected release of one of these substances. Facilities covered by the OSHA Hazard Communication Standard must prepare and submit to the LEPC and the local fire department material safety data sheets for chemicals covered by the OSHA standard. Many of these same firms are required to prepare and submit to the LEPC an “emergency and hazardous substance inventory form” that describes the amount and location of certain hazardous chemicals on their premises. Finally, firms in the manufacturing sector must provide to the EPA an annual reporting of certain routine releases of enumerated hazardous substances. These reports comprise what is known as the Toxics Release Inventory (TRI). In addition, certain commercial facilities are required to cooperate with their respective LEPCs in preparing emergency response plans for dealing with major accidents involving hazardous chemicals. The applicability of these provisions to any particular facility depends on the amount of the designated chemicals that it uses or stores during any given year.

These requirements constitute a broad federal declaration that firms choosing to rely heavily on hazardous chemicals in their production processes may not treat information regarding their use of those chemicals as their private domain. Indeed, except for trade secrecy protections that generally parallel those available under the OSHA Hazard Communication Standard, there are no statutory restrictions on the disclosure of EPCRA information to the general public. The act mandates that most of the information subject to EPCRA reporting requirements “be made available to the general public” upon request and requires each local emergency planning committee to publicize this fact in a local newspaper.

9.6.3.2 The Toxic Substances Control Act (1976, 2016)

9.6.3.2.1 THE FIRST FORTY YEARS

The Toxic Substances Control Act (TSCA), passed in 1976, was envisioned as an omnibus chemical law that would allow the EPA both to obtain information about new and existing chemicals and to regulate the production, use, and/or disposal of those chemicals that pose an “unreasonable risk of injury to health or the environment.” The law extends to all “chemical substances” (and “mixtures” of chemical substances), which it defines broadly enough to include almost all substances except those that are explicitly exempted: pesticides, tobacco, radioactive materials, alcohol, foodstuffs, cosmetics, and pharmaceuticals (all of which are regulated under separate authorities). Given the breadth of TSCA’s mandate, the EPA has used the statute as a means of regulating bioengineered substances and nanotechnology, as well as more “traditional” chemical substances.

TSCA authorizes the EPA to order the manufacturer to conduct health and safety testing of new or existing chemicals under certain prescribed circumstances and to report the results of such testing to the agency. The act also authorizes the EPA to require industry to provide data on the production, use, and health and environmental effects of chemicals. TSCA contains a pre-market notification – but not pre-market screening – process for new chemicals and for existing chemicals put to a significant new use. Manufacturers of such chemicals must file a premarket notification (PMN) with EPA. Clearance of a chemical for commercial use proceeds automatically if the EPA does not take regulatory action to limit production, use, or exposure within 90 days (or 180 days if the EPA chooses to extend the period) or to require more information before introduction of the chemical into commerce. The EPA may also order a specific change in chemical process technology. In

addition, TSCA gives aggrieved parties, including consumers and workers, specific rights to sue to enforce the act, and to petition the EPA for regulatory action.

The EPA's authority to regulate chemicals under the 1976 act was theoretically broad – including the power to impose a ban on production and use – but was dependent on the EPA's first determining that the chemical “presents or will present” an unreasonable risk. Although “unreasonable risk” was undefined in the statute, TSCA did specify that the EPA “shall consider the environmental, economic, and social impact of any action” taken under the statute, which suggested an obligation to evaluate the costs and benefits of a proposed regulation. Congress also made what was essentially a statutory finding that polychlorinated biphenyls (PCBs) pose an unreasonable risk, as TSCA specifically directed the EPA to regulate, and phase out, PCBs. Of the EPA's twenty-two regulatory actions under TSCA directed at existing chemicals between 1977 and 1990, fifteen addressed PCBs.

Moreover, the potentially powerful role of TSCA regulation was dealt a serious blow in 1991, when the U.S. Court of Appeals for the Fifth Circuit overturned an asbestos phase-out rule issued by the EPA under TSCA. Citing language in TSCA that required the EPA to use “the least burdensome requirements” necessary to protect against unreasonable risks, the court held that the EPA erred in issuing a ban on asbestos without having first considered the costs and benefits of each regulatory alternative that would have been less burdensome to industry.* This arguably would require the agency to perform a comprehensive, detailed, and resource-intensive alternatives analysis prior to regulating chemicals under TSCA, something which the plain text of TSCA did not require. As noted by Harvard's Cass Sunstein (2017, p. 19), who is in general a strong advocate of using cost–benefit analysis in deciding whether and to what extent to regulate chemicals,

it is not at all obvious that the court was right. An agency's obligation to use the least burdensome alternative does not, by itself, require a quantitative analysis of the costs and benefits of that alternative, even under a statute that requires cost–benefit analysis of the ultimate policy choice.

Nonetheless, the EPA viewed this case (which was not appealed to the U.S. Supreme Court) as a prohibitive obstacle to future TSCA regulations, and the agency generally thereafter regarded standard-setting for chemicals other than PCBs to be a nearly impossible task.

While some may not agree, a more determined EPA might have avoided this result. The EPA's reluctance to go back to the Fifth Circuit with an extensive analysis of the costs and benefits of each alternative to an asbestos ban is understandable in terms of the agency resources needed to do so. But allowing twenty-five years to pass without a single attempt at challenging the Fifth Circuit's rationale in another circuit court – in another case, involving another chemical – is not. Indeed, the Fifth Circuit itself stressed that TSCA did not require “an exhaustive, full-scale cost–benefit analysis,” which arguably left the door open for a favorable review of new TSCA regulation even in that court.

TSCA's testing authority was also compromised by the EPA's reluctance to establish testing rules, and its tendency to instead negotiate testing agreements with industry which avoided statutory deadlines. To date only five chemicals have been banned under TSCA (Ashford 2017) and 600 await the completion of risk evaluations (Erickson 2017).

Indeed, perhaps the most significant regulatory advance under TSCA during this period came at the specific direction of Congress. Although the EPA had declared formaldehyde a probable carcinogen and the International Agency for Research on Cancer classified it as a confirmed human carcinogen, the EPA initially chose not to address the substance

* *Corrosion Proof Fittings v. EPA*, 947 F.2d 1201 (5th Cir. 1991).

under TSCA, opting instead to defer to OSHA workplace regulations. However, Congress ultimately intervened in 2010, probably influenced by the government's reluctance to house Hurricane Katrina refugees in trailers containing formaldehyde particle-board, and added a new Title VI to TSCA establishing national limits for formaldehyde emissions from composite wood products, mirroring standards previously established by the California Air Resources Board for products sold, used, or manufactured for sale in California.

9.6.3.2.2 THE 2016 AMENDMENTS

A more ambitious congressional “fix” of TSCA came in 2016 (the fortieth anniversary of the original act), when the chemical industry teamed with a portion of the environmental community to persuade a bipartisan congressional majority to make sweeping changes to the core of the act. The revised TSCA makes a clear demarcation between risk assessment and risk management – prohibiting the consideration of costs and benefits at the risk assessment stage but requiring consideration of those factors during the risk management stage – and also seeks to focus the EPA's attention on the most serious risks. The EPA is directed to establish “a risk-based screening process, including criteria for designating chemical substances as high-priority substances for [subsequent] risk evaluations or low-priority substances for which risk evaluations are not warranted at the time.” The amended statute defines as “high-priority” chemicals those that the EPA

concludes, without consideration of costs or other nonrisk factors, may present an unreasonable risk of injury to health or the environment because of a potential hazard and a potential route of exposure under the conditions of use, including an unreasonable risk to a potentially exposed or susceptible subpopulation identified as relevant.

The agency is then required, according to a specified timeframe, to perform a risk evaluation for each chemical designated as a high-priority substance, to determine whether the chemical actually poses an unreasonable risk.

As before, “unreasonable risk” is not defined. Rather, the EPA is directed to determine whether, “under the conditions of use,” the chemical substance “presents an unreasonable risk of injury to health or the environment, without consideration of costs or other nonrisk factors, including an unreasonable risk to a potentially exposed or susceptible subpopulation identified as relevant to the risk evaluation.” In eschewing consideration of “nonrisk factors,” the amendments essentially transform the “unreasonable risk” determination into a “significant,” “substantial,” or “serious” risk determination. While this allows the agency to focus on the degree of potential harm, it may also mask the opportunity to strengthen the market for safer chemicals. For example, if a chemical is found to pose a moderate risk, the EPA might decide to declare a “reasonable” risk based solely on the chemical's projected level of harm. However, if the agency took into account the wide availability of a safer substitute chemical, the chemical under review might very well be deemed to pose an unreasonable risk (because the risk could be reduced by substituting the safer chemical). For this reason, it is hoped that the EPA does not characterize the availability of substitutes as a “nonrisk factor.”

Moreover, in limiting the determination to whether the chemical “presents” an unreasonable risk and removing the original statutory requirement that the EPA also regulate chemicals that “will present” an unreasonable risk, the amended statute arguably restricts the EPA's ability – and obligation – to be proactive and to look beyond current uses of a chemical. This concern may be offset by the revised statute's directive to the EPA to consider “the circumstances [. . .] under which [. . .] a chemical [. . .] is [. . .] reasonably foreseen to be [. . .] used.” As this book goes to press, however, the Trump administration

has indicated that the EPA's review will not even consider all *current* uses of a chemical. Finally, if the agency reads its mandate to conduct a risk evaluation as requiring a full, formal, science-based risk *assessment* before a chemical can be deemed to pose an unreasonable risk, it may limit its unreasonable risk findings to chemicals for which full testing has already been done, meaning that fewer chemicals are likely to cross the threshold for mandatory risk reduction. The lack of explicit reference to the precautionary principle in the revised statute may also encourage the agency to insist on stringent criteria for determining unreasonable risk. This concern could be moderated if the EPA makes use of its authority to issue testing rules (with incorporated timelines) for high-priority chemicals, but this depends on the willingness of the agency to take this step.

If the EPA makes the determination that a chemical does present an unreasonable risk, the agency is required to regulate that chemical, according to a specified timeframe, "to the extent necessary so that [sic] the chemical substance or mixture no longer presents such risk." The afore-mentioned requirement that the EPA select "the least burdensome requirements" to accomplish that goal has been deleted. However, the EPA is required to consider, "to the extent practicable," (1) the benefits of the substance, (2) reasonably ascertainable economic consequences of the rule, (3) the costs, benefits, and cost-effectiveness of the proposed action as weighed against at least one regulatory alternative, and (4) in the case of a ban or phase-out, whether "technical or economically feasible alternatives" will be available as a substitute. While these considerations do not override the primary requirement to eliminate the unreasonable risk (defined without respect to costs and nonrisk factors), they do add time-consuming complexity to the EPA's analysis, thus raising the specter of the regulatory inertia that has plagued TSCA in the past. Further, simply shifting economic concerns to the risk management stage does nothing to address the practical reality that economic considerations will often trump public health and environmental protection.

Chemicals subject to the PMN process – new chemicals or existing chemicals put to a significant new use – are targeted for an expedited review process. The EPA is required to review such chemicals as part of the PMN process and determine whether they pose an unreasonable risk. If the agency determines that such a chemical (1) presents an unreasonable risk, (2) may present an unreasonable risk, or (3) will be produced in large amounts and will result in large releases or exposures, or if the agency determines that it lacks sufficient information to make a reasoned evaluation as to the extent of the chemical's risk, the EPA must impose restrictions to the extent necessary to protect against any such risk. This gives the agency a stronger obligation to regulate (and/or require testing of) new chemicals, but a timid or business-friendly EPA could avoid this obligation simply by concluding that there is no unreasonable risk to reduce.

In summary, it is unclear whether the 2016 TSCA will advance the protection of consumers, workers, or the general public. Ashford (2016) warned that serious flaws existed in the proposed reforms, and these flaws largely persist in the version ultimately passed by Congress (Ashford 2017). In addition, the revised TSCA preempts more stringent state regulation of chemicals, which threatens to weaken protection in some states (Polsky 2016).

It is certainly conceivable that an administration dedicated to implementing environmental laws and willing to exercise its discretion towards the protection of public health could use the revised act to make some real progress on chemical safety. For example, if the EPA were to aggressively promote safer substitutes for chemicals found to pose an unreasonable risk, a greater number and variety of environmentally superior chemicals might emerge. Further, TSCA and the OSH Act, used together, could still provide potentially comprehensive and effective information-generation and standard-setting authority to protect workers. In particular, the information-generation activities under TSCA could provide the necessary data to have a substance qualify as a "recognized hazard" under

the OSH Act that, even in the absence of specific OSHA standards, must be controlled in some way by the employer to meet the general duty obligation under the OSH Act's requirement that the employer provide a safe and healthful workplace.

9.6.3.3 *Chemicals in pesticides, food additives, pharmaceuticals, and consumer products*

It has long been recognized that pesticides – which are valued precisely *because* they can kill certain species of animals or plants – pose a potential risk to human health and the environment. Similarly, food additives and pharmaceuticals (therapeutic drugs) have long been of public health interest because they are directly ingested by humans. Federal statutes addressing all three date far back into the twentieth century, and have gradually evolved to a similar approach: the pre-market screening of new products, with the burden of establishing the requisite margin of safety placed on the manufacturer.

Pesticides: The Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), which has been substantially amended a number of times, most recently in 1988, began as a law designed to ensure the efficacy of pesticide products. As concern over the environmental effects of pesticides grew – spurred by Rachel Carson's influential book *Silent Spring* (1962; see Chapter 2) – Congress moved to recraft the statute as a means of protection from, as well as promotion of, pesticides. FIFRA regulates the production and use of pesticides, requires manufacturers to meet certain standards for safety and efficacy before marketing new pesticides, and allows the EPA to remove existing pesticides from the market under certain circumstances. Throughout, the burden is on the manufacturer or commercial supplier to establish that the pesticide does not generally cause “any unreasonable risk to [humans] or the environment, taking into account the economic, social, and environmental costs and benefits of the use of [the] pesticide.” The EPA's often relaxed administration of FIFRA has been widely criticized by environmental and public health groups, and the act contains several provisions that allow unsafe pesticides to remain in use. Pesticide manufacturers, on the other hand, complain that the tests that the EPA requires them to conduct before they are allowed to broadly market new products can cost in excess of \$20 million per pesticide. From a long-term societal perspective, however, the most telling criticism of FIFRA may be that – at least as presently administered – it does little to promote a transition to a more sustainable form of agriculture. The act's risk–benefit approach would appear to provide an *opportunity* for such promotion, as the relative benefit of a dangerous chemical pesticide diminishes when safer substitutes, such as integrated pest management approaches, are available to farmers. Thus far, however, the EPA has not used FIFRA in this manner.

Food additives and drugs: Food additives (e.g., chemicals added to foods as preservatives, stabilizers, or to enhance flavor) and pharmaceuticals are both regulated by the Food, Drug, and Cosmetic Act (FDCA), which is administered by the Food and Drug Administration (FDA). Like FIFRA, the FDCA incorporates a pre-market screening process for new products. The system for pharmaceuticals, like FIFRA's for pesticides, employs a risk–benefit approach and requires manufacturers to compile data on both safety and efficacy. In general, then, new drugs are allowed onto the market if their value to the people who will take them is adjudged to be greater than the risk to those persons (and to the population as a whole). The FDCA's regulation of food additives, however, is based on safety alone. The manufacturer of a new food additive is required to bring forth data demonstrating that the additive is “safe” under its conditions of use, which has generally been interpreted as requiring a showing of a “reasonable certainty” of no harm. Further, the act specifically provides that no additive can be deemed “safe” if it has been shown to cause cancer in humans or animals. This latter provision, placed into the law in 1958, was an early – if somewhat modest – application of the precautionary principle. Sweeping aside arguments that certain cancers have a nonzero safety threshold, that cancer causation in an animal

test may not presage cancer causation in humans, or that cancer causation through a different route of exposure may not indicate cancer causation through human ingestion, Congress declared a strong preference for being risk averse in the face of uncertain data. Despite this safety-based approach, however, the FDCA has allowed food additives on the market, such as aspartame, whose long-term effects, especially over a large population of consumers, are controversial. Indeed, many have criticized the FDCA's approach to food additives precisely because it is based on safety alone, with no requirement to demonstrate either that the additive does what it is purported to do or that its purported function is something that is *needed*. If the manufacturer were required both to demonstrate the benefit of the additive and to show that this benefit outweighs the potential risks, the law might actually do more to promote safe and healthful foods.

Consumer products: Toxic materials in consumer products in general are regulated by the Consumer Products Safety Act (CPSA) and the Federal Hazardous Substances Act. The CPSA was enacted with considerable fanfare in 1972, with the common expectation that it would do for consumer protection what the various environmental protection statutes were doing for human health and the environment. The reality has been far different. The act created the Consumer Products Safety Commission (CPSC) and charged it with a broad mandate to ensure the safety of consumer products, but the impact of the CPSC has been far less pronounced than that of the EPA, OSHA, or the FDA.

Like the program for pesticides and pharmaceuticals, the CPSA relies on risk–benefit (or risk–utility) analysis to trigger regulation. If the CPSC finds that a product poses “an unreasonable risk of injury” – that is, if the risk of a consumer product outweighs its utility – the commission is empowered to issue a consumer product safety standard either imposing conditions for the product's safe use or, if no such conditions can be found, banning the product. Unlike the provisions for pesticides and pharmaceuticals, however, the CPSA does not require pre-market screening. Perhaps because this same risk–utility standard is already employed in the common law tort system for products liability that has long been the primary driver of product safety in the U.S., and certainly because CPSC has never found a champion among the many presidential administrations it has served, the CPSA has been far more useful as a generator of information on consumer product safety than as a regulator of consumer products.

This has been especially true with regard to products that pose potential toxic chemical hazards. While the courts have made clear that a small individual risk of a great harm (such as cancer) can be an “unreasonable” risk, they have also emphasized that the burden is on the CPSC to establish that risk with substantial evidence. This was made clear to the CPSC in the early 1980s, after it issued a standard banning the use of urea-formaldehyde foam insulation in new construction. The CPSC took this action after an industry-funded research lab conducted a long-term study indicating that formaldehyde causes cancer in rats (the test animals used in the study). The International Agency for Research on Cancer subsequently confirmed that the study was performed in accordance with accepted protocols, and issued its own finding that formaldehyde is a probable human carcinogen. Nonetheless, the Fifth Circuit Court of Appeals struck down the CPSC's formaldehyde standard, ruling that reliance on a single study was not “good science.” The court also cited a provision in the CPSA stating that the CPSC must use the Federal Hazardous Substances Act (FHSA) unless it can make a showing that regulation under that statute would be inadequate. The federal government – then administered by the popular and avowedly anti-regulatory President Ronald Reagan – chose not to appeal that decision, and thereafter the CPSC generally confined its regulation of toxic chemical hazards to the FHSA, which operates largely through mandated product labeling and warnings (but not safety standards).

The 2006 amendments to the CPSA, however, signaled something of a change of course. The amendments repealed the direct statutory preference for the use of the FHSA for toxic products and sought to bring renewed attention to the use of the CPSA to address

those hazards. Also, by directing the CPSC to take specific actions with regard to products containing lead and certain phthalates, Congress both spurred the commission to action with regard to those products and made it easier for its regulation of those products to withstand court challenge. As with TSCA and its mandate to regulate PCBs, a specific congressional mandate to take particular actions with regard to particular hazards is perhaps the most reliable way to prompt agency action. It remains to be seen if the CPSC will build upon this mandate to promulgate regulations that more broadly encourage the substitution of known and suspected toxicants in consumer products with safer substitutes.

9.6.4 Laws integrating pollution reduction into federal decision-making

Recognizing that the policies and programs of the federal government often set the tone both for private industries and for state governments, and that the activities of the federal government can themselves have profound effects on environment and human health, Congress has endeavored, with varying degrees of success, to orient government programs toward measures that will reduce, rather than increase, pollution. We address the three most important of these below.

9.6.4.1 The National Environmental Policy Act (1969) and the Endangered Species Act (1973)

The first of such statutes, and the first of the major modern environmental initiatives passed by Congress, was the National Environmental Policy Act (NEPA), which was joined four years later by a revitalized Endangered Species Act (ESA). Although both have had significant implications for private industry, each has as its primary focus the policies and programs of the federal government, and each seeks to instill federal agencies and instrumentalities with an appreciation for environmental amenities.

The National Environmental Policy Act acknowledges “the critical importance of restoring and maintaining environmental quality to the overall welfare and development” of society and imposes on federal agencies a general obligation to develop and operate their programs so as to attain a number of broadly phrased goals, including fulfillment of “the responsibilities of each generation as trustee of the environment for future generations.” NEPA also declares it an overall national policy “to create and maintain conditions under which [humans] and nature can live in productive harmony.” Arguably, this presupposes a gradual evolution toward a more sustainable economy, when trade-offs between human advancement and the environment will be far less necessary.

While these declarations of policy are of strong thematic importance, their implementation is both difficult to measure and difficult to enforce. To help with these issues, NEPA created the federal Council on Environmental Quality (CEQ), which is charged with advising the president on matters of the environment and gathering and publishing data on the quality of the environment. Annual CEQ reports received considerable attention during the 1970s, but with the increasing importance of the EPA and the burgeoning public and private sources of information on the environment, CEQ’s influence has waned over the years. And, not surprisingly, the relevance and importance of NEPA’s goals and principles to overall federal policy has tended to wax and wane with the respective viewpoints of the various presidential administrations.

One aspect of NEPA that has retained considerable vitality and influence though the years, however, is the requirement that federal agencies and instrumentalities conduct an environmental review before embarking on programs or projects likely to have an environmental impact, and that they prepare a formal, detailed environmental impact statement (EIS) before undertaking a major federal project that is likely to have a

significant impact on the environment. Except where exempted by other statutes, this requirement applies broadly to prospective federal regulations and projects, including private projects that require a federal license to proceed. As a practical matter, this often means that the EIS, when required, is prepared by private consultants hired by the private party seeking the federal license. While the Supreme Court has held that NEPA imposes no substantive obligation to take any particular action in response to the findings of an EIS, the court has also made clear that the requirement to perform a meaningful EIS must be followed, and that the EIS must consider a reasonable array of alternatives to the proposed federal action if they would reduce the overall environmental impact. Thus, the EIS process – while by no means a guarantee of an environmentally protective outcome – provides an opportunity for those favoring interests to make their case known to the government.

One of the reviews typically conducted during a NEPA environmental evaluation is a consideration of how the contemplated project may affect imperiled animal or plant species. This is driven by the Endangered Species Act, which requires federal agencies and instrumentalities to consult with the National Marine Fisheries Service (NMFS) and/or the U.S. Fish and Wildlife Service (USFWS) to determine whether the contemplated action is “likely to jeopardize the continued existence of any threatened or endangered species,” and to take action to protect those species.

The ESA declares that the natural diversity of animal and plant species is “of aesthetic, ecological, educational, historical, recreational, and scientific value to the Nation and its people,” and establishes as “the policy of Congress” that “all federal departments and agencies seek to preserve” that diversity. To this end, the ESA charges NMFS and USFWS (commonly collectively referenced as “the Services”) with the duty to “list” (as “threatened” or “endangered”) animal and plant species that face potential extinction. The ESA imposes a duty on all federal agencies and instrumentalities to refrain from harming these species, and potential harm to these species triggers consultation with the Services. Moreover, the act prohibits *all* persons, including industrial actors, from committing a “take” of a member of an endangered species (e.g., by causing “harm”), and this prohibition is often extended to threatened species as well. There are provisions in the act that allow “incidental takes” to occur – such as where harm to a species is “incidental” to the operation of a factory – such authority commonly is conditioned on the taking of certain actions to protect and preserve the species in question.

The Services’ determination of what is, and what is not, “jeopardy” is often controversial (sometimes on both sides of the issue), but there is no doubt that the ESA provides a layer of environmental protection beyond that provided by NEPA and the various media-based statutes. And the reach of the ESA clearly extends to pollution-caused harm that may be enabled by federal decision-making. When various species of Pacific Salmon were listed under the ESA, for example, Clean Water Act ambient water quality criteria were scrutinized to determine whether the permissible pollutant concentrations posed harm to salmonid species.

9.6.4.2 *The Pollution Prevention Act (1990)*

The Pollution Prevention Act (PPA) endeavors to imbue the EPA and other federal agencies with a preference for pollution prevention and inherent safety and directs them to encourage both. The PPA declares it the “national policy” that pollution be addressed in a hierarchical fashion. First, “pollution should be prevented or reduced at the source whenever feasible.” Second, “pollution that cannot be prevented should be recycled in an environmentally safe manner, whenever feasible.” Third, “disposal or other release into the environment should be employed only as a last resort.”

The PPA uses the rubric of “source reduction,” which it defines as

any practice that (1) reduces the amount of any hazardous substance, pollutant, or contaminant entering any waste stream or otherwise released into the environment (including fugitive emissions) prior to recycling, treatment, or disposal; and (2) reduces the hazards to public health and the environment associated with the release of such substances, pollutants, or contaminants.

Explicitly included within the statutory definition are “equipment or technology modifications, process or procedure modifications, reformulation or redesign of products, substitution of raw materials, and improvements in housekeeping, maintenance, training, or inventory control,” while explicitly *excluded* is any practice that

alters the physical, chemical, or biological characteristics or the volume of a hazardous substance, pollutant, or contaminant through a process or activity which itself is not integral to and necessary for the production of a product or the providing of a service.

Thus, pollution prevention and primary accident prevention both come within the PPA’s definition of “source reduction.” On the other hand, recycling or reuse does not meet this definition unless it is done as part of a closed-loop production process (as is often done within the metal finishing industry, when metals are recovered at the end of the process and immediately returned to the beginning of the process).

Like NEPA, the PPA relies on mostly “soft” directives that rely on the willingness of the federal government to take them seriously and are more difficult to enforce through the courts. The act directs the EPA to evaluate its existing and proposed regulations to ensure their consistency with source reduction, to coordinate among its various offices and with other agencies to research and promote source reduction, and to establish a separate office to carry out these policies. The EPA did establish an Office of Pollution Prevention, but the tremendous potential of the PPA has yet to be realized. The EPA’s overall commitment to implementing the PPA has waned considerably since the early 1990s, as no presidential administration has wholeheartedly embraced the potential opportunities for fundamental change that the PPA represents. And now, and as this book goes to press, President Trump has announced plans to eliminate the Office of Pollution Prevention altogether.

Nonetheless, many industrial firms have found it in their economic interest to adopt pollution-prevention approaches because they can eliminate the need for waste handling, disposal, and treatment and can reduce pollution-control and abatement costs. However, these incentives are often absent with regard to the prevention of chemical accidents; because these events are both rare and not statistically predictable, the potential for rational behavioral changes premised on cost avoidance is much smaller.

Finally, the PPA amended EPCRA to require firms subject to TRI reporting to also report their “source reduction” (pollution prevention) and waste management practices on an annual basis.

9.7 Deciding the extent of intervention

9.7.1 Trade-off analysis distinguished from cost–benefit analysis

Those decision-makers who are influenced by neoclassical economics often rely on the use of cost–benefit analysis (CBA) as a decision outcome algorithm or rationale to decide whether and to what extent to exercise control over environmental, health, and safety

hazards (Ashford and Caldart 2008, Chapter 3). The problems with cost–benefit analysis are widely acknowledged and include:

- 1 The difficulty of monetizing health, safety, and environmental benefits based on inherently uncertain risk assessment and epidemiological data and on monetary values that are not well-established or agreed-upon (e.g., what is a human life or case of disease prevented worth?)
- 2 Using a discount rate to address far-future benefits (and deciding what rate to use);
- 3 Using costs of compliance generated by the regulated industry;
- 4 Failure to take learning and economies of scale into account (which tends to inflate costs);
- 5 Failure to take technological innovation (which changes, and can often reduce, costs) into account; and
- 6 Failure to delineate and distinguish who benefits and who bears the costs of a proposed regulation, i.e., failure to take distributional effects into account.

In contrast, trade-off analysis requires decision-makers to explore the trade-offs that are often obscured in tools such as cost–benefit analysis. Instead of aggregating a wide range of heterogeneous factors into a single monetary value, trade-off analysis keeps each factor in its natural units. The trade-off analysis approach can be characterized by a series of six steps outlined below (Ashford 1978, 2007; Hall et al. 2008).

Step 1 Define the problem: Describe the societal or technical problem in need of attention (for example, unmet needs or technical/institutional failure). Describe why the problem arose. Clarify the problem type (see Table 9.1) and describe why an intervention is required. Identify the key stakeholders.

Step 2 Describe previous efforts to address the problem: Describe any prior attempts to resolve/improve the problem, and discuss their inadequacy/failures in terms of:

- *Economics and markets*
 - inadequate and/or perverse incentives, prices, markets, institutional/organizational structure and behavior, free-rider problems, and unrecognized/unmet needs and demands
- *Legislation and political process*
 - inadequacy of existing legislation/regulations, lack of knowledge/enforcement thereof, and inadequate stakeholder involvement
- *Public/private sector management*
 - lack of adequate incentives or perverse incentives for, or commitment to, management of the problem
- *Technical system capabilities*
 - inadequacy of existing technology to address the problem or a lack of any suitable technological solution

Step 3 Identify instruments to promote change: Identify the tools, models, techniques, and approaches that could affect the willingness, opportunity/motivation, and capacity of the stakeholders (that is, industry, consumers, workers, citizens, government at all levels) to change (see Section 7.6 in Chapter 7).

Willingness

- towards change in general (rigidity)
- influenced by an understanding of the problem
- influenced by knowledge of options or solutions
- influenced by the ability to evaluate alternative courses of action

Opportunity/motivation

- presented by gaps in technological/scientific capacity
- possibility of economic cost savings or new/expanded market potential (competitiveness)
- consumer/worker/societal demands
- regulatory/legal requirements

Capacity

- influenced by an understanding of the problem
- influenced by knowledge of options or solutions
- influenced by the ability to evaluate alternative courses of action
- resident/available skills and capabilities

Step 4 Develop alternatives: Make a creative effort to formulate several alternative futures to address the problem, paying special attention to distributional inequalities. The alternatives should be developed in consultation with the stakeholder groups.* Formulate specific strategies (economic, legal, institutional, firm-based, societal-based, etc.) for each alternative to affect the willingness, opportunity/motivation, and capacity for change. If technology is an important part of the problem, consider ways to address the problem through technological advancement. The alternatives should consider the following:

- *Economics and markets*
 - changes in prices, markets, and industry structure
 - changes in demand
- *Legislation and the political process*
 - changes in law and political process (legislation, regulation, negotiation, and stakeholder participation)
- *Public/private sector management*
 - system changes related to organizational/institutional structure
 - changes in public and private sector activity
- *The technical system*
 - technological/scientific changes (options for R&D, innovation, and diffusion)

* A complementary step here is not only to consult with stakeholders to identify future positions/states of the world that represent solutions to the current problem, but also to use a participatory backcasting approach (see Section 8.4 in Chapter 8) and work backwards from these positions/states to identify a series of policies/choices to achieve this future. Adopting a participatory backcasting approach is recommended if a decision-maker/agency/community is confident of the desirability of future positions or states that are to be achieved (the targets of backcasting). However, if a single desired future is difficult to choose, a portfolio approach may be better since a variety of alternative futures can be investigated.

Table 9.1 Examples of problem types that can be addressed using trade-off analysis

<i>Problem types</i>	<i>Examples</i>
Informational: Problems relating to contradictory or uncertain scientific and technological information	Breast implants; missile defense systems
Technology: Problems relating to the adverse effects of technology on humans and the environment	Climate change; toxic chemicals
Technology development: Problems relating to the creation of technology in a socially beneficial way/direction	Genetically engineered crops
Undeveloped technology: Problems relating to the lack of technology available to meet unmet human needs	Rapid rail/transport systems; new cancer therapies
Accountability: Responsibility of scientists and engineers in industry and government	Challenger (space shuttle) accident; FDA clearance of questionable pharmaceuticals
Distributional: Uneven distributions of the benefits and costs of a technology or policy	Access to health care technology

Step 5 Analyze alternatives: Use the trade-off matrix (represented in its generic form in Table 9.2) to qualitatively and quantitatively assess (in a *comparative* manner) the likely outcomes from each alternative against a “do nothing” scenario. Evaluate the likelihood that an alternative will solve the problem under different future scenarios.* Particular attention should be paid to whether distributional inequalities are adequately addressed.

Step 6 Overcoming Barriers to Change:[†] Identify potential barriers (economic, legal, institutional, firm-based, technology-based, societal-based, value-based,[‡] etc.) to change and identify strategies to overcome them, recognizing that political coalition-building is likely to play an important role.

Step 1 of trade-off analysis is to describe the societal or technical problem in need of attention. To provide a context to the problem, it is often helpful to document a brief history of why the problem arose and why specific action needs to be taken. Many sociotechnical problems form/develop over time until they reach a point where action becomes necessary. It is also useful to characterize the type problem since this can inform the development of alternatives – for example, is the problem relating to a lack of information or undeveloped/missing technology (see Table 9.1)? Finally, the primary stakeholders impacted by the problem should be identified.

Step 2 should be undertaken in parallel with Step 1. In this step, any prior attempts to address the problem should be identified and documented. To ensure the problem is

* Since the future is uncertain, creating several scenarios against which a policy alternative can be assessed is likely to provide an indication of the robustness of the alternative.

† Step 6 is to be undertaken by the politician/decision-maker and not the analyst. The role of the analyst is to develop and present (in Steps 1 through 5) objective information and to avoid promoting one alternative over another.

‡ Value-based conflicts may be characterized as: (1) conflicts arising from differences in legitimate interests of different actors/institutions; (2) conflicts in moral and legal duties of each actor/institution; and (3) conflicts among actors/institutions arising from different perceptions of what is right or wrong, fair, or unfair (Ashford 1994, p. 1427).

Table 9.2 Generic matrix of policy consequences for different groups/regions

Group	Effects		
	Monetary/financial	Health/safety	Environmental
Group/region A	C_s, B_s	$C_{H/S}, B_{H/S}$	C_{Env}, B_{Env}
Group/region B	C_s, B_s	$C_{H/S}, B_{H/S}$	C_{Env}, B_{Env}
Group/region C	C_s, B_s	$C_{H/S}, B_{H/S}$	C_{Env}, B_{Env}
...	...	...	...

considered from multiple perspectives, the analyst should be guided by four broad lenses of inquiry. Each lens focuses on a particular system – that is, economics and markets, legislation and the political process, public/private sector management, and the technical system. For example, if we consider the poor fuel efficiency of the U.S. vehicle fleet, it is possible to characterize the problem as (1) a failure to price fuel correctly, (2) a failure to develop sufficiently stringent corporate average fuel economy (CAFE) standards, (3) a failure of the private sector to invest sufficient R&D funds into the development of more fuel efficient vehicles/technology, and (4) a lack of readily available technology – such as a hydrogen fuel cell or electric vehicle – to address the problem. In reality, many sociotechnical problems, such as the one described, will be the result of a combination of economic, political, management, and technology failures. If an analyst were to use only an economic lens to view the problem, the alternatives/solutions created might address economic concerns to the exclusion of others. The root cause(s) of the problem may continue to persist in the other systems that were not considered. Thus, adopting an approach that seeks to uncover the full complexion of a problem – rather than focusing only on those aspects of a problem that relate to one’s area of responsibility/expertise – is essential if society is to make progress on problems relating to sustainable development, which often pervade disciplinary boundaries. In this regard, *sins of omission* are just as important as *sins of commission* that occur when an alternative is influenced/captured by special interests.

Once any previous attempts to address the problem have been identified, Step 3 considers ways to affect the willingness, opportunity/motivation, and capacity of the stakeholders associated with the problem to change (see Section 7.6 in Chapter 7, for a detailed discussion of these factors). While many stakeholders might have the willingness to act, they may not have the opportunity or capacity to do so. Therefore, developing creative ways to support these elements of change is a valuable starting point from which to create alternatives (Step 4) for addressing the problem.

When developing the alternatives in Step 4, it is important to return to the four system lenses (introduced in Step 2) to ensure that all the dimensions of the problem are addressed. The task of developing the alternatives should be considered as a creative process, which draws upon the rich information and knowledge developed in Steps 2 to 4.

Step 5 of trade-off analysis is to analyze the alternatives using a trade-off matrix (represented previously in its generic form in Table 9.2). An important task when creating the matrix is to determine which indicators to use to evaluate each alternative. Ideally, these indicators should be developed in cooperation with stakeholders and should provide clear information on the state of the system over time. To make the analysis manageable, it is recommended that a small number of important environmental, health/safety, and monetary/financial indicators are used. The indicators can be of a quantitative or qualitative form.

The structure of the trade-off matrix keeps the environmental, health/safety, and monetary/financial impacts in their natural units for each stakeholder group. By keeping

Table 9.3 Using the trade-off matrix for a comparative analysis of policy alternatives

Group	Effects at time $T_1 / T_2 / \dots$		
	Monetary/financial	Health/safety	Environmental
Group/region A	$\Delta C_s, \Delta B_s$	$\Delta C_{H/S}, \Delta B_{H/S}$	$\Delta C_{Env}, \Delta B_{Env}$
Group/region B	$\Delta C_s, \Delta B_s$	$\Delta C_{H/S}, \Delta B_{H/S}$	$\Delta C_{Env}, \Delta B_{Env}$
Group/region C	$\Delta C_s, \Delta B_s$	$\Delta C_{H/S}, \Delta B_{H/S}$	$\Delta C_{Env}, \Delta B_{Env}$
...	...	...	...

these factors separate, it is possible to assess who benefits and whose condition is made worse as the result of a proposed alternative when compared to the “do nothing” scenario.* Further, the trade-off between the costs of environmental or health improvements are made explicit, if they occur. While it has been argued that the informational burden of such an approach to decision-making “tends to reduce the efficacy of political institutions” and leads to stakeholder conflict and delay (Congleton and Sweetser 1992, p. 16), hiding such information would surely be inappropriate in a democratic process. Hence, one benefit of using a trade-off matrix is that stakeholders have the option to become involved in the process of deciding the trade-offs. In this regard, decision-making becomes more open and transparent and is “based on accountability rather than accounting” (Ashford 2005, p. 5; Ashford 2007).

An additional benefit of non-aggregation is that the time period in which each effect is experienced can be revealed and future non-monetary benefits/costs need not be discounted to a present value. The impact of time can be considered using a *time series* of trade-off matrices. These matrices would capture the changing dynamics of the system under analysis and facilitate a *comparative analysis* of alternatives over time. Table 9.3 shows how the generic trade-off matrix shown previously can be used in a *comparative* sense to present the changes in each indicator between time periods. This “back of the envelope” approach to the analysis of alternatives can be relatively straightforward. It is also of particular value to decision-makers, who will be able to see the likely implications of changing an existing alternative to overcome any problems that have been identified.

One challenge facing decision-makers/analysts is often described narrowly as how to create an alternative that arrives at an appropriate trade-off or balance between economic efficiency and equity. Given that decision-making is political, not formulaic (Swartzman 1982; Sagoff 1988), arriving at a single or “right” answer is unlikely. The fact that there are likely to be multiple solutions increases the importance of transparent decision-making, which makes decision-makers more accountable for their actions.

In a situation where potential solutions raise unacceptable compromises in economic efficiency or equity, trade-off analysis enables the decision-maker to explore more effective alternatives. In this regard, trade-off analysis resists simplistic thinking and allows decision-makers to deal with those difficult questions involving (1) economic efficiency/equity trade-offs, and (2) alternatives analysis. In effect, uncertainties and distributive inequalities are accepted as part of the normal (real world) decision-making process. A critical point is that trade-off analysis holds the potential for environmental, social, and

* The idea of using a form of trade-off analysis that considers utilitarian and non-utilitarian factors, as well as the consequences of alternative courses of action, was endorsed by the Millennium Ecosystem Assessment. See the Millennium Ecosystem Assessment report, *Ecosystems and Human Well-being* (pp. 19–21), available at http://pdf.wri.org/ecosystems_human_wellbeing.pdf (accessed June 5, 2018).

Table 9.4 A classification of approaches to decision-making and evaluation

	<i>Ideologically closed</i>	<i>Ideologically open</i>
Highly aggregated	I [CBA]	II
Highly disaggregated	III	IV [Trade-off analysis]

Source: Adapted from Söderbaum (2000, p. 80).

monetary/financial factors to be considered on a more equal footing and provides a setting where *alternatives* can be considered that do not raise Hobson’s choices.

The final step of trade-off analysis (Step 6) is to identify any potential barriers to the chosen alternative and create strategies to circumvent them. One objective of trade-off analysis is to minimize stakeholder conflict by adjusting alternatives as potential conflicts arise. However, it is recognized that it may not be possible to address all stakeholder concerns and that disagreements occur as a normal part of the democratic process. It is the decision-maker’s responsibility to address any conflicts in a fair manner, recognizing that political coalition-building is likely to play an important role in overcoming any barriers to change.*

Trade-off analysis has two main differences from a tool such as CBA. Whereas CBA is an aggregated and ideologically closed framework (quadrant I, Table 9.4), trade-off analysis is disaggregated and ideologically open (quadrant IV, Table 9.4). CBA is aggregated in that all factors are translated into a single monetary value, and ideologically closed in that neoclassical economics (or economic rationality) is the decision-making lens. Trade-off analysis is disaggregated in that environmental, social, and monetary/financial factors/indicators are kept in their natural units, and ideologically open in that it permits alternatives to be evaluated through any lens (for example, from the perspective of deep ecology, social welfare, economic rationality, etc.).

It is helpful to consider some examples of how a trade-off matrix can be used to inform decisions. The first example explores the type of trade-offs that face the EPA when it is formulating air and water pollution regulations. Figure 9.1 shows how the costs of more stringent regulation are borne by all stakeholder groups (to varying degrees) and how the benefits are received primarily by customers and others (that is, society). If the EPA were to promulgate more rigorous air quality standards aimed at electricity utilities, for instance, much of the compliance costs would likely fall upon consumers (assuming the producers pass on the costs). This example demonstrates a classic externality problem where the health risks are unknowingly and involuntarily assumed by society (Ashford 1978). Thus, a critical question is how much pollution abatement are we willing to pay for?

The trade-off matrix enables a range of solutions to be explored. If we adopt a polluter pays approach, the regulation will focus on making utilities take the necessary steps for compliance.† Thus, the key trade-off is between monetary costs to the producer/consumer

* Former President Obama’s struggle to provide an expanded health care system for the U.S. provides a vivid example of how difficult it can be to satisfy all the stakeholders in transforming a system. The new administration is having an even more difficult time at restructuring his effort. For that reason, asking “who is standing in the way of needed progress” in examining attractive alternatives is essential.

† In this situation, a utility might decide to buy the right to pollute, adopt a more efficient technology, or search for alternative fuels or methods for producing electricity. If the focus is placed on the availability and price of electricity, the method by which it is generated becomes less of a concern to the consumer. Therefore, adopting a polluter pays approach might raise the price of electricity (e.g., through the

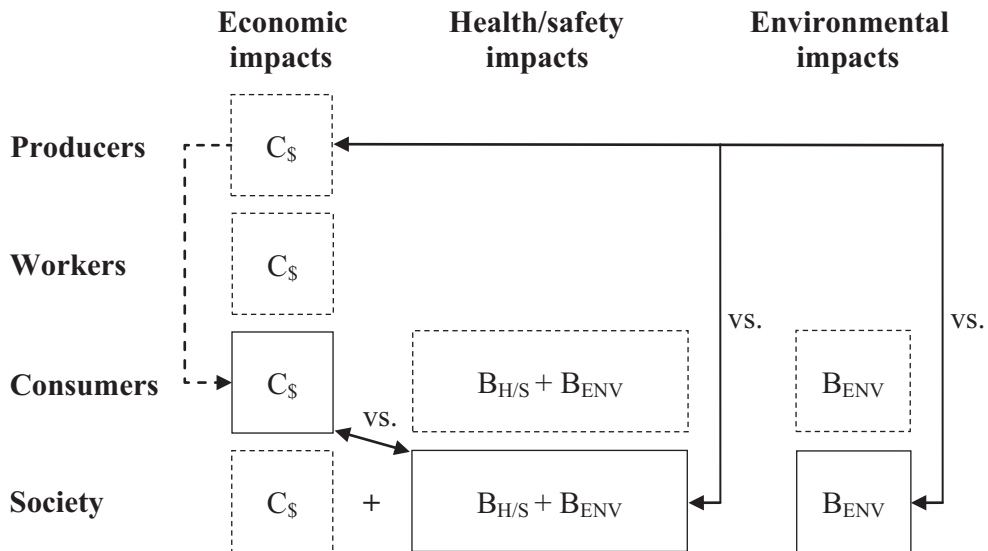


Figure 9.1 Trade-offs of EPA air- and water-pollution regulations

Source: Adapted from Ashford (1978, p. 166).

and environmental and health benefits to society. (Note: Society is considered here to receive the utility for improvements in the well-being of affected species or the natural environment. An alternative approach would be to create a fifth group for species and/or the natural environment.) A different policy approach, however, would be for government to subsidize the costs of compliance, thereby passing the costs onto society. Under each regulatory scenario, a *comparative analysis* of the benefits, costs, and distributional effects over time can be undertaken using a trade-off matrix (Table 9.3). In addition, consideration needs to be given to the likely effects of technological change (see the discussion in the next section of technological options analysis (TOA)), the proper treatment of uncertainty, and potential future changes to the legal environment (Ashford 1978; Driesen 2003, 2004). Each of these factors can change the outcomes in a trade-off matrix and therefore should not be excluded from the decision-making process.

A second example is the controversy over the continued use of the organophosphate insecticide Chlorpyrifos in the United States. The pesticide has been correlated with neurodevelopmental problems in children and adults who consume it in food, and in farmworkers who are exposed during their work (Figure 9.2). It is widely criticized by environmental scientists worldwide and is subject to greater restriction and scrutiny in

introduction of a carbon tax) to a point where new ways of generating electricity that were previously too expensive become feasible. For example, households may find it is more cost-effective to buy an array of photovoltaic cells and produce their own electricity than pay the higher price for electricity generated by coal or gas. Interestingly, the term polluter pays can be confusing since it is the customer – not the producer – who will ultimately pay for the internalization of negative externalities. However, if an increase in the price of electricity results in a change in consumer behavior, the producer might “pay” in the long-term if its business is disrupted by a more effective way of producing electricity.

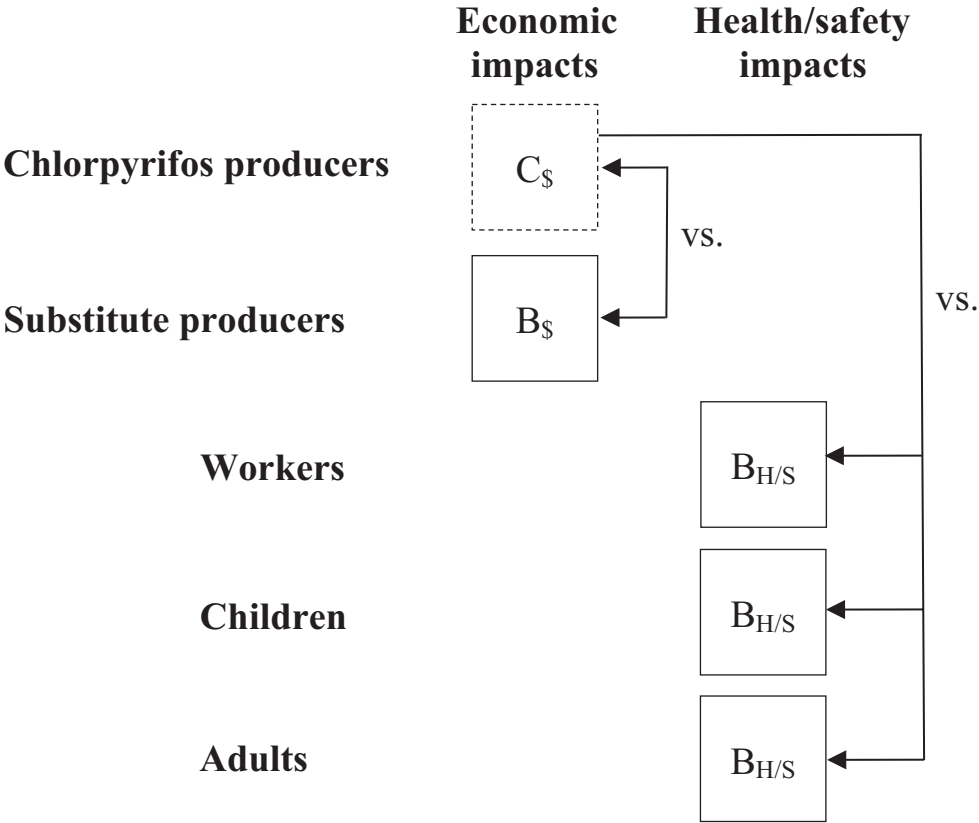


Figure 9.2 Trade-offs of banning chlorpyrifos

Europe. If banned, the likely loser of a market is Dow-DuPont, while the economic winners are likely to be the industrial promoters of a safer substitute, and children, adults, and farmworkers who would benefit from better neurological health. Its continued use is undoubtedly motivated by benefits it bestows on the producer, whose chief administrative officer is, as this book goes to press, heading a U.S. manufacturing initiative by the Trump administration. This demonstrates the importance of asking whose health and whose economic benefits are served by its continued use.

In summary, trade-off analysis requires decision-makers to make the difficult trade-offs among *effects*, among *actors*, and across *time periods** that tend to be obscured by techniques such as CBA. As a decision-support tool, it (1) allows decision-makers to avoid monetizing and aggregating non-monetary factors over time; (2) invites the involvement of stakeholders into policy debates since there is greater transparency as to who benefits

* The Stern (2007) report on global climate change came under severe attack for using too small a discount rate for the benefits of preventing global warming that would accrue to some in the future. It might have been better for the effects to have simply been presented in the time period over which they occurred – with no discounting – rather than for the analysts to choose a discount rate which would engender criticism no matter what the value.

and who is harmed by a particular policy; (3) enables analysts to undertake a comparative analysis of alternatives over time; (4) takes into account the important role of technological change in shaping the state and performance of a system, and (5) requires decision-makers to be accountable for their actions. Finally, since the approach encourages the development *and* redesign of alternatives during the analysis to overcome difficult trade-offs, perhaps a more appropriate name for the tool might be *Alternatives Analysis*, although one must be vigilant to ensure that alternatives analysis is not reduced to alternative *cost-benefit* analysis.

9.7.2 Trade-off analysis in the context of sustainability

If achieving sustainable development is the desired objective, it is important to consider the likelihood of arriving at a more sustainable outcome when one uses trade-off analysis. Because the ideological orientations (or value systems) of decision-makers and stakeholders can vary significantly, there is no guarantee that this approach will promote sustainable development. At best, keeping the environmental, social, and monetary/financial indicators in their natural units can promote a more transparent approach to considering non-monetary indicators. But such indicators and their relative impacts can be undervalued if those engaged in the decision-making process favor (or promote) monetary/financial measures. Further, the type of indicators used in the analysis will also play a critical role. Ideally, the indicators should capture changes in the state of the system, as well as the intensity of the flows (or pressures) that change the system's state between time periods. If sustainable development is a primary concern, these indicators need to set parameters that can monitor and guide future development away from critical environmental thresholds and unsustainable activities. Again, the ideological orientations of the decision-makers and stakeholders will play an important role in framing the problem and determining what is measured. Thus, if sustainability is not a leading priority, it may not be adequately reflected by the indicators or the decision situation.

Therefore, there is an opportunity to consider ways to integrate a *sustainability ideology* into trade-off analysis. Because *equity* and *environmental protection* lie at the heart of sustainable development,* one way to guide decision-making toward sustainability is to adopt a decision-making philosophy that is grounded on these objectives. The following section outlines a revised Rawlsian decision-making philosophy (see Section 1.2.1 in Chapter 1 for a discussion of Rawl's *Theory of Justice*), which can be applied when using trade-off analysis to combine equity considerations and environmental protection in the decision-making process.

A second issue that is often left out of many analysis tools/frameworks and has a direct impact on sustainability is technological innovation. Technological change should be a central consideration in trade-off analysis. Section 9.7 takes a closer look at how the trade-off analysis framework can be used to consider or promote innovation.

9.7.2.1 Operationalizing the social contract

Given the preceding discussion, a critical question remains: how should we operationalize the social contract in environmental decision-making? Further, if government is to act as a trustee, how should it interact with the public? One of the authors of this text has

* In the broader context of this book, which identifies competitiveness, the environment, and employment as the three main pillars of sustainability, equity must include both environmental justice and economic equity involving goods, services, and employment. The original formulation of trade-off analysis considers equity in this manner.

previously proposed an answer to these questions. Ashford and Rest (2001) argue that the perceived and actual role of government in public participation is crucial, as is the role adopted by the stakeholders:

In order for the government to act in a trusteeship capacity, it must be committed to justice and fairness in the Rawlsian sense – i.e., it must first and foremost encourage or allow those activities that provide relatively greater advantage to those individual members or groups who are relatively worse off to begin with. [...] In a political climate where stakeholder involvement is encouraged to legitimize conflict resolution or the parceling out of scarce agency resources, government can easily abdicate its trusteeship role in favor of a more utilitarian approach to problem solving. The result is often a continued polarization of various community groups and members.

(Ashford and Rest 2001, pp. VII–9).

The research underlying this observation (Ashford and Rest 2001) indicates that the outcome of discourse between government agencies and the public depends on the roles adopted by each. To help visualize the interactions between government and society, they developed a matrix that presents the likely outcomes under the different government/stakeholder positions (Table 9.5).

In the left column of Table 9.5, the two roles of government are indicated: (1) the government acts as a *trustee* of stakeholder interests, and (2) the government acts as a *mediator* of conflicting interests between or among stakeholders. For the stakeholders, two (somewhat idealized) positions are presented: (1) *utilitarianism*, in which stakeholders seek to maximize their own utility; and (2) *communitarianism*, in which stakeholders act for what they perceive as the greater social good. Further, a distinction is made between the *participating* stakeholders – that is, those actively involved in public participation efforts – and the nonparticipating public who are also stakeholders.

Table 9.5 Types and outcomes of interactions between the government and stakeholders

<i>Government's role</i>	<i>Stakeholder posture</i>	
	<i>Utilitarian</i> (<i>Maximizing individual/social benefit</i>)	<i>Communitarian</i> (<i>Promoting the greater social good</i>)
As a trustee for the affected stakeholders	1 Decision is made by government in a trusteeship role on behalf of all the <i>participating stakeholders</i> .	2 Decision is made by government in a trusteeship role on behalf of the stakeholders (mirroring a <i>normative</i> consensus, possibly expanding to benefit the larger nonparticipating public as well).
As a facilitator of utilitarian or majoritarian consensus, or alternative dispute resolution among the stakeholders	3 Stakeholder involvement processes reach a <i>consensus</i> or <i>compromise</i> among the <i>participating</i> stakeholders.	4 Idealized stakeholder involvement processes reach <i>normative</i> consensus, possibly expanding to benefit the larger nonparticipating public as well.

Source: Adapted from Ashford and Rest (2001, pp. VII–14).

If we consider the first row in Table 9.5 where the government adopts the role of *trustee*, two situations can arise (Ashford and Rest 2001, pp. VII–13). First, government acts on behalf of the participating stakeholders to promote utilitarian solutions (cell 1). Second, government acts on behalf of all stakeholders, including those who are not present, to promote communitarian solutions (cell 2). Likewise, if we consider the second row in Table 9.5 where the government adopts the role of *facilitator* of compromise or consensus, we see two different situations (ibid.). First, government acts to implement the compromise or consensus reached by the participating stakeholders (cell 3). Second, government acts to implement the normative consensus achieved by stakeholders on behalf of the larger nonparticipating public (cell 4). As before, the former promotes utilitarian solutions and the latter communitarian ones.

A *Rawlsian outcome* is where new legislation, policies, or programs support initiatives that offer greater advantage to individuals or groups who are relatively worse off to begin with. A *Rawlsian government* refers to a government that is willing and has the capacity to either impose or endorse Rawlsian outcomes.

It follows that a *non-Rawlsian government* is either unwilling or does not have the capacity to impose Rawlsian outcomes on the stakeholders. Instead, it adopts the position of mediator of stakeholder interests. Under this arrangement, the responsibility for achieving a just and fair society is left to the stakeholders. A non-Rawlsian government does not mean that a Rawlsian outcome cannot be achieved; it simply means that the government does not act as a trustee for stakeholder interests, and it would take a strong communitarian group of stakeholders to press for a Rawlsian outcome.

The Rawlsian approach should be seen as a movement (a process) and not a final state, but it is nonetheless possible to operationalize Rawls's theory of justice by "bounding" the acceptable moves and rejecting the clearly utilitarian moves that are not Rawlsian.

If we consider the concept of sustainable development, an important question is whether Rawls's theory of justice can ensure that human activity does not degrade the environment to a state where it is unable to recover. The reason for asking this question is simple. It stems from the belief that the ultimate rationale of governance is to support and encourage a way of life that recognizes and values human needs (economic and social) and the natural environment, is just and fair, and continually strives to achieve an acceptable balance between civil liberty and regulation. Hence the philosophy of government and the stakeholder posture adopted by society will have a significant influence on whether it is able to move toward sustainability.

We have argued that the four major environmental factors that underlie the concern for sustainable development are the following:

- 1 The disruption of ecosystems and loss of biological diversity and the indirect effects these have on human health and well-being;
- 2 The rapid use of finite resources and energy supplies;
- 3 The direct impacts of toxic pollution on human health and the health of other species; and
- 4 The disruption of the global climate.

All four of these factors occur as a result of *human action* and the *technology* we have at our disposal. Therefore, it will be possible to address these problems only if there are social arrangements that enable us to do so in an effective manner. The growing interest in *environmental justice* provides some evidence that society is willing to ensure that development does not adversely affect the disadvantaged by protecting the environment in which they live. However, as a practical matter, environmental justice is primarily concerned with the protection of people. Hence, in addition to searching for Rawlsian solutions to

social problems (which include economic and indirect environmental considerations), government and stakeholders also need to search for solutions that take environmental protection into consideration.

In *A Theory of Justice*, Rawls provides little discussion of the environment. In many ways, his decision not to extend his theory from the social to natural worlds represents a missed opportunity. Because protecting and preserving the environment are essential for the longevity of the human race, we propose the following principle of justice that could be considered in the original position:

Third Principle. Social arrangements are to be organized so that they (a) protect and improve the environment, especially for those individuals and species most heavily affected by environmental degradation or pollution, and (b) do not result in activities that exceed ecological carrying capacity.

The intent of the third principle – the environmental principle – is (1) to ensure that society continually strives to protect and improve the environment and the lives of people negatively affected by pollution (broadly defined), and (2) to keep human activity within ecological limits.* The basic premise of this principle is twofold. First, protecting human health is believed to be of paramount importance. Second, the natural environment is believed to be good in and of itself and should be protected and regenerated if it is being degraded by human activity. In reality, part (a) of this principle is likely to be the most useful because defining and agreeing on the ecological carrying capacity of the environment to implement part (b) is still a major work in progress. In addition, part (a) of the principle aligns well with the idea of movement toward justice (or fairness) and does not attempt to define an end state or goal.

The addition of the environmental principle to Rawls's framework directly links the social and natural worlds and holds the potential to promote sustainable development in decision-making. First and foremost, it places social equity at the center of decision-making. Second, it supports the notion of economic growth so long as the benefits from this growth are distributed fairly among society. Social and economic inequalities are tolerated only if the most disadvantaged members of society are made better off under new arrangements. Finally, it makes movement toward a better environment a critical component of any new social arrangements. The combination of the proposed addition to the Rawlsian/utilitarian decision-making philosophy (presented above) with the trade-off analysis framework (in Section 9.7.1), creates a valuable approach to decision-making for sustainable development. More specifically, the approach can reveal the equity/distributional consequences and impacts of environmental, health, and safety regulation or the likely impacts of regulatory inaction.

A second issue, in addition to the fairness of a regulatory decision, that is often left out of many analysis tools/frameworks and has a direct impact on sustainability is the importance of technological innovation. Technological change must be a central consideration in trade-off analysis, and, as discussed in Chapter 8, this brings a dynamic element into what might otherwise be a static assessment of the effects of regulation.

* A significant work that focuses on the links between environmental quality and human equality and those between sustainability and environmental justice more generally is Agyeman et al.'s (2003) *Just Sustainabilities: Development in an Unequal World*. This publication, which consists of a selection of essays, focuses specifically on the linkages between the political and policy processes surrounding environmental justice and sustainability. *Just Sustainabilities* highlights "an important and emerging realization that a sustainable society must also be a just society, locally, nationally and internationally, both within and between generations and species" (ibid., p. 3).

9.8 Static versus dynamic efficiency and the implications for promoting technological innovation using trade-off analysis

Before considering how trade-off analysis can be used to promote technological innovation, this section begins with a brief discussion of the important difference between static and dynamic efficiency (as a focus of environmental policy) and how these views can affect the analysis of technology.

It is important to emphasize the difference between achieving *static* and *dynamic* efficiency in applying technological solutions to societal problems. Having static efficiency as the mainstay of neoclassical environmental economics ignores the important role of innovation in achieving better environmental outcomes (Ashford and Hall 2011; Ashford and Caldart 2008; Driesen 2003, 2004; Jänicke et al. 2000, 2005, 2010). It assumes that the objective of decision-makers is to reach an efficient state where social welfare is maximized. If the prevailing state of the world is suboptimal, a more efficient state is identified, and changes are made to move the system toward that state. In general, neoclassical economists define this efficient state by matching supply and demand in a competitive market, with the assumption that technology remains constant. In contrast, dynamic efficiency places considerable attention on instruments that will encourage transformations. Driesen observes: “Economic dynamic analysis emphasizes change over time, systematic change, and precise analysis of how incentives affect individuals and institutions” (Driesen 2004, p. 515).

The roots of dynamic efficiency must be understood in the context of institutional economics and organizational theory (Driesen 2003),* where it is important to appreciate the difficulty that a new incentive has in capturing the attention of institutions and individuals, given that their decisions are influenced by path dependency or lock-in (that is, past actions/decisions might constrain future actions/decisions) and bounded rationality (that is, purposes, knowledge, and habits combine to constrain the choices an institution/individual makes) (Driesen 2003, 2004).

Dynamic efficiency views technological change (with accompanying institutional, organizational, and social changes) as a central variable in the analysis of environmental policy, increasing the importance of understanding the direction of change and how technology might alter benefits/costs over an appropriate time horizon (Ashford 2002). Given that changing a sociotechnical system is likely to require a long timeframe, the role of government in setting technology and environmental policy to guide innovation increases in importance. Further, whereas static efficiency focuses on the efficient state that appropriately balances competing goals, dynamic efficiency emphasizes win-win outcomes that are achieved through the co-optimization of multiple societal goals. Thus, achieving dynamic efficiency focuses on the process of a sustainable transformation, while achieving static efficiency focuses on a sustainable, or more optimal, state. This observation highlights the implicit bias embedded in traditional analytic tools. Tools such as cost benefit analysis, which are based on static efficiency (or optimality), move considerations of the process of transformations outside the analytical framework. In contrast, Driesen’s (2003) focus on the economic dynamics of environmental law places the process of transformation at the center of the analysis. **In trade-off analysis, in contrast with traditional cost-benefit analysis, the process of technological change and innovation is an explicit consideration in the analysis** (Hall 2006; Hall et al. 2008). In addition to evaluating the multivariate impacts of different alternatives, a trade-off matrix can be used to assess the impacts of different technology options (Ashford 2000; Ashford et al. 1980). The strength of combining both kinds of impacts in a trade-off matrix is that it can be used to compare multivariate criteria – such as environmental, health/safety, and economic factors – to determine how

* See Chapter 7 on organizational innovation and learning.

new technology options compare with each other and with the do-nothing scenario. Further, the impacts of each technology option on different stakeholders are made explicit. The comparative analysis of different technology options in a trade-off matrix constitutes what is known as technology options analysis (TOA) (Ashford 2000; O'Brien 2000).

The idea of TOA was first applied to the chemical industry to facilitate the consideration of technology options that could make production processes inherently safer for workers and the surrounding community. Either new technologies could be added to existing systems to mitigate risks, or a production process could be designed to remove the risk altogether. The purpose of a TOA is to inform the firm, the regulating agency, and stakeholders of the full range of technological options that can be used or developed to address a problem or achieve a desired objective.

The benefit of using TOA is that analyzing comparable factors among the technology options is easier than using techniques such as CBA that usually require monetary quantification, aggregation of variables, and discounting to present value. Keeping the variables in their natural units within a trade-off matrix avoids unnecessary assumptions about how to translate environmental or health and safety impacts, for instance, into a monetary value. The result is a more believable, disaggregated analysis of options where the impacts of technologies are made explicit and win-win solutions can be more easily identified. TOA can be used in both a static and a dynamic sense. When used in a static sense, TOA simply compares available (or existing) technology to decide which option should be selected. This is the approach adopted by neoclassical environmental economics (as currently practiced), which searches for optimal outcomes using static efficiency. A failure by environmental economists to take technological innovation into account means that their analysis is likely to overestimate the cost of compliance with new, more stringent environmental regulation. Setting regulation on the basis of existing technology, or what is deemed feasible from a static efficiency perspective, is not likely to produce the kinds of systemic transformations that could lead to sustainable development.

When used in a dynamic sense, TOA is able to compare available technology with technology that could be developed.* Using the trade-off matrix in this manner leads to a form of dynamic environmental economics that includes the consideration of technological change over time (Ashford and Hall 2011; Driesen 2003, 2004).

Achieving dynamic efficiency requires the analyst or decision-maker to focus on the transformation process, paying special attention to path dependency and bounded rationality of institutions and stakeholders.† Given that changing a sociotechnical system is likely to require a long time frame, the role of government in setting technology and (stringent) environmental policy to guide innovation is of particular importance (see Section 8.3.5 in Chapter 8 for a discussion of the weak vs. strong form of the regulation-induced innovation

* One benefit that traditional cost-benefit analysis has in considering only existing technologies for the purposes of assessment is that these technologies are easy to identify and cost; although, the latter usually leads to large cost overestimates, especially if provided by a regulated industry. By explicitly considering technological options that include innovation not yet undertaken, the assessment becomes open ended. What will the performance and cost of new technology be? Regulatory history has confirmed impressive positive results in general, justifying stringent regulatory requirements, but there will be uncertainties in any particular case. Analysts do not like open-ended assessment. Politicians may be reluctant to bank on future innovation, but that is precisely what government investments in new technologies count on and what government incentives for innovation are provided for.

† The trade-off matrix enables decision-makers to ask what could be done to improve the prevailing situation. Because the trade-off matrix for each technology option (existing and undeveloped) presents information in a disaggregated form, the potential political implications of setting more stringent regulation or investing in a certain type of technology become apparent. Once these factors are identified, steps can be taken to address the problems of path dependency and bounded rationality.

hypothesis). Adopting an approach that guides technological change means that decision-makers are not relying on serendipitous technological development. Instead, they are pursuing an approach where the development of technology is more likely to progress along a desired pathway. Therefore, it is the dynamic use of TOA that is likely to lead to system transformations toward sustainable development.

Using trade-off analysis, it is possible to consider the dynamics of the impacts associated with more stringent regulation over a number of time periods (Ashford 1978; Hall 2006; Hall et al. 2008). Developing a series of trade-off matrices that capture how the distributed impacts adjust with improving technology might be a useful way to explain to stakeholders how their situations are likely to improve, even if at first they worsen. This approach to analysis also supports Driesen's (2003) description of the economic dynamics of environmental law. Further, the revised Rawlsian/utilitarian decision-making philosophy (discussed in Section 9.7.2.1) provides the philosophical basis upon which decisions for sustainable development can be made within the trade-off matrix.

Using trade-off analysis to assess the stringency and distributed impacts of regulation over time, along with careful consideration of the path dependency and bounded rationality of institutions and stakeholders/players, it may be possible to formulate regulatory initiatives to nurture sustainable transformations. For further reading on stimulating dynamic transformations for environmental improvements, see Ashford and Hall (2011).

In this chapter, we have outlined the U.S. environmental and occupational health and safety regulations and developed a decision-support framework to assess policies and regulations intended to advance sustainable development. In the next chapter, we turn to regional-level approaches that focus on protecting the natural and working environment.

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10 Regional and international regimes to protect health, safety, and the environment

Coauthored with Charles C. Caldart

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10.1 Introduction

10.1.1 Concepts addressed in this chapter

As discussed in Chapter 9, pollution and other environmental problems adversely affect both the natural environment and human health and safety. The concomitant increase in industrial throughput, driven by increased consumption, also contributes to the depletion of natural and physical resources and energy. This chapter addresses the four central environmental problems discussed in Sections 1.3.4 (in Chapter 1) and 2.1 (in Chapter 2): toxic pollution, climate disruption, resource depletion, and the maintenance of biodiversity and the integrity of ecosystems. These environmental problems are not necessarily bounded by geopolitical borders, and often have international and even global consequences that must be managed through a combination of domestic and international legal instruments, agreements, and principles. Inherent in the concept of sustainable development is the need to have sufficient tools and instruments to manage environment, health, and safety issues effectively for the well-being of present and future generations.

Chapter 9 addressed regulation of these concerns from the perspective of the single nation–state, focusing on the United States as an example. While many of the general regulatory principles discussed in Chapter 9 – such as the precautionary and polluter pays principles – are also relevant to the multinational arena, the policy mechanisms used at the international level tend to differ from those used at that national level. This chapter explores the policy tools and instruments to improve health, safety, and the environment that function more generally across, as well as within, other national economies. These include efforts to harmonize national environmental legislation for nations that are members of a federated entity such as the European Union, whose member-wide regional law is evolving, and may serve as a model for other regions. Other nations operating independently, but signing onto multilateral environmental, health, and safety agreements, bind themselves by international environmental law.

This chapter first focuses on the regional system in the European Union (EU), and then focuses more broadly on international environmental law and on international institutions that play a role in encouraging multinational cooperation in environmental issues. International law figures into the discussion of the EU system in two ways: (1) its tenets influence the way the separate countries making up the European Union have come together through a series of treaties to form a tighter federation involving commerce, trade, and environmental issues with a centralized government in Brussels and Strasbourg and (2) international (multilateral) environmental law agreements have often been adopted, sometimes with modifications, into EU law.

It is useful to classify four major categories of legal regimes for establishing international health, safety, and environment law as follows:

- Multilateral environmental agreements (MEAs);
- Conventions of the International Labour Organization (ILO);
- Incorporation of environmental standards into trade regimes; and
- Incorporation of labor standards into trade regimes.

In this chapter, we explore harmonization of national health, safety, and environmental law and multilateral environmental and labor accords. The third and fourth categories in the list above will be the focus of Chapter 11, which considers trade regimes and sustainability.

Figure 10.1 highlights the important relationship between this chapter and Chapter 9. As shown in the Venn diagrams, U.S. environmental law has deeply influenced parallel developments in the European Union. The European Union is also influenced by developments in international environmental law (often adopting that law into its legal framework) and in turn influences international environmental law. This explains the discussion of both EU and international environmental law in the same sections of this chapter, for example in the discussion of the EU directive addressing stakeholder participation and the international Åarhus Convention on access to information, public participation in decision-making, and access to justice in environmental matters, which further promotes and ensures the role of the public in making decisions about the environment by providing it access to information.

10.1.2 The broader picture

Underlying the concepts presented in this chapter is the necessity not only to understand the mechanisms of international environmental and health and safety law, but also to recognize the increasing importance of international cooperation as an essential element for resolving the many concerns currently plaguing global human and environmental

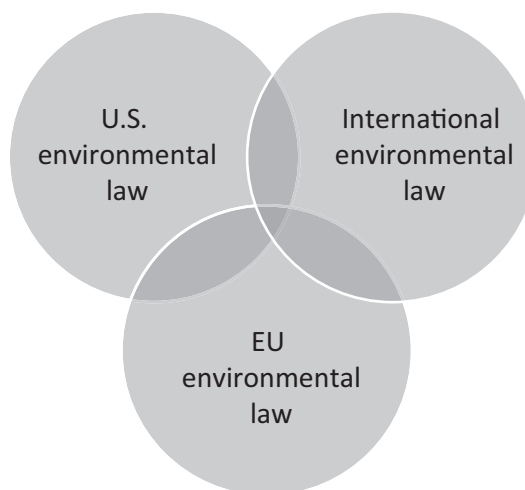


Figure 10.1 Relationship between international, U.S., and EU environmental law

resources. With the globalization of the world economy, occupational and environmental health problems have increasingly taken on a multinational and international dimension. Controlling these health and environmental hazards requires both the harmonization of national legislation, standards, and practices intended to prevent waste and air and water pollution, for example, and having nations join in international agreements, with mechanisms for enforcement and verification. So-called voluntary agreements and legally enforceable codes of conduct are also important, even if they are motivated by a desire to avoid legal regulation (Ashford 1997).

Further, different levels of health, safety, or environmental protection can act as either subsidies or barriers to trade (Plofchan 1992). Lax or nonexistent protection may relieve the producer or exporter from costly measures, in effect acting as a state subsidy through the comparative lowering of the export price of a commodity or service. Alternatively, stringent standards may prevent the importation of products or services from less compliant exporters. The implications of different levels of health, safety, or environmental protection for international trade are examined more fully in Chapter 11.

Finally, the United States bears a significant responsibility for the success of international law mechanisms because of its dominant position. Without its cooperation, international arrangements may be difficult to preserve and advance. With the exception of the administration of President Barack Obama, the United States has been a major obstacle to international cooperation regarding the environment and health and safety. Traditionally, the United States was resolutely opposed to any international arrangement that infringed on its sovereignty. The historical areas of opposition from the United States include evading commitments to the International Criminal Court, the Kyoto Protocol, the agreement at Copenhagen, many ILO conventions, the Law of the Sea Convention, and the Convention on Biological Diversity. President Trump's announced intent to withdraw from the Paris accord on global climate change is the most recent example. Continued lack of cooperation from the U.S. would be a significant obstacle to establishing strong international regimes and mechanisms to achieve sustainable development.

10.2 Regional approaches to protect health, safety, and the environment: the European Union

10.2.1 Environmental law in the European Union

Decades ago, the European Community was strongly criticized for putting trade and economic development before environmental and worker health and safety considerations. More recently, however, the European Community has recognized that sound development cannot be based on the depletion of natural resources, the deterioration of the environment and public health, or poor workplace conditions. The EU thus has developed progressive environmental and labor protections in order to advance environmental and workplace goals. Vogel (2003, 2012) has argued that the United States and the EU have actually traded places in the degree of their commitment to environmental, health, and safety goals. From the 1960s to the 1980s, U.S. regulatory standards tended to be more stringent than any European standards. U.S. environmental initiatives, such as mandatory emission and effluent limits, mandatory environmental impact assessments, and reliance on the precautionary and polluter pays principles tended to set the standard for other countries. However, since 1990, the reverse has been true, and many EU regulations are now more precautionary in their approach than their U.S. counterparts (Vogel 2012, p. 3). In many ways, EU environmental law has now gone beyond that of the U.S. and contains initiatives not present in U.S. federal law, such as ecolabeling, reduction of packaging waste, and recycling of vehicles and electronic products. The EU has also signed

many multilateral environmental agreements that the United States has either not signed or not ratified, such as the Basel Convention on Hazardous Waste (discussed later in this chapter), the Convention on Biological Diversity, and the Biosafety Protocol (see Chapter 11 for a discussion of the last two agreements), all of which are now a part of EU law.

When the European Union was founded in 1957 as the European [Iron and Steel] Community, it had no environmental policies or laws; it was formed primarily to strengthen national economies and intergovernmental relations after World War II. Throughout the 1970s and early 1980s, items of EU environmental policy were agreed to by the Council of Environment Ministers. Beginning in 1972, environmental agendas were pursued through a series of successive environmental action plans, chiefly concerned with minimum standards for air and water pollution and waste management.

In the 1980s, European environmental laws and policies were enacted through an emerging trilateral arrangement of the Council of Environment Ministers, the European Commission, and the European Parliament's Environment Committee. Issues that had previously been contained in intergovernmental committees of national bureaucrats and scientists entered the political mainstream. In addition, the concerns of increasingly vocal international nonprofit pressure groups, as well as a heightened public awareness of environmental matters within the EU, had to be accommodated in the policy-making process. A change in environmental policy after the mid-1980s was also driven by greener "leader" states such as Germany, the Netherlands, and Denmark, whose influence led the EU to adopt environmental standards that were sometimes as stringent as, if not more stringent than, their own national standards. The European Court of Justice (ECJ) also played a critical role in raising and maintaining high environmental standards across the EU. The structure of EU governance of environmental matters is summarized in Box 10.1.

With regard to the environment, the EU had for some time demonstrated that it was likely to perceive itself increasingly as a whole, moving closer to the "union among the peoples of Europe" called for in the preamble of the Treaty of Rome (Hildebrand 2002). Recent political developments in the EU, such as Brexit and the emergence of nationalist anti-immigrant factions in member governments, now somewhat threaten the solidarity that was developing. Nonetheless, although many challenges still remain in policy

Box 10.1 Environmental governance in the European Union

European environmental governance is structured as follows:

- Commission (twenty-eight commissioners) ~ cabinet secretaries
- Council of (twenty-eight) Ministers (different persons for different issues, for example, a council of environmental ministers)
- Parliament (members elected in scheduled national elections)
- European Court of Justice
- European Environmental Agency (Copenhagen): Information, studies, and research, but not an inspectorate

EU environmental obligations are imposed on accession countries as a condition of admission. EU environmental law evolves through a series of treaties that further define the legal authority/policy focus of the European Community. It influences and is influenced by international environmental law, serves as a model for other/future regional environmental regimes, and requires transposition into national law and implementation.

implementation and enforcement, the EU is becoming the world's authority in addressing emerging environmental issues. Through a series of three major treaties, the European Union has solidified its approach to the environment and sustainable development (see Jans 2000, chap. 1; Jordan 2002, chaps. 3 and 4; Sands 2003, chap. 15; and Axelrod and Schreurs 2015).

The first was the Single European Act of 1986 (see Box 10.2), which did much to create a more coordinated environmental policy among EU members. Especially notable was the endorsement of "pollution prevention at the source" as the preferred approach to reducing pollution and of the polluter pays principle, later to be incorporated into specific liability directives. That treaty also instituted the "principle of subsidiarity," under which collective EU action is preferred where separate national efforts would be inadequate or less effective. Finally, of special significance was the substitution of the EU, as a collective political entity, for individual European member nations in the negotiation of multilateral environmental agreements with other countries.

The Maastricht Treaty of 1992 (Box 10.3) further raised the currency of environmental issues in the governance of the EU and required their integration into other European Community (EC) matters, especially commerce, economic development, and trade. The treaty created a co-decision mechanism for approving legislation between the Commission and the Parliament, and also expressed a clear preference for emission standards to encourage prevention rather than reliance on environmental quality standards.

Box 10.2 The Single European Act of 1986

The Single European Act of 1986

- included environmental measures in Title VII that went beyond mere codification of environmental law, providing for future lawmaking;
- required a "high level of [health, safety, and environmental] protection";
- affirmed that environmental concerns should be a part of other EC policies, especially commerce/trade within the Community;
- introduced qualified majority voting for issues affecting the "internal market";
- emphasized pollution prevention at the source;
- endorsed the polluter pays principle;
- established the principle of subsidiarity
 - where national (member) actions would be inadequate (especially regarding transnational issues);
 - where objectives could be better achieved at the EC level; and
- authorized the EC to participate in multilateral environmental agreements.

Box 10.3 The 1992 Treaty of Maastricht

The 1992 Treaty of Maastricht

- affirmed the environment as a fundamental EC objective;
- endorsed the development of emission standards to encourage prevention, rather than rely on environmental quality standards;

- affirmed that environmental protection was not just a component but was to be “integrated” into the definition and implementation of other EC policies;
- allowed qualified majority voting for issues affecting the environment (except for energy sources and for national water- and land-use management issues not having to do with waste-related activities);
- strengthened the role of Parliament through allowing a co-decision process on “action items”; and
- provided for incorporation of the most important EC environmental acts into the law of the accession countries.

Box 10.4 The 1997 Treaty of Amsterdam

The 1997 Treaty of Amsterdam

- affirmed that the environment was to be “integrated” into the definition and implementation of other EC policies in order to foster “sustainable development” – a major EC goal;
- endorsed the prior emphasis of the Single European Act and the Maastricht Treaty on prevention, source reduction, polluter pays, the precautionary principle, and subsidiarity;
- added a requirement for “proportionality” of measures, commensurate with the seriousness of the problem; and
- established a complex “co-decision” process for developing and adopting environmental legislation that involves the Commission, the Parliament, and the Council (of Environmental Ministers) (the Council could be challenged by the Commission/Parliament in the European Court of Justice); and provided a “safeguard” clause by which member states could take emergency (urgent) measures if necessary.

Finally, the Amsterdam Treaty of 1997 (Box 10.4) established “sustainable development” as a major EC purpose, thus integrating economic and environmental goals. In a compromise move, the treaty endorsed the principle of “proportionality,” whereby the stringency (and economic impact) of environmental measures should reflect the seriousness of the environmental threat to be addressed in a balanced way. The treaty also allowed member states to establish emergency measures on their own to address local environmental threats.

EU law imposes rights (and obligations) not only on member states, but also on firms, NGOs, and “associations,” giving them rights in national courts, and also establishes mechanisms for enforcement. In this way, it expands the narrower reach of international environmental law.

The EU Commission proposes environmental (and other) legislation. The Environment Directorate (DG XI) is responsible for administering environmental affairs. The European Environmental Agency (EEA), which became operational in 1994, is dedicated

to research and information gathering and dissemination and seeks to encourage comparability in national data.*

The sources of EU law are EU treaties, general principles of law, international obligations binding on the EC, and so-called secondary legislation, consisting of regulations, directives, and decisions concerning legal interpretations. Regulations are directly binding in that they do not need to be implemented by the member states to be turned into national law. In contrast, directives give member states a specified time to transpose them into national law (Hall 2007). The EU also adopts nonbinding conventions and resolutions. The EC now negotiates international environmental agreements on behalf of all EU countries. In the case of a conflict, EU environmental law prevails over the national law of any member state, although member states are allowed to go beyond EC obligations and requirements so long as their measures do not constitute arbitrary discrimination or disguised restrictions on trade.

Perhaps the most significant shift in European practices occurred from 1998 onward when the EU took three important steps to strengthen enforcement: (1) providing for judicial enforcement, with the threat of sanctions; (2) providing for central coordination of inspections and monitoring; and (3) enacting new legislation on public access to environmental information embodying the UN's Århus Convention (see Section 10.3.9) (Hall 2007). However, while the U.S. federal government is itself authorized to enforce environmental laws if states and municipalities fail to achieve compliance, the EU Commission's role is to oversee the adoption, implementation, and enforcement of environmental obligations by the member states. As a result, member states occasionally resist or delay full compliance with EU directives (Van Calster and Reins 2017, p. 69).

The current thrust of environmental law in the EU emphasizes precaution, prevention (with a stated preference for emission limitations), reduction at the source, polluter pays, and subsidiarity, all providing what the EU has characterized as a "high level of protection" of the environment (Single European Act 1986; Axelrod and Schreurs 2017). Rather than the EU harmonization resulting in a "race to the bottom," in the form of weaker EU-wide standards, the vast majority of EU regulations have imposed stricter regulations (see Holzinger and Sommerer 2011). The authors analyzed the development of seventeen EU environmental regulations in twenty-four countries over a period of thirty-five years (*ibid.*). These data show not only the absence of a "race to the bottom," but a clear "race to the top." Brussels has, in effect, imposed much stronger standards than had existed in many member states. Some 94 percent of all changes in regulations are "upward" moves, while only 6 percent are "downward" moves. A downwards competition can therefore be ruled out on the basis of the descriptive data to date.

Although EU environmental policy has progressed significantly since 1980, there are still important challenges to overcome, including how to enforce policies such as the promotion of sustainability. This calls for building alliances between different aspects of policy, as well as different actors and nations. Additionally, achieving sustainability requires integrating an environmental perspective into long-term political, social, and economic priorities. Another challenge facing the EU is how to improve the implementation of policy at the national level. Currently, not all member nations of the EU are equal in their ability (and/or desire) to reach the goals of environmental policy. For example, elevating the states from the former Eastern bloc to a desired environmental standard will require significant effort, as those countries are still focusing on rebuilding their capacity and economy and lowering societal barriers (Jordan 2002). In this respect, the stronger or more experienced EU states have a role to play in providing models of success for states still striving to achieve appropriate policies.

* See www.eea.europa.eu (accessed December 9, 2017).

10.2.2 Regulation of air pollution, water pollution, and waste

Historically, the EU approach to air and water pollution has generally paralleled, and lagged behind, that of the U.S. Clean Air, Clean Water, and Safe Drinking Water acts described in Chapter 9. However, EU waste regulation goes beyond that of the United States in some areas, and generally reflects a more comprehensive approach that both encourages recycling and addresses the various waste implications of a product's life cycle. Moreover, the Industrial Emissions and Integrated Pollution Prevention and Control permit program, discussed later in this chapter, envisions multimedia regulation of pollutant emissions and wastes at the source. When (and if) fully implemented, this permit program should become the primary means of reducing point source pollution of all three media: air, water, and land.

The following sections outline briefly some of the salient features of the media-based EU initiatives. For an historical treatment, consult Jans (2000), Jordan (2002), Sands (2003), and Van Calster and Reins (2017). For a more detailed treatment of the current law, see the annual *Yearbook on European Environmental Law* published by Oxford University Press.

10.2.2.1 Air pollution

As in the United States, the EU approach to air pollution has focused on (1) establishing ambient standards for selected pollutants, and (2) imposing emission limits (for these and other pollutants) on stationary and mobile sources. The 2008 Air Quality Directive (Directive 2008/50), which consolidated and superseded a number of earlier initiatives, is the primary driver for ambient air quality. It sets upper and lower threshold ambient air concentrations for sulfur dioxide, nitrogen dioxide and other oxides of nitrogen, particulate matter (PM_{2.5} and PM₁₀), lead, benzene, and carbon monoxide. (With the exception of benzene, all of these are also the subject of National Ambient Air Quality Standards under the U.S. Clean Air Act.) The Air Quality Directive sets increasingly stringent air monitoring requirements and methodologies for these pollutants, depending on whether they are present in concentrations below, between, or above the designated threshold levels. An earlier directive (Directive 2004/107) establishes a similar framework for ambient concentrations of arsenic, cadmium, mercury, nickel, and polycyclic aromatic hydrocarbons. The member states are then required to develop action plans to reduce ambient concentrations or, where the concentrations are already below the thresholds, to keep them from rising.

In addition, there are other pollutant-specific sector-specific emissions controls. The National Emission Ceilings Directive (Directive 2001/813) is focused on reducing emissions of acidifying and eutrophying pollutants and ground-level ozone precursors. Included within its reach are sulfur dioxide, nitrogen oxides, volatile organic compounds, and ammonia. The Emission Ceilings Directive covers almost all sources of emissions and sets emission reduction goals for 2010 (interim) and 2020 (final). Member states are expected to implement national plans to reduce overall emissions to meet these goals. As this book goes to press, the National Emission Ceilings Directive is under review; there are proposals to extend the compliance date to 2030, and also to add methane and PM_{2.5} to the list of regulated pollutants. The EU also has a series of "transport" directives pertaining to emissions from motor vehicles, marine vessels, trains, and attendant fuels (Van Calster and Reins 2017), and a separate directive (Directive 2004/42) to control the emissions of volatile organic compounds (VOCs) from paints and varnishes. This "Paints Directive" employs a pre-market screening process to limit the content of VOCs in regulated paints and varnishes.

The EU also has an evolving program to reduce greenhouse gas (GHG) emissions, which is currently embodied in the "2020 strategy" (Brussels, 3.3.2010, COM (2010)), which sets a 2020 goal of a 20 percent reduction of GHG emissions; 20 percent increase

in the share of renewables in the EU's energy mix; and 20 percent increase in energy efficiency.

10.2.2.2 *Water pollution*

Beginning in the 1970s, as in the United States, European water protection policies focused principally on regulating pollutant discharges from major point sources to surface waters, and on setting ambient water quality standards for those waters (known as environmental quality standards, EQS) intended to be protective of human health and aquatic life. Later, an effort was made to extend regulatory control over nonpoint water pollution (diffuse runoff from various sources) but, also as in the United States, this source of pollution proved more difficult to bring under the regulatory ambit due to the challenges associated with implementation and enforcement.

Since 2000, the EU has taken an integrated approach to water that focuses not only on keeping pollution out of waterways, but also on ensuring adequate supplies of water and on issues of flood control and erosion. The key document integrating these functions is the Water Framework Directive (Directive 2000/60), which subsumed a number of previous water protection initiatives and placed them into an overarching policy. Its goals and scope are set out in Article I of the Directive:

The purpose of this Directive is to establish a framework for the protection of inland surface waters, transitional waters, coastal waters and groundwater which (a) prevents further deterioration and protects and enhances the status of aquatic ecosystems [. . .] (b) promotes sustainable water use [. . .] (c) aims at enhanced protection and improvement of the aquatic environment [. . .] through specific measures for the progressive reduction of discharges, emissions and losses of priority substances [. . .]; (d) ensures the progressive reduction of pollution of groundwater and prevents its further pollution; and (e) contributes to mitigating the effects of floods and droughts [. . .].

Unlike the United States, which has separate regulatory programs for surface water and drinking water protection, the EU pursues both programs under the same regulatory umbrella. Further, while the U.S. has no federal law directly addressing groundwater protection, the Water Framework Directive is explicitly focused on the protection of groundwater as well as surface waters and drinking water. As noted on the European Commission's website for the Directive, "the presumption in relation to groundwater should broadly be that it should not be polluted at all."^{*}

The Directive takes a river basin approach. Member states are required to identify the various river basins lying within their borders, and to assign each of them to individual river basin districts. River basins lying within more than one country are also assigned to an international river basin district. A management plan is then to be prepared for each river basin. Although various exemptions may be applicable, each plan must be designed to meet the environmental objectives and standards for surface waters, groundwater, and protected areas as prescribed in the Directive. According to a 2012 progress report (COM(2012)670 of November 14, 2012), member states are claiming exemptions more often than anticipated, thus slowing the realization of implementation goals. Nonetheless, this legislation has been a significant driver of changes in water management for member

^{*} See http://ec.europa.eu/environment/water/water-framework/info/intro_en.htm (accessed December 9, 2017).

states across Europe. The Directive anticipates public participation from key stakeholders as a central feature and thus moves compliance and implementation from a purely technical undertaking to the political and social arenas (Gooch and Huitima 2008).

10.2.2.3 *Waste*

10.2.2.3.1 IN GENERAL

From 1975 through 2013, the EU adopted a plethora of laws dealing with solid waste (both hazardous and non-hazardous). The Waste Framework Directive, adopted in 1975 and amended periodically thereafter (currently Directive 2008/98/EC), provides the overall framework for waste management in the EU, seeking to ensure that waste does not present a risk to water, air, soil, wildlife, or human health. The Hazardous Waste Directive (91/689/EEC) sets standards for the management of hazardous waste. EU legislation also sets detailed requirements for landfills (Directive 2000/76) and incinerators (Directive 99/31).

A move toward a more integrated approach came with the issuance of the 2005 Thematic Strategy on the Prevention and Recycling of Waste. As described in an EU explanatory document, “The Strategy’s key objective is to make Europe a recycling society that seeks to prevent waste and, where waste cannot be prevented, uses it as a resource” (EC 2005, p. 4). In other words, the Thematic Strategy envisions something of a mix of a pollution prevention-oriented approach (“avoid waste”) and an industrial ecology approach (emphasizing “waste as a resource”). In an effort to achieve these goals, the Thematic Strategy identifies seven “key actions” for implementation throughout the EU:

- **Implementation and enforcement of existing EU waste legislation:** Enforcement of waste management and disposal standards is critical to creating an economic incentive for waste prevention. Perhaps predictably, this has proven easier said than done. As noted in a 2011 report to the European Commission, “A recent Commission report confirms that the lack of proper implementation continues to cause widespread failure in achieving the agreed environmental protection objectives in practice and shows significant disparities between Member States” (EC 2011, p. 3). Similarly, as noted in the earlier EC (2005, p. 4) report, “There are thousands of mismanaged or unauthorised landfills in the EU, and Member States fail to exert effective control over some shipments of waste.”
- **Simplification and modernization:** The goal here has been to make EU waste regulations more “cost-effective” for the regulated industries, with the expectation that this will help encourage companies to seize on the economic advantages of waste recycling and reuse.
- **Introducing life cycle thinking in waste policy:** The Thematic Strategy seeks to imbue its waste policy with the importance of the waste and environmental implications of the entire life cycle of a product, from initial extraction of the raw materials to the ultimate disposal of any remaining waste at the end of the product’s life. As discussed below, with the WEEE Directive and the Integrated Products Policy, the EU has embarked on significant initiatives to implement this principle.
- **Waste prevention:** To encourage reduction of waste at the source, the Waste Framework adopted a “waste hierarchy” of the type often discussed in the U.S. in the 1980s and 1990s. This hierarchy lists five options for managing solid waste, ordered from “best” to “worst”: (1) prevent waste in the first place; (2) reuse the product; (3) recycle or compost the material; (4) recover the energy by incineration; and (5) landfill the waste. In general, implementation of this hierarchy is advisory rather than mandatory,

and EU policy documents acknowledge that the concomitant emphasis on waste recycling – which depends on the existence of a market for waste – will require a departure from the hierarchy in many instances.

- **Improving the knowledge base:** The EU, like the U.S. before it, has determined that having accurate information on the generation, management, and disposal of waste is essential both to developing a meaningful assessment of the scope of the waste problem and to crafting solutions thereto. To this end, Eurostat, a Directorate-General of the European Commission located in Luxembourg, now hosts a Waste Data Center that serves as “the central entry point for reporting and access to waste data” (EC 2011, p. 4). In addition, several EU bodies gather and disseminate information on recycling opportunities and product life cycle issues.
- **Development of recycling standards:** Recognizing that “dirty” recycling practices – those with adverse environmental or public health consequences – were prevalent in some EU industries, the Thematic Strategy has made the tightening of recycling standards one of its principal goals. The hope is that this will both decrease those adverse consequences and increase consumer confidence in products made from recycled materials.
- **Setting recycling goals:** Finally, the Thematic Strategy seeks to create policies that encourage recycling. The EU has set percentage goals for the recycling of various types of products, such as batteries and end-of-life vehicles, and has established a 50 percent target for recycling of municipal waste comprising at least paper, metal, plastic, and glass, and a 70 percent target for construction and demolition waste, both of which are to be met by 2020. The EU has also encouraged recycling by imposing percentage limitations on the landfilling of biodegradable waste, which has helped to improve the market for the recycling of such waste.

10.2.2.3.2 THE WEEE DIRECTIVE

The Thematic Strategy’s focus on “life cycle thinking” was predated by the promulgation of the EU Directive on Waste Electrical and Electronic Equipment (WEEE Directive). First adopted in 2002 (Directive 2002/95), and then amended to expand its scope in 2012 (Directive 2012/19), the WEEE Directive aims to reduce the amount of electrical and electronic waste disposed in landfills and incinerators. Under the directive, producers are responsible for taking back and recycling electrical and electronic equipment. This strategy is intended to provide incentives to design electrical and electronic equipment in a more environmentally efficient way, taking waste-management aspects fully into account. To prevent the generation of hazardous wastes, the WEEE Directive also requires the substitution of safer alternatives for heavy metals (such as lead, mercury, cadmium, and hexavalent chromium) and brominated fire retardants in new electrical equipment. Member states were required to promulgate the laws, regulations, and administrative provisions necessary to comply with the directive, to set up systems for the separate collection of waste electrical and electronic equipment, to collect 4 kg per capita/per year from private households, and to ensure that a very high percentage is re-used, recovered, or recycled. The producers of electrical and electronic products are required to finance the collection, treatment, recovery, and environmentally sound disposal of household waste electrical and electronic equipment deposited at the collection facilities. In addition, member states are to draw up a register of producers and keep information on the quantities and categories of electrical and electronic equipment placed on the market, collected, recycled, and recovered in their territory. Every three years, they must also send a report to the Commission on the implementation of this directive. The Commission is then to publish a report on the same subject within nine months after receiving the reports from the member states.

Although there are still industrial concerns about the costs of implementing and operating under the WEEE Directive, such as the implications for trade outside the EU, industries across the EU are beginning to work together in order to meet the WEEE objectives, creating further awareness of life cycle assessment and waste minimization of harmful contaminants on a more global scale.

10.2.3 The Industrial Emissions Directive (Integrated Pollution Prevention and Control)

The purpose of the European Union's Integrated Pollution Prevention and Control Directive (IPPC), adopted in 1996 (Directive 96/61), was to provide a high level of environmental protection by preventing, wherever practicable, or otherwise reducing (controlling), emissions to air, water, and land from a range of industrial and agricultural sectors and activities.* The IPPC represented a shift in focus in EU environmental law from separate emphases on pollution of air, water, and waste – usually employing end-of-pipe or secondary prevention approaches – to an integrated approach of preventing pollution (and sudden and/or accidental releases) at the source. In this way, it paralleled the approach envisioned – but not (yet) accomplished – by the U.S. Pollution Prevention Act of 1990.

In 2010, the IPPC Directive, along with seven emissions directives for certain industries, was consolidated into, and subsumed by, the Industrial Emissions Directive (IED, Directive 2010/75), and is now commonly known by that name. Unlike many EU environmental directives, the IED places specific restrictions on member states to ensure that individual firms (in the energy industries, the production and processing of metals, the mineral industry, the chemical industry, waste management, livestock farming, and others defined in Annex I of the directive) comply with operating permits. Its implementation is known as the Seville Process, named after the EU institution located in Seville, Spain, that establishes the emission limits and other conditions to be placed in the permits. The permits themselves are issued by the relevant authorities within the individual member states.

The permits are designed to require the regulated installations to meet the following basic obligations:

- Use the best available techniques (BAT) for pollution prevention (those that produce the least waste, use the least hazardous substances, and maximize the recovery and recycling of substances generated);
- Prevent all large-scale pollution;
- Prevent, recycle, or dispose of waste in the least polluting way possible;
- Use energy efficiently;
- Ensure accident prevention and damage limitation; and
- Return sites to their original state when the activity is over.

The key feature of these permits is the specification of emission limitations (“emission limit values,” usually expressed numerically) for various pollutants (excluding radioactive and bioengineered materials), and applicable to all waste streams emanating from the installation. These limits are set according to what is deemed achievable with the use of BAT within the particular industry sector. Article 3 of the IED defines BAT as:

the most effective and advanced stage in the development of activities and their methods of operation which indicates the practical suitability of particular techniques for

* For a comparison of the differences in the implementation of the IPPC Directive in the United Kingdom and the Netherlands, see Gouldson and Murphy (1998).

providing the basis for emission limit values and other permit conditions designed to prevent and, where that is not practicable, to reduce emissions and the impact on the environment as a whole,

and further clarifies that “‘techniques’ includes both the technology used and the way in which the installation is designed, built, maintained, operated and decommissioned,” that “available” techniques are those that are “developed on a scale which allows implementation in the relevant industrial sector, under economically and technically viable conditions, taking into consideration the costs and advantages,” regardless of whether the techniques are currently used within the member state, and that “best” means the “most effective in achieving a high general level of protection of the environment as a whole.” The BAT limits are established on an industry-by-industry basis, much like the national technology-based standards set by the U.S. EPA under the Clean Water and Clean Air acts. Identification of required performance levels achievable by BAT is undertaken by the EU Center in Seville and published in its Best Available Techniques Documents (BREFs). Member states are also required to encourage the development and application of “emerging techniques” (in particular for those referenced in BAT reference documents) which if commercially developed could provide a higher level of protection or a more cost-effective means. Thus, modest technology-forcing is intended. Greenhouse gas emissions are exempted from the emission limitations if they are covered by an emissions trading scheme.

In addition to the emission limits, the permits must contain a number of other specific requirements, including:

- Any required soil-, water-, and air-protection measures;
- Waste-management measures;
- Measures to be taken in exceptional circumstances (such as what to do when there are leaks, malfunctions, or temporary or permanent stoppages);
- Minimization of long-distance or trans-boundary pollution;
- Monitoring of releases to the environment; and
- All other “appropriate” measures.

Because it was acknowledged that the implementation of these new and considerably tougher BAT rules could be expensive for a number of existing EU installations, the directive granted the covered installations a lengthy transition period to come into compliance. By 2013, around 60,000 installations across the EU were required to have IED permits. In many cases, conversion to BAT has meant radical environmental improvements within industries. In other cases, however, the cost of strict compliance with BAT limits has led some member states (citing the directive’s instruction that BAT is to be assessed “under economically and technically viable conditions, taking into consideration the costs and advantages”) to relax the limits when issuing permits for certain facilities. Thus, in a 2016 review, the European Union Network for the Implementation and Enforcement of Environmental Law stressed the need for “a level playing field and implementation [of the IED]” across the EU (European Union Network 2016).

The IED’s requirement that permits impose an affirmative obligation to monitor emissions may prove to be one of its strongest features. In accordance with the Århus Convention (see Section 10.3.9), and with appropriate safeguards for commercial and industrial secrecy, this information must be made available to interested parties. Further, a portion of the EU law implementing the Århus Convention (Regulation (EC) 166/2006) established a European Pollutant Release and Transfer Register (PRTR), which harmonized rules governing the regular reporting of such information from the member states to the EU Commission. The PRTR contains pollutant data reported annually by some 30,000 industrial facilities across Europe and makes these data available to the public.

10.2.4 *The Integrated Product Policy*

While the pollution generated by facilities and installations has been the traditional focus of environmental regulation, the many activities associated with the production, use, and disposal of products add a different dimension to environmental degradation. As noted by Tukker and Jansen (2006, p. 159), “environmental effects of economic activities are ultimately driven by consumption, via impacts of the production, use, and waste management phases of products and services ultimately consumed.” In 2003, after years of informal discussions on the need for a life cycle approach to product regulation, the EU Commission issued a “Communication” on the development of an Integrated Product Policy (IPP), a largely voluntary initiative that seeks to strengthen product-related environmental policies, with a view to promoting the development of a market for greener products. It is linked to what is called the EU New Approach, a number of directives with a focus on product safety. The IPP strategy focuses mainly on an assessment of the environmental impacts throughout the life cycle of products and relies on the use of “Ecolabels” to serve as a voluntary market-focused screening mechanism (through the exercise of consumer choice) and to transmit important information about products. The proposed strategy envisions the involvement of all interested parties at all logical points of intervention throughout a product’s life cycle. Environmentally friendly design (“eco-design”) should be promoted by the manufacturers. Distributors should put “green” products on the shelves and should inform consumers of their existence and benefits. Consumers should preferably choose green products and use them in such a way as to prolong their shelf life and reduce their impact on the environment. NGOs could play a role in identifying problems and solutions with a view to creating products that are more environmentally friendly.* There have also been suggestions that the IPP concept should be incorporated into the Industrial Emissions Directive, such that installation permits would also pertain to the design of the products made at the installation, but this idea has not received enthusiastic support from industry (Dalhammar 2007, p. 107).

The safety of consumer products has received attention in a number of countries, and the evidence seems to indicate that mandatory product standards (regulating product safety and buyback) have by far been the most powerful driver for inducing eco-design practices in industry, and perhaps the decisive factor (Dalhammar 2007, pp. 77–78). Historically, however, “implementation of most product-related policies and procedures has been rather ad hoc, and there has been no systematic strategy to address the environmental impacts of products over the entire life cycle” (ibid., p. 78). In a real sense, policies that focus only on the consumer safety aspects of products are out of date. Environmental pollution and safety risks from the extraction of materials, the transformation of these materials into feedstocks and starting materials for product manufacturing, and the manufacturing, transportation, use, and disposal of the products themselves are all part of the life cycle of products.† On the other hand, although the current EU Integrated Product Policy focuses mostly on environmental impact, it does pay some attention to consumer safety associated with products.‡

Partial attempts to integrate various stages of a product’s life are reflected in the developing laws for implementing extended producer responsibility, whereby producers of industrial chemicals have obligations to ensure safe use by their industrial customers; the establishment of buyback provisions, as in the case with used motor oil in Germany; and the EU WEEE Initiative for electronics, discussed above, which establishes a complex

* See <http://ec.europa.eu/environment/ipp/> (accessed December 9, 2017).

† See Geiser (2001).

‡ Consumer product safety in the EU is more directly regulated by the General Product Safety Directive (2001/95/EC), which establishes a General Safety Requirement.

system linking producers and users. The essential point, of course, is that these various health, safety, and environmental concerns ideally should be taken into account at the design stage, where the choice of materials, manufacturing methods, safety, and disposal consequences must be considered. The design of sustainable products is an essential part of sustainable development.

Unfortunately, the IPP initiative has not matched the rhetoric accompanying the announcement of the initial creation of the plan. As one NGO commentator opined (Sheehan 2004, p. 3):

IPP is an EU initiative that emerged with revolutionary flair in the late 1990s as a holistic, systems-based approach to developing and “harmonizing” policies that target the entire product life cycle. [. . .]

While talk about IPP continues, the political will to advance IPP at the EU level does not appear to be present. [. . .] The Commission sees IPP in the expansive sense as a dead issue; no directive is under consideration or expected. The EU seems to be assuming a more passive stance and focusing on incremental product innovation.

The Eco-design Directive of 2005 (2005/32/EC) – generally considered the first IPP directive – aims at reducing the environmental impact of energy-related products and attempts to reduce energy consumption throughout their life cycle. However, it does not contain many binding obligations and, in any case, may not provide first-mover advantages because the requirements are not stringent enough (Dalhammar 2007, p. 106; see the discussion of the regulation-induced innovation hypothesis in Section 8.3.5 in Chapter 8). One aspect of the IPP that has advanced over the years is the Ecolabel. The Ecolabel concept actually predates the formal IPP by a decade, having first surfaced in 1992 as an “eco-label award scheme” (Regulation 880/92), but came into its present form in 2010, with the Regulation on the EU Ecolabel (Regulation 66/2010). To obtain an Ecolabel, a product (or service) must meet several criteria indicative of it being environmentally friendly throughout its life cycle. Reportedly, more than 44,000 products and services had been awarded the right to display the Ecolabel as of 2014 (Van Calster and Reins 2017, p. 120). While this may encourage the development and use of environmentally friendlier products, the label itself says nothing about whether these products are the best we can do now or in the future.

10.2.5 Prevention of chemical accidents

One of the most important and best-known EU directives is the EU Directive on Major Accident Hazards of Certain Industrial Activities (82/501/EEC), commonly known as the Seveso Directive. First implemented in 1982, it requires member states to ensure that all manufacturers prove to a “competent authority” that they have identified the major chemical hazards associated with their industrial activities, that they have adopted appropriate safety measures (including emergency plans), and that they provide information, training, and safety equipment to their on-site employees. A revised version, the Seveso II Directive (96/82/EEC), came into effect in 1997. In addition to extending the scope of the directive to a broader range of installations, Seveso II declared that “inherent safety” – the chemical safety analogy to pollution prevention – would be the preferred approach. This places the EU ahead of the U.S. practice, which continues to emphasize secondary prevention measures, such as stronger containment vessels to contain chemical explosions. In contrast, the inherent safety approach focuses on preventing the explosion in the first place, and thus calls for, for example, the substitution of less volatile chemicals for more volatile ones. This approach was reaffirmed in the Seveso III Directive (12/18/EU), which took effect in 2015. This new directive made mostly minor changes to Seveso II,

but also strengthened the right of the public to obtain chemical safety information from individual facilities and called for the involvement of the public in decisions regarding the siting of new or modified facilities.

10.2.6 Access to information and participatory rights

The EU has implemented directives adopting the UN's Århus Convention on Access to Information and Public Participation on Decision-making and Access to Justice in Environmental Matters. See Section 10.3.9 for a discussion of the Århus Convention and the corresponding EU directives. The third element of the Århus Convention is to provide citizens access to the courts and legal tribunals. Since many EU countries do not follow the British common law tradition – which provides judicial review as a matter of right – the Commission has only partially adopted the convention, leaving it up to each member state to allow or not allow judicial review according to their legal tradition. Where judicial review is not authorized, the affected publics (citizens, workers, etc.) are often given opportunities to actively engage in rule-making prior to its final formulation.

10.2.7 Chemicals policy and REACH*

Although the European Union implemented regulations mandating safety testing of new chemicals in the 1970s, no routine tests were required for chemicals already in use - the so-called existing chemicals. Even today, these existing chemicals constitute the vast majority of the chemical substances on the market.

In 1993, the European Union implemented the Existing Substances Regulation (EC Regulation 93/793) to overcome the lack of knowledge about the hazards and uses of existing chemicals. The regulation required some producers, manufacturers, and importers to present a base data set for existing chemicals. On the basis of these data, the European Commission developed four priority lists that included 141 existing high production volume (HPV) chemicals. For each such chemical, a member state was chosen to conduct a risk assessment, and to suggest risk-management proposals, on the basis of all available data about the hazards of the chemical and the extent of human and environmental exposure to the chemical. Afterward, the risk-management proposals of the member states were to be discussed at the European level, and changed where required, until all member states agreed with them. Because there were few incentives for the firms manufacturing or using the chemicals to provide risk information to the member states, and because of the time and resources necessary to conduct a meaningful risk assessment, only seventy risk-assessment reports had been finished after many years.

In 1999, the European Chemicals Bureau (ECB) analyzed the data it had received from industries and member states on the properties of the HPV chemicals. This study found that there were sufficient publicly available data for only 14 percent of these chemicals, that there were some, but not sufficient, available data for 65 percent, and that there were no available data for the remaining 21 percent (Allanou et al. 1999). Without sufficient data, the ECB found it impossible to determine which chemicals should be prioritized for further evaluation. Moreover, it was unclear how industry was managing to carry out its other responsibilities, such as classification and labeling of chemicals and assessing risks to workers, in the absence of these data.

To address this gap in information, and to lay the foundation for the potential regulation of these chemicals, the European Commission issued a regulation in 2006

* Some portions of this section are drawn from Koch and Ashford (2006).

establishing what is known as the REACH (**R**egistration, **E**valuation, and **A**uthorization of **C**hemicals) system (EC 1907/2006). In essence, REACH is the European counterpart to the U.S. Toxic Substances Control Act, passed thirty years earlier. REACH also created the European Chemicals Agency (ECHA) in Helsinki, Finland, to administer the European chemicals policy.*

The main elements of REACH are uniform procedures for (1) the registration and evaluation of new and existing chemicals, (2) the transfer of responsibility for producing and assessing chemicals data to industry, (3) the expansion of the responsibilities of downstream users, and (4) the regulation of chemicals and the placing of restrictions on them through the authorization process. As discussed below, chemicals of “very high concern” can be placed on the market only upon explicit authorization.

It is estimated that there are approximately 30,000 chemicals that are of hazardous significance or that are used on a significant scale in the EU, and the requirements for their registration (targeted for completion by 2018) depend on the amount produced annually. Generally, the system has three tiers. By November 2010, chemicals produced or imported in excess of 1,000 tons/yr., and those considered particularly hazardous, were to be registered; some 4,300 were in fact registered.† Chemicals produced or imported in excess of 100 tons/yr. were to be registered by June 2013, and those produced or imported at a volume of 1 to 100t/yr. by June 2018.

All chemicals produced in amounts from 1 to 10 tons/yr. may be initially registered upon the submission of only minimal toxicological information. A safety assessment report is necessary for substances produced in quantities over 10 tons/yr. (estimated to be about 15,000 substances). This report must identify the relevant chemical properties and exposure profiles and must also identify the risk-reduction measures necessary to assure the safe use of the chemical by the producer through the downstream users. Further, a safety data sheet identifying necessary risk-reduction measures must be supplied to, and if necessary modified by, all the actors in the supply chain. All substances produced in quantities greater than 100 tons/yr. (estimated to be about 10,000 substances) and all substances produced in smaller quantities that are suspected of being hazardous (estimated to be about 5,000 substances) are being initially evaluated by the relevant authorities in the member states after registration. Different member states, selected by ECHA, have the responsibility for evaluating different chemicals, subject to ECHA approval.

Throughout this process, it is expected that animal testing will be kept to a minimum, with reliance instead on the use of alternative testing methods. REACH sets out a number of detailed obligations aiming to reduce animal testing and provides incentives for the use and development of alternative methods for hazard assessment. Through 2011, the European Commission had allocated €330 million to fund research into the development of such alternatives.‡ Ideally, the move away from a regimented reliance on expensive and time-consuming animal toxicity studies, and an increased reliance on reliable screening tests such as molecular structure-activity determinations (Cronin et al. 2003; Lewis et al. 2007; OECD 1993), will help accelerate the pace of meaningful risk assessment. However, a 2013 Commission report indicates that companies are opting out of animal testing in situations where such testing may well be warranted.§

* See <http://echa.europa.eu> (accessed December 9, 2017).

† Source: Report [on the Implementation of REACH] from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions (2103) (2013 REACH Report), p. 1.

‡ 2013 REACH Report, p. 9.

§ 2013 REACH Report, p. 9 (noting that “the quality of the justifications for not conducting animal tests is of concern,” and citing “the inappropriate adoption of alternative approaches”).

After the submission of registrations, ECHA prioritizes candidates for authorization and determines whether restrictions on use or introduction into commerce are warranted. The member states then have the responsibility for enforcing ECHA's regulations and for establishing specific sanctions for noncompliance within their borders. As with other regulatory requirements and standards set by the central EU agency – here ECHA – member states are free to set more stringent requirements if they choose.

In contrast to the well-defined data requirements for risk assessment, the responsibility for risk management is defined only cursorily and superficially in REACH. Manufacturers and importers must identify and apply “appropriate” measures to “adequately control” the risks identified in the chemical safety assessment and must, where suitable, recommend them in the required safety data sheets. If this risk-management element of REACH is to attain the regulation's goal of promoting safer chemicals, there must be both a clear definition of “adequate control” and meaningful sanctions for noncompliance. Currently, the point of reference for adequate control appears to be the probable no-effect concentration (PNEC) for the environment and the derived no-effect level (DNEL, equivalent to the no observed adverse effect level (NOAEL) in U.S. parlance) for human health, but the sanctions for exceeding these levels are not clear. Further, the current sanctions for failing to identify risks during the registration process are very limited and often are insufficient to overcome the producer's incentive to withhold such information. To guarantee that the system of risk management works, it must be accompanied by adequate control mechanisms and sanctions. Otherwise, REACH could simply collect data about risk without significantly forcing or encouraging risk-reduction measures.

REACH does take a more aggressive approach with regard to particular classes of substances. Chemicals with certain hazardous properties – known as “substances of very high concern” (SVHC) – must be separately authorized. These include (1) substances that can cause cancer or mutations or are toxic to reproduction (the so-called CMR substances); (2) those that are persistent, bioaccumulative, and toxic (PBT) or very persistent and very bioaccumulative (vPvB); and (3) substances that are identified on a case-by-case basis as causing probable serious effects to humans or the environment of an equivalent concern, such as endocrine disrupters. In June 2010, there were thirty-eight substances of very high concern identified by ECHA (Cohen 2010, p. 61). In June 2018, the candidate list of substances of very high concern included 181 substances.* For any of these substances, the burden of proof on safety shifts from the authorities to the producers, regardless of the amount of the substance produced.

The REACH reporting system can be seen as the embodiment of the precautionary principle, because substances are to be screened for their possible effects even if the risk has not been scientifically validated. The extent of the actual precautionary effect, however, is called into question by the relative vagueness of the mandate. In general, an authorization of the chemical for certain uses will be issued if the producer proves either that the risks of those uses can be “adequately controlled” or that their socioeconomic benefits exceed their risks. If the use of the chemical cannot be “adequately controlled,” an analysis of alternative substances or technologies – and an adequate substitution plan – must be provided by the firm seeking authorization. These relatively broadly worded requirements leave wide discretion to the implementing authorities. Moreover, ECHA has found “insufficient assessments by registrants of persistent, bioaccumulative and toxic (PBT) and very persistent, and very bioaccumulative (vPvB) properties.”† Nonetheless, despite these potential drawbacks, there are indications that this system is having a positive impact, as ECHA reports that the authorization restrictions on the SVHC chemicals are leading companies to adopt safer substitutes that can be used without these restrictions (C&EN 2017).

* See <https://echa.europa.eu/candidate-list-table> (accessed June 5, 2018).

† 2013 REACH Report, p. 4.

In principle, a wider use of this approach to authorization could establish a new form of (regulatory) risk management, reversing the burden of proof for a broader class of substances with certain defined properties. As the EU expands REACH to accommodate the registration of nanomaterials – a process that is now underway – it has an opportunity to strengthen and more clearly delineate the risk management protocols throughout the authorization process. As past experience shows, discretion has often weakened the application of a regulation in practice. Indeed, though REACH has immense potential, the U.S. experience with the Toxic Substances Control Act (TSCA) suggests a need for caution. As discussed in Chapter 9, the promise of TSCA has far outstripped its performance historically, as the EPA has not made significant use of the statute's opportunities to regulate harmful chemicals and encourage the development and use of safer ones. Perhaps the 2016 reform of TSCA will bring about needed changes, but it is too early to tell. At this point, it would not be inaccurate to characterize TSCA as something of a paper tiger. Given the broad regulatory discretion of the EU under REACH, there remains legitimate concern that, despite its apparent progress, it could suffer a fate similar to TSCA's.

One discouraging sign is the EU's five-year extension of the authorization of glyphosate, a Monsanto-manufactured organophosphate pesticide known as "roundup," after a bitterly contested reauthorization battle. Despite the World Health Organization's determination that glyphosate is "probably carcinogenic to humans," EU's food (EFSA) and chemicals (ECHA) agencies did not find sufficient evidence to justify withdrawal of the EU's prior authorization of the chemical (Askew 2017). Glyphosate continues to be authorized in the U.S. as well, although California added it to that state's list of chemicals requiring warning labels (Watson 2017).

10.2.8 Food safety

A series of potential crises concerning human food and animal feed (for example, bovine spongiform encephalopathy [BSE] and dioxins) exposed weaknesses in the design and application of food legislation within the EU.* This led the Commission to include the promotion of a high level of food safety among its policy priorities, emphasizing transparency, risk analysis, and prevention. The EU states that its food-safety objective is:

to protect consumer health and interests while guaranteeing the smooth operation of the single [European] market. In order to achieve this objective, the EU ensures that control standards are established and adhered to as regards food and food product hygiene, animal health and welfare, plant health, and preventing the risk of contamination from external substances. It also lays down rules on appropriate labeling for these foodstuffs and food products.†

Regulation EC 178/2002 of the European Parliament and the Council laid down the general principles and requirements pertaining to the entire food chain and established the European Food Safety Authority (EFSA). The regulation was amended by many subsequent regulations.‡ The EFSA established advisory panels on a variety of topics, including panels on food additives, contaminants in the food chain, biological hazards, and genetically modified organisms (GMOs). A "rapid alert system" was also established by which a

* See also Section 10.14 on international approaches to food-safety regulation and policy, and Chapter 11 for the EU's defense of its policy banning beef with added hormones.

† See European Union regulations, European Encyclopedia of law, Food Safety, <http://europeanlaw.lawlegal.eu/food-safety/> (accessed December 9, 2017).

‡ See the Food Safety Authority of Ireland, General Principles of Food Law, www.fsai.ie/legislation/food_legislation/general_principles_of_food_law.html (accessed December 9, 2017).

member state can provide information about a significant food risk to the EU Commission, which will in turn transmit appropriate information to other member states and order provisional emergency action as deemed necessary. Member states may take interim protective action if no EU action is taken.

In 2005, to address the possible contributions of food contaminants and diet to human cancer, the EU established the Environmental Cancer Risk, Nutrition, and Individual Susceptibility (ECNIS) “network of excellence,”* a consortium of various research groups tasked with developing an

understanding of cancer risks posed by exposure to carcinogens present in the environment in its broadest sense, i.e. food, air, water and other environmental media, or resulting from lifestyle-related activities such as exposure to environmental pollution or tobacco smoke, and of the way that such risks are modulated by nutrition and individual genetic predisposition.†

Nonetheless, the EFSA has refused to take any action to restrict the use of the ubiquitous artificial sweetener aspartame, despite the findings by Cesare Maltoni Cancer Research Center in Milan – the same laboratory that discovered that vinyl chloride is a carcinogen – that aspartame causes cancer in laboratory animals (Hills 2009). While the use of the precautionary principle, in the context of taking “appropriate provisional risk management measures” where there is a lack of scientific certainty, is an articulated centerpiece of EU food law, its actual application is voluntary. The continued presence of aspartame on the European market is a stark reminder of that fact.‡

In another controversial action, the Council of Agricultural Ministers of the EU has indicated its intent to approve the marketing of food derived from cloned animals (Harrington 2009). Applications for these “novel foods” would be sent to the EFSA for a risk assessment. However, the EU Commission, following the wishes of the Council of Environmental Ministers, imposed an (informal) moratorium on these foods, as well as on foods containing nanoparticle ingredients (European Parliament 2010). The moratorium on nanoparticles in food remains in effect, but since 2014 the EU has allowed the marketing of meat cloned from animals so long as it is labeled as such (Europa 2014).

In general, the EU tends to take a more precautionary approach to food regulation than the U.S. The attempt to forge a new trade regime between the U.S. and the EU stalled, in part, because of the parties’ difficulty in agreeing on regulatory approaches for food safety (Copley 2016). U.S. regulations have generally been less strict than those of the EU (IFG 2014). For example, 70 percent of all processed foods sold in the U.S. contain GMOs, compared to none in the EU (Greenpeace 2016).

10.2.9 Biotechnology§

The EU has been very active in the area of biotechnology oversight and regulation. The current EU legal framework for biotechnology became effective in 2004 and is considered

* See ECNIS (Environmental Cancer Risk, nutrition and Individual Susceptibility) Project website, http://cordis.europa.eu/project/rcn/74967_en.html (accessed December 9, 2017).

† Source: Final Report – ECNIS (Environmental Cancer Risk, Nutrition and Individual Susceptibility) Project, p. 8, Available at http://cordis.europa.eu/publication/rcn/13312_en.html (accessed December 9, 2017).

‡ The EU is not alone in this policy choice; despite the Delaney Clause of the Food, Drug, and Cosmetic Act, which bans food additives found to cause cancer in animals (see Chapter 9), the U.S. has also allowed aspartame to remain on the market.

§ See Chapter 11 for a discussion and implications of biotechnology for international trade.

to be one of the strictest in the world (EC 2006). Box 10.5 summarizes the EU approach, which is comprised of several directives. The central directive on the deliberate release of GMOs into the environment (2001/18/EC) addresses both experimental releases, such as the conducting of field tests, and the cultivation, importation, or transformation of GMOs into industrial products. A considerable number of implementing measures to support the operation of this framework have also been adopted by member states. These include, among others, guidelines for risk assessment, monitoring, formats for submission of notifications, sampling and detection, and coexistence measures. For a thoughtful evaluation of the implementation of the central GMO directive, see Valve and Kauppila (2008) and van Calster and Reins (2017, pp. 300–307).

Box 10.5 EU legal framework for biotechnology

The excerpt below describes the main legal instruments of the revised EU legislative framework on GMOs (updated from EC 2006 and 2007):

Directive 2001/18/EC on the deliberate release into the environment of GMOs

applying to the intentional introduction of GMOs into the environment without specific containment measures. The Directive covers both releases of GMOs for experimental purposes (e.g., in connection with field trials) and for commercialisation (e.g., the cultivation, importation, and processing or transformation of GMOs into industrial products).

Regulation (EC) No 1829/2003 on genetically modified food and feed, which regulates the placing on the market of GMOs for food and feed use, as well as food and feed containing, consisting of, or produced from GMOs. If one of the uses of a GMO concerns food or feed, the applicant may file a single application for the GMO and all its uses (cultivation, processing).

Regulation (EC) No 1946/2003 on transboundary movements of genetically modified organisms regulates unintentional trans-boundary movements of GMOs and exports of GMOs to third countries.

Directive 90/219/EEC, as amended by Directive 98/81/EC, **on the contained use of genetically modified microorganisms (GMMs)**. This Directive regulates research and industrial work activities involving GMMs (such as genetically-modified viruses or bacteria) under conditions of containment, i.e., in a closed environment (e.g., a laboratory) in which contact with the environment and the population is avoided.

Regulation (EC) No 1830/2003 concerning the traceability and labeling of genetically modified organisms and the traceability of food and feed products produced from genetically modified organisms and amending Directive 2001/18/EC.

Regulation 1829/2003 lays down specific labeling requirements for GM food and feed.

Directive 2015/412 allows member states to bypass EU authorization and set their own more permanent rules. The member states can “opt out” of allowing GMO cultivation in their territories if they can establish one or more enumerated “compelling grounds,” which include environmental policy objectives. But those grounds do not include disagreement with the (traditional) scientific risk assessments recommended by the European Food and Safety Authority (EFSA).

“Traceability” – the means to trace products through their production and distribution lines – is an essential part of the EU regulatory framework for GMOs. The general objectives of traceability are to facilitate control and verification of labeling claims; allow targeted monitoring of potential effects on health and the environment, where appropriate; and permit the withdrawal of products that contain or consist of GMOs when an unforeseen risk to human health or the environment is established. The Labeling and Traceability Regulation (Regulation 1830/2003) covers all GMOs that have received EU authorization to be placed on the market, which comprises all products containing or consisting of GMOs, including food and feed. Examples include GM seeds and bulk quantities or shipments of whole GM grain, such as soybeans and maize. The regulation also covers food and feed derived from a GMO, such as flour produced from genetically modified maize. The traceability rules oblige the operators concerned – that is, all persons who place the product on the market within the EU or who receive the product once it is placed on the market – to be able to identify their supplier and the companies to which the products have been supplied. Further, all food products that make direct use of GMOs at any point in their production are subjected to labeling requirements, regardless of whether GM content is detectable in the end product.

The EU regulatory framework on GMOs incorporates the international Cartagena Protocol on Biosafety (discussed in Section 10.3.8), specifically with regard to the obligations of importers of products in the EU and the obligations of exporters of products to non-EU countries. The regulatory system for authorizing GMOs is consistent with the EU’s international trade commitments and with WTO rules: it is clear, transparent, and nondiscriminatory. For a discussion of legal and political conflicts among different nations regarding GMO cultivation and trade, see Section 11.2.8 of Chapter 11.

Traditionally, a number of member states have invoked what is known as the “safeguard” clause of the GMO directive, which allows a member state to *temporarily* restrict or prohibit the use and/or sale of an otherwise authorized GMO within its borders when it has justifiable reasons. (See Dobbs (2010) for an exploration of legal avenues under EU law, such as “safeguard measures,” for allowing individual EU member states to exercise post-authorization control over GMO crops and food products in their own territories.) As of 2015, however, EU Directive 2015/412 has allowed member states to bypass EU authorization and set their own more permanent rules (Rabesandratana 2015) in certain circumstances. That directive allows the member states to “opt out” of allowing GMO cultivation in their territories if they can establish one or more enumerated “compelling grounds,” which include environmental policy objectives. But those grounds do not include disagreement with the (traditional) scientific risk assessments recommended by the European Food and Safety Authority (EFSA). Moreover, this exemption may not be invoked to establish different rules for GMO food or products (although the temporary safeguard clause may still be available for this purpose). Nicolas de Sadeleer (2015) and Mihail Kritikos (2018) provide insightful accounts of the EU’s regulation of the cultivation of GMO crops, culminating in the 2015 directive.

Unfortunately, the risk assessment approach recommended by EFSA appears to have effectively ossified a broadening of considerations that might flow from the application of the precautionary principle, or from non-scientific considerations incorporating member states’ ethical or local concerns. The EU’s reliance on a separation of risk assessment from risk management has allowed the EU Commission to fashion its regulatory policy based on traditional expert scientific opinion without application of the precautionary principle, which would have opened the determination of risk to alternative scientific interpretations, as well as to consideration of non-scientific input from important stakeholders. The long-term consequences of this approach, as applied for example to other applications of genetic engineering or to considerations of emerging technologies such as nanotechnology, could indeed be unfortunate. It would appear that by elevating the

importance of risk assessment, and by adopting an exclusive reliance on expert scientific opinion that glosses over the well-known limitations of the risk assessment exercise, the EU has left risk management decisions to be worked out in the details of implementation, rather than through a comprehensive consideration of policy options and the social acceptability of risk.

10.2.10 Environmental liability

In 2004, twenty-four years after the United States enacted CERCLA (the federal “Superfund” law) – and thirty-two years after the U.S. enacted the provisions of the Clean Water Act governing spills of oil and hazardous chemicals to surface waters that served as the model for CERCLA (see Chapter 9) – the EU adopted its own Environmental Liability Directive (ELD) (Directive 2004/35/EC). Article I of the Directive states that its purpose “is to establish a framework of environmental liability, based on the ‘polluter-pays’ principle, to prevent and remedy environmental damage.” As with its U.S. counterparts, the primary focus of the ELD is to address harm to the natural environment occasioned by the release of hazardous substances, although its wording is not strictly limited to damage caused by pollution. And, also like CERCLA and the Clean Water Act, the ELD is concerned with damage affecting the public as a whole and is not a vehicle for individual recovery of compensation for economic or personal injury. As the EC commented at the time:

So far, the Member States of the European Union have established national environmental liability regimes that cover damage to persons and goods, and they have introduced laws to deal with liability for, and cleanup of, contaminated sites. However, until now, these national regimes have not really addressed the issue of liability for damage to nature. This is one reason why economic actors have focused on their responsibilities to other people’s health or property, but have not tended to consider their responsibilities for damage to the wider environment. This has been seen traditionally as a “public good” for which society as a whole should be responsible, rather than something the individual actor who actually caused the damage should bear. The introduction of liability for damage to nature [. . .] is expected to bring about a change of attitude that should result in an increased level of prevention and precaution.*

Accordingly, the ELD extends liability for three types of damage to the natural environment: (1) damage that has significant adverse effects on protected species or their habitats; (2) damage that has significant adverse effects on the ecological, chemical, and/or quantitative status, or on the ecological potential, of surface water or groundwater; and (3) contamination of land that creates a significant risk to human health from the introduction of substances, preparations, organisms, or microorganisms.

The Directive imposes liability for the remediation and prevention of such damage on the (actual and/or legal) “operators” of the activities causing the damage. Operators of any one of a large class of activities listed in the Directive – including large industrial installations, waste management operations, facilities using hazardous substances, facilities releasing genetically modified organisms, and other operations covered by the

* Source: European Commission, Environmental Liability, White Paper on Environmental Liability (EC 2000), http://ec.europa.eu/environment/legal/liability/white_paper.htm (accessed December 9, 2017).

IPPC program, the Waste Framework Directive, the Air Quality Directive, and the Water Directive – are strictly liable for any environmental damage caused by their activities. Other operators (excluding operators of nuclear facilities and operators of national defense or international security activities) are liable to the extent that their negligence or recklessness caused the damage in question. Under either form of liability, the causal connection between the activity and the damage must be shown. Member states may, if they wish, limit the scope of liability by excluding damages caused by (1) activities conducted in compliance with a government-issued permit, and/or (2) activities conducted in conformance with the state of the art as defined in the particular member state.

Liability under the Directive comes in the form of financial responsibility. Operators found liable under the ELD are required to fund the remediation of the environmental damage caused by their activities, according to remediation specifications laid out in the Directive, and to take the measures necessary to prevent environmental damage when their activities have caused an imminent threat of such damage. The ELD also authorizes member states to take such remediation or preventative measures, and to recover the expenses from the operators found liable.

Unlike CERCLA, however, the Environmental Liability Directive does not impose liability retroactively; environmental damage occurring before May 2007 is not covered by the Directive. Thus, while it clearly provides a financial incentive for operators to use greater care in conducting their activities going forward, it does nothing to address the decades of damage to natural resources that occurred before 2007. Further, unlike CERCLA in its first few decades, the ELD contains no public financing mechanism to supplement the funding obtained from liable parties, thus leaving “orphan sites” (those where the cost of remediation exceeds the financial capacity of the liable parties) without a clear remedy. The Directive does direct the member states to “encourage” the development of an adequate financial security (insurance) market, but recent Commission reports conclude that insuring adequate financial security remains a significant issue. Moreover, a 2014 Commission report found that implementation of the ELD varied significantly among the member states, both in terms of the number of ELD cases and the manner in which the Directive is enforced.

10.2.11 Worker health and safety

Whereas occupational health and safety standards are mandatory in the United States, the EU distinguishes “mandatory” obligations/standards, such as those established for carcinogens and mutagens in the Parliamentary and Council Directive 2004/37/EC, from “indicative” standards, such as the indicative Occupational Exposure Limits (OELs) in Council Directive 2000/29/EC and Commission Directive 2006/15/EC. The individual member states implement the indicative OELs through their national laws and have the discretionary authority to make them mandatory. They can also establish more stringent levels of protection or protect workers from hazards not established by EU initiatives. The EU establishes a hierarchy to be used by employers in reducing risk to workers from exposure to hazardous substances.* In order of preference, these include the following:

- Elimination of the need to use the substance (that is, prevention of exposure);
- Substitution by a less hazardous substance;
- Technical and organizational measures to reduce contact with, or the air concentration of, a hazardous substance; and
- As a last resort, personal protective equipment.

* See the EU-OSHA OiRA (Online interactive Risk Assessment) tool, <https://osha.europa.eu/en/tools-and-publications/oira> (accessed December 9, 2017).

Although this is similar to the U.S. approach of preferring “engineering controls” to personal protective equipment, the focus on primary prevention and cleaner and inherently safer technology for worker protection has not been a hallmark of U.S. occupational regulation.

Workers may also have safety obligations, such as being required to follow the employer’s health and safety policies and to report health and safety incidents to supervisors. In general, the primary responsibility for workplace health and safety lies with the employer, who makes the decisions relating to production systems, processes, materials, practices, and conditions of work. Workers also have the right to stop or refuse dangerous work, to make proposals for improving health and safety, and to be consulted on matters relating to health and safety.

10.2.12 The potential for EU environmental law to promote sustainability

Elsewhere in this book we have argued that four kinds of innovation are required to bring about a sustainable transformation of industrial systems: *changes in technology*; *changes in institutions* (government providing technical and financial assistance, incentives, and regulation/legal structure); *changes in organizations* (private-sector firms with appropriate avenues to address health, safety, and environmental concerns); and *changes in society*. The EU is attempting to influence sustainable development in all four realms. The IPPC Directive (now subsumed under the Industrial Emissions Directive), the Integrated Product Policy, the Eco-design Directive, REACH, and the media-based regulatory approaches – which are institutional vehicles – have the potential to directly influence technological innovation, but they also affect organizational changes.

The Aarhus Convention providing the public access to environmental information and participatory rights could change the dynamics of stakeholder influence. We argued earlier that providing the public with information about technological alternatives may be more effective than providing information about hazards. All this leads to the conclusion that focusing on directly encouraging/forcing technological change is central to achieving sustainability, especially if it is buttressed by complementary changes in institutions, firm organization, and societal demand. The last three categories of action are not sufficient by themselves.

10.2.13 Comparative summary of U.S. and EU environmental laws

Table 10.1 provides a comparative summary of EU environmental and occupational health and safety laws and indicates their counterparts among U.S. laws.

While there are many similarities between U.S. and EU laws, important differences exist. U.S. worker protection standards are mandatory, while EU worker protection directives are indicative, leaving it to the member states to designate them as mandatory or as guidelines. But this does not tell the full story. Any evaluation of the effectiveness of specific protections must include not only the details of the standards but also take into account the degree of enforcement, monitoring, and compliance. In practice, for example, more protection is actually offered workers in the UK, where the directives are guidelines, than in Greece, which has mandatory requirements. This reflects the different cultural attitudes and traditions towards regulation.

In the context of air pollution, the U.S. Clean Air Act makes a clear distinction in different parts of the Act between limitations on a small number of “criteria” pollutants (such as SO₂), and limitations on the more dangerous, and sometimes carcinogenic, non-threshold hazardous air pollutants (such as benzene), while the EU Air Directive incorporates a moving collection of standards for air pollutants (including those that are designated criteria pollutants in the U.S.) without drawing distinctions based on seriousness or the existence of a safe threshold. The EU Air Directive was formulated by first

Table 10.1 Selected U.S. and EU environmental initiatives

THE UNITED STATES	THE EUROPEAN UNION
Air legislation	
The Clean Air Act (CAA) 1970, 1977, 1990	The Air Directives 1996, 2008, and related directives
Water legislation	
The Clean Water Act (CWA) 1972, 1977, 1987	The Water Framework Directive 2000
The Safe Drinking Water Act 1974, 1986, 1996	
Hazardous waste legislation	
The Resource Conservation and Recovery Act (part of the Solid Waste Disposal Act) 1970, 1976, 1984	The Waste Directive 1975 The Hazardous Waste Directive 1991 WEEE 1991 Thematic Strategy on the Prevention and Recycling of Waste 2005
Chemical legislation	
The Toxic Substances Control Act 1976, 2016	The REACH Directive 2003
Cleanup of contaminated land and water legislation	
The Oil and Chemical Spill Provisions of the CWA 1972	The Liability Directive 2004
The Oil Pollution Act 1990	
The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (Superfund) 1980, 1986	
Worker health and safety legislation	
The Occupational Safety and Health Act (OSH Act) 1970	Occupational health and safety directives
Worker and community right to know legislation	
OSH Act Hazard Communication Standard 1983	Incorporation of the Åarhus Convention into EU law 2006
Environmental Planning and Community Right-to-Know Act (EPCRA) 1986	
Pollution prevention and inherent safety legislation	
The Pollution Prevention Act 1990	The Integrated Pollution Prevention and Control (IPPC) Directive 1996, as amended by The Industrial Emissions Directive 2010
OSH Act 1990 (the workplace)	
CAA 1990 (industry generally)	The Seveso Directives 1982, 1996, 2012
The safety of food, drugs, and other consumer products legislation	
The Consumer Product Safety Act 1972, 2008	Product, drug, and food safety directives
The Federal Hazardous Substances Act 1960, 2008	The Integrated Product Policy (IPP)
The Food, Drug, and Cosmetic Act 1938, 1958, 1996	

adopting standards regulating emissions and then afterwards added concentration limits, whereas the U.S. Clean Air Act first imposed ambient concentration standards for criteria pollutants, and then imposed emission limits

Both the U.S. and the EU regulate discharges to surface waters and set standards for drinking water, but the U.S. does so under two separate regulatory programs, while the

EU regulates both under its coordinated Water Framework Directive. Further, unlike the U.S. water laws, the EU directive explicitly regulates discharges to groundwater, while the U.S. leaves that to the states (and to the indirect protection provided by federal hazardous waste regulations).

The U.S. and the EU have similar restrictions on hazardous waste disposal, but the EU has taken a broader, more comprehensive approach to longer-term waste issues. The EU's WEEE initiative is a comprehensive program requiring manufacturers to exercise cradle-to-grave control of electronics products and wastes. The U.S. has no similar program at the federal level, although a number of states have programs requiring retailers to accept used electronics products brought to them by the public. The EU also has adopted a Thematic Strategy emphasizing both waste prevention and waste recycling, thus attempting to prevent the generation of waste while at the same time attempting to promote the markets for the waste that is created.

Perhaps the most significant emerging difference between U.S. and EU regulation of media-based pollution lies in their respective permitting systems. While the U.S. has a media-based permit system, with separate permits for air emissions, water discharges, and land disposal of waste, the EU is implementing a coordinated single-permit system. Both the U.S. Pollution Prevention Act and the EU Industrial Emissions Directive, consolidating and absorbing the former Integrated Pollution Prevention and Control Directive (IED), articulate a preference for reducing pollution at the source rather than adopting end-of-pipe approaches, but the U.S. legislation has never been seriously implemented or integrated/coordinated with air, water, and waste legislation. Accordingly, U.S. approaches to controlling pollution continue to be fragmented through the separate permitting of emissions to air, water, and land. In contrast, the EU IED is focused on unified facility-wide permitting, encouraging both cleaner technologies (pollution prevention) and accident prevention through inherently safer approaches.

Similarly, accident prevention in the U.S. through the OSH Act and Clean Air Act continues to rely on secondary prevention measures through the workplace Process Safety Management Rule and the manufacturer/user-focused Risk Management Plans, respectively, while the EU emphasizes inherently safer approaches through its Seveso Directives.

Financial liability for the remediation of pollution damage to land and water is more stringent in the U.S., with joint, several, and retroactive liability, while in the EU, member states largely determine whether polluters are liable in particular instance, and liability is not retroactive.

In the U.S. and the EU, chemicals in pesticides, food additives, pharmaceuticals, and consumer products are individually regulated under separate legislation. Additionally, the EU has adopted the Integrated Product Policy (IPP), a largely voluntary policy including requirements for an Ecolabel and the Eco-design Directive (see Section 10.2.4.)

The "right to know" – worker and community access to information about chemical use and toxicity – is secured in separate U.S. legislation that provides access to toxics information and in some cases information about a firm's pollution prevention activities: the OSH Act, the Emergency Planning and Community Right to Know Act, and the Toxic Substances Control Act. Judicial review (access to the courts to challenge regulatory policies or enforce the law) is provided in both the Administrative Procedure Act and most of the separate substantive statutes such as the Clean Air Act. In the EU, the adoption of the Århus Convention provides general access to toxics information, but the degree of access to the courts for judicial review of the directives and standards is decided by the member states, according to their respective legal traditions.

Finally, with the U.S. Toxic Substances Control Act (TSCA) and the EU REACH Directive, both systems have laws that seek to provide centralized screening, testing, and regulation of chemicals. Historically, however, the promise of TSCA has far outstripped its actual effect, and it remains to be seen whether the 2016 reformulation of that law will make a

material difference in its impact going forward. Similarly, while REACH has real potential to promote safer chemicals, the degree of regulatory discretion inherent in its structure raises the concern that it will be no more successful than TSCA has been thus far.

Generally speaking, from the 1960s to the 1980s U.S. regulatory standards tended to be more stringent than European standards. U.S. environmental initiatives, such as mandatory emission and effluent limits, mandatory environmental impact assessments, and reliance on the precautionary and polluter pays principles tended to set the standard for other countries. However, since 1990, the reverse has been true, and many EU regulations are now more precautionary in their approach than their U.S. counterparts (Vogel 2012, p. 3). In many ways, EU environmental law has now gone beyond that of the U.S. and contains initiatives not present in U.S. federal law, such as ecolabeling, reduction of packaging waste, and recycling of vehicles and electronic products.

10.3 The nature of international environmental law

International environmental law is a specialized branch of international law. From an environmental perspective, sources of international law include the rules and principles aimed at protecting the global environment and controlling activities within national borders, including those that may affect the environment within and/or beyond national jurisdictions. For example, developing a common or uniform approach to access to information reflected in the Århus Convention is an attempt to provide citizens and others with the needed information to engage in environmental advocacy and provide pressure for more protective action on the part of national governments in the domestic realm.

In the past few decades, there has been increasing recognition of the need to provide more substantial principles and more specific rules to govern environmental issues, such as preventing marine pollution from toxic discharges, controlling emission of gases that damage the ozone layer and, more recently, mitigating global warming and disruption and regulating trans-boundary movement of hazardous waste. These pressing concerns have facilitated the development of international environmental law and have promoted the adoption of new concepts and principles.

The framework of environmental treaties, principles, and codes that has been developed is often focused more on what is often called a “soft law” approach, through use of umbrella treaties or nonbinding agreements, guidelines, and principles (Birnie and Boyle 1992; Birnie, et al. 2009; Axelrod and VanDeveer 2015). This does not mean that traditional sources of law, or “hard” law, are usurped for the soft approach, but rather that there are many nuances and transformations merging both hard and soft approaches in the development of international environmental law. For example, the recent adoption of the Paris Accords on Climate Change contains voluntary commitments on greenhouse gas (GHG) emissions reductions but requires periodic progress reporting.

Over the past several decades and into the twenty-first century, the international community has moved toward implementing multilateral environmental agreements (MEAs) as vehicles through which environmental problems requiring global cooperation are managed - see Tables 2.1, 2.2, and 2.3 in Chapter 2, which document a range of sustainability-related MEAs, and also Peel (2015, pp. 72–76). MEAs can be either global or regional agreements. However, international accords are only as effective as the parties make them. Countries may join treaties that they regard as in their interest, to make a political statement, or because of pressures from other governments. In some cases, countries may enter into MEAs without intending to modify their behavior significantly, or they may lack the capacity to do so. However, with increasing numbers of MEAs now in force, countries in both the developed and developing world are facing growing pressure to ratify these agreements.

We begin this section by considering three sources of international environmental law – treaties, customs, and principles (Birnie 1987) – while acknowledging that the writings of international law scholars are also influential in its development, for example, Birnie et al. (2009), de Sadeleer (2002, 2007, 2014), Jans (2000), Jordan (2002), Sands (2003), R. Winter (2000), and Axelrod and VanDeveer (2015).

10.3.1 Treaties, customs, and principles as elements of international environmental law

Historically, treaties and custom have traditionally been binding law, and treaties are a typical method of creating binding international law on environmental issues. Environmental law treaties are also called conventions, protocols, covenants, pacts, and acts, and there are currently no rules prescribing their form. The 1969 Vienna Convention on the Law of Treaties provides some fundamental rules for treaties concluded after 1980 on matters such as entry into military force, reservations, interpretation, termination, and invalidity. States signing a treaty are expected, subject to ratification, not to do anything that undermines the treaty's objectives and principles. Upon ratification, the treaty becomes binding on its parties on the basis of the underlying principles of customary law. In general, treaties do not bind third-party states, although the provisions of the treaty may affect those third parties or may become part of customary international law. For example, a number of general environmental principles, such as those put forward in the 1982 UN Convention on the Law of the Sea, are incorporated into regional treaties and practice. However, treaties do not always provide clear or specific rules that can be extrapolated to regional, national, or local law, but are often more of a framework, outlining general guidelines in order for governments to take practical measures related to the issue at hand, such as the United Nations Environment Programme (UNEP) regional sea treaties or the 1979 Convention on Long-Range Trans-boundary Air Pollution.

The 1969 Vienna Convention recognized that there are certain basic “norms of international law” that no states can circumvent, but it did not initially detail what these norms entail (Birnie and Boyle 1992; Birnie et al. 2009). The Vienna Convention for the Protection of the Ozone Layer and the subsequent Montreal Protocol adopted under this convention became the first UN treaties ratified universally, serving a model for subsequent environmental treaties (Faure and Lefevre 2015, p. 116).

While treaties are the most commonly used method of international environmental law, some states prefer “customary lawmaking,” where there is no lengthy and complicated process of ratification. Customary law may be useful for incorporating commonly used environmental concepts (such as “sustainable development,” “intergenerational equity,” and “the precautionary principle”) into everyday language of national lawmaking. But it is often difficult to know whether such terms constitute valid and concrete parts of a law or are simply descriptive terms without any binding authority. Additionally, in a world of diverse interests and cultures, new concepts and principles can be interpreted in many different ways. In this atmosphere, customary law can take some time to develop into the consciousness of a nation or place. The UN and other international bodies have primarily been responsible for representing the majority consensus of opinion on international environmental issues. However, the UN Charter gives its General Assembly power only to make recommendations; that is, the UN does not have legislative power over states, regardless of whether they are UN members. Some legal scholars continue to argue that these recommendations, or resolutions, cannot be regarded as customary law because the UN is not a lawmaking body for all nations, whereas other legal scholars promote the idea that resolutions that have the consensus support of international organizations should have legal significance (Birnie and Boyle 1992; Birnie et al. 2009; Peel 2015). Even if these resolutions are not enforceable, they do present principles and concepts that may be

increasingly adopted by nations, and therefore they are crucial elements of international environmental law.

In addition to customary law, there is now a significant development in the number of principles shaping international environmental law. As is the case with soft law in general, there is some controversy over whether principles are substantial elements of international environmental law. Although some principles are becoming the cornerstones of international environmental law, not all are viewed as hard law, and not all have been invoked in support of decisions related to environmental issues. This was the case in the International Court of Justice's decisions on delimitation of the continental shelf and exclusive economic or fishery zones, in which the court invoked "equitable principles" not as rules of law but as a means of facilitating an equitable solution (Birnie 1987). As more international environmental agreements are developed, it is likely that common principles – especially the polluter pays principle and the precautionary principle (discussed below) – will start to take on a more binding nature, eventually leading to widespread acceptance of sustainable development and equitable utilization of shared resources.

10.3.2 Three evolving principles of international environmental law: the polluter pays, precautionary, and intergenerational equity principles

Under the influence of international law and the civil law tradition, key concepts in international environmental law are defined in part by a set of principles that have accumulated through declarations such as the Stockholm and Rio declarations, treaties, and the practice of nations, and, increasingly, initiatives of the European Union (de Sadeleer 2002, 2014). We discuss three of those below.

First, as discussed in Section 9.5.1 in Chapter 9, the *polluter pays principle* holds that polluting enterprises bear responsibility for the environmental damage caused by their activities and should bear the costs of restoring the damaged environment to its previous condition. While this is not a bedrock principle of international environmental law generally, it does appear to be coming slowly to the forefront. In the United States, it was applied in the 1980 Superfund legislation, which was modeled on the oil spill provisions of the 1972 Clean Water Act. In Europe, the chemical spill at Seveso, Italy, in 1976 and other industrial episodes of contamination highlighted a need to ensure that the damaged environmental assets are restored, or, more ideally, that further damage to the environment is prevented through improved practices and management. The 2004 EU Environmental Liability Directive (see Section 10.2.10) was that response.

Second, there is the *precautionary principle* (or the *precautionary approach*, as it is called in the Rio Declaration), which is more subtle and less clearly defined than the polluter pays principle. In many cases, the timescales, uncertainties, and consequences of environmental changes are unknown and difficult to define in scientific terms. Environmental impact from activities carried out today may not be seen for many generations, and certainly may have implications beyond current political terms and agendas. In order to address uncertainties regarding environmental and health effects of anthropogenic activities, a precautionary approach is also often integrated into international environmental agreements. The application of the precautionary principle in the U.S. is much older than some commentaries have suggested, and earlier than the appearance of the precautionary principle in European law (Ashford 2007; de Sadeleer 2000, 2009, 2014). The precautionary approach has been applied in the United States in decisions about health, safety, and the environment since at least the 1970s, and was incorporated into U.S. food law in 1958, with the passage of the Delaney Amendment banning carcinogenic food additives. See Section 9.5.2 in Chapter 9 for a discussion of the application of the precautionary principle in the United States.

The precautionary inclinations of the American and Anglo-Saxon jurisprudential systems, as well as codified expressions of the precautionary principle in German law, have found their way into multilateral environmental agreements and international law. Principle 15 of the Rio Declaration was the first international statement on the precautionary approach (see Chapter 2). It states that

in order to protect the environment, the precautionary approach shall be widely applied by States according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation.

Although it uses the word “approach” rather than “principle,” and considerations of cost are present in the phrases “according to their capabilities” and “cost-effective measures,” it is a principle, albeit one to be balanced in one way or another against other principles.* Curiously, this statement of the principle is expressed in the negative – that is, uncertainty should not be used to deny or delay protection – rather than mandating protection, even in the face of uncertainty (a subtle but important distinction). The latter is more positively expressed in U.S. case law (Hornstein 1992). The debate in Europe today is not whether the precautionary principle is a principle, but whether it trumps other international law, particularly the manner in which risk assessment is addressed, and is relevant to, trade law involving the World Trade Organization (Majone 2001).

Because the United States signed and ratified the Rio Declaration, it could be argued that it is bound to apply the precautionary principle. However, the United States currently refuses to acknowledge the obligatory nature of the principle, preferring to relegate it to a nonbinding “approach.” The situation is quite different in Europe and at the international level, where the application of the principle is presently far more advanced. The precautionary principle is one of the bases for EU community policy on the environment. In Europe, the precautionary principle had its beginnings in the German principle of *Vorsorge*, or foresight. At the core of early conceptions of this principle was the belief that society should seek to avoid environmental damage by careful forward planning, blocking the flow of potentially harmful activities. The *Vorsorgeprinzip* developed in the early 1970s into a fundamental principle of German environmental law (balanced by principles of economic viability) and has been invoked to justify the implementation of vigorous policies to tackle acid rain, global warming, and North Sea pollution. It has also led to the development of a strong environmental industry in Germany.

An important aspect of the principle is the emphasis placed on acting without full scientific data. The principle requires that states take a long-term perspective on environmental measures to prevent irreversible damage and adopt an anticipatory and, perhaps, a dynamic approach to environmental law that anticipates change as new information becomes available. The precautionary principle thus provides states with a legitimate approach to addressing complex problems that are characterized by uncertainty, long time horizons, and potentially irreversible environmental damage. For example, the European

* Attempts to distinguish “approaches” from “principles” by arguing that approaches are flexible, but principles are not, fail a logical test. Principles in the law are not necessarily absolute and are not without their limits. They are sometimes in direct conflict, and which of those prevail in a particular instance requires a choice or balancing of values. For example, the freedom of speech can be said to be a fundamental principle of U.S. law, but it is not absolute and may be compromised in favor of public safety: “No one has the right to yell fire in a crowded theater.”

Union Seventh Environmental Action Programme (from 2013 to 2020) is explicitly based on the precautionary principle and states that

research indicates that some chemicals have endocrine-disrupting properties that may cause a number of adverse effects on health and the environment, including with regard to the development of children, potentially even at very low doses, and that *such effects warrant consideration of precautionary action*.

(emphasis added)

Incorporation of the precautionary approach can be found in various other international legal instruments. For example, the 1995 Agreement on Fish Stocks adopts the precautionary approach in Article 6, which directs states to apply the precautionary approach widely to conservation, management, and exploitation of straddling fish stocks and highly migratory fish stocks in order to protect the living marine resources and preserve the marine environment.*

The precautionary approach is also included in early examples of multilateral environmental agreements, for example, in the ninth paragraph of the preamble of the Convention on Biological Diversity, in Article 3.3 of the Convention on Climate Change, and in the preamble of the Oslo and Paris (OSPAR) Convention for the Protection of the Marine Environment of the North-East Atlantic.† The 1996 Protocol to the London Dumping Convention states in Article 3.1:

In implementing this protocol, Contracting Parties shall apply a precautionary approach to environmental protection [. . .] when there is reason to believe that wastes or other matter introduced in the marine environment are likely to cause harm even when there is no conclusive evidence to prove a causal relation between inputs and their effects.‡

The third principle, concern for *intergenerational equity*, has a deep basis in international law. It is one of the premises of the precautionary principle, but its importance goes well beyond that context. The United Nations Charter, the preamble to the Universal Declaration of Human Rights, and many other human rights documents prescribe a fundamental belief in the dignity of all members of human society and in an equality that extends in time. Since World War II, states have begun to express concern for the welfare of future generations in legal mechanisms. In particular, the preamble to the 1972 Stockholm Declaration on the Human Environment refers to the object of protecting the natural environment and the well-being of future generations (see Chapter 2).

But although there is general agreement that the decisions we invoke today may affect the welfare of future generations, this element is not effectively represented in the decision-making processes of international agreements. If we are to avoid and resolve likely or even possible adverse effects on future generations, a much more proactive approach is needed not only in developing international environmental law but also in the way nations operate domestically. For example, although the U.S. National Environmental

* See the UN conference documents on Straddling Fish Stocks and Highly Migratory Fish Stocks, www.un.org/depts/los/fish_stocks_conference/fish_stocks_conference.htm (accessed December 9, 2017).

† See the Convention on Biological Diversity (www.cbd.int/), the Convention on Climate Change (http://unfccc.int/essential_background/convention/items/6036.php), and the OSPAR Convention (www.ospar.org/convention) (accessed December 9, 2017).

‡ Source: 1996 Protocol to the Convention on the Prevention of Marine Pollution By Dumping of Wastes and Other Matter, 1972, www.imo.org/en/OurWork/Environment/LCLP/Documents/PROTOCOLAmended2006.pdf (accessed December 9, 2017).

Policy Act requires environmental impact statements that consider the long-term impact on the “human environment” of major federal activities, this is largely done from the perspective of the present generation. In many other situations, including implementation of the 1992 Convention on Environmental Assessment in a Transboundary Context, consideration of long-term effects is not explicitly required (Weiss 1993). If we are truly to protect future generations, we need to incorporate the perspective of future generations and ask what the effects of our current actions may be.* Implementing this responsibility requires raising public consciousness and also changing our institutions and political systems, which are designed to cope with short-term issues of, at most, several years’ duration.

10.3.3 “Hard” versus “soft” law

What distinguishes law from other social norms is that it is prescriptive and binding. Therefore, the term “soft” law seems to contradict law’s authoritative power. In contrast to hard and binding laws, states often prefer nonbinding obligations as a simpler and more flexible foundation for future relations known as “soft law.” The difference between hard law and soft law, therefore, “lies mainly in the parties’ wish to model their relationship in a way that excludes the application of treaty” sanctions upon a breach of obligations and instead is more an approach of encouraging cooperation, dispute settlement, and conflict resolution (Hillgenberg 1999, p. 499). However, one would not be justified in viewing such soft-law agreements as being only “political” or “moral” in nature. In each instance, it would be more appropriate to consider the extent to which the parties choose to bind themselves “voluntarily” and what legal consequences they want to attach to their agreement (Hillgenberg 1999).

While soft law is a somewhat controversial subject, it is an important component of international law. Given the lack of any supreme international authoritative body with lawmaking powers, it has been difficult to establish a consensus for determining binding rules. Securing agreements in an era of political, cultural, and religious diversity, even on issues of extreme importance, is particularly difficult. These constraints on the lawmaking process present problems in developing standards for environmental protection and also for worker health and safety. Treaties are useful mechanisms, but often they do not enter into force, or they do so for a limited number of parties that do not necessarily include the states whose involvement is most vital to the achievement of the treaty objectives (for example, the failure to persuade the United States to adopt the Kyoto Protocol). Treaties therefore present problems as vehicles for changing the law.

Halfway measures are increasingly being used in the lawmaking process, in codes of practice, recommendations, guidelines, resolutions, declarations of principle, standards, and “framework” or “umbrella” treaties that do not fit neatly into legal categories. These elements are not binding law, but they can lead to affirmative policies. Although it is easy to be critical of soft law, it provides a vehicle for nations to express their responsibilities either in general terms – to be specified later – or in strong but nonbinding ways. Soft law often later morphs into harder law once experience with the subject matter has been gained under the initial “soft” approach. International environmental law thus often makes use of the soft-law approach to allow states to tackle a problem collectively at a time when they may not want to unduly restrict their actions, either because they are unsure of the size of the burdens imposed or because the scientific evidence of likely harm is

* To the extent that markets discount events far into the future, intergenerational and future equity concerns are minimized in economic-based decision processes. For this reason, among others, law and economics represent competing paradigms for fashioning policy responses. For further discussion of this dynamic, see the discussion in Section 9.7 in Chapter 9 of trade-off analysis as an alternative decision-making algorithm.

somewhat uncertain at the time – see Birnie et al. (2009) and Axelrod and VanDeVeer (2015, pp. 70–71).

Although soft law is difficult to define and may not be seen as strictly enforceable, it has an important contribution to make in establishing legal order in the development of international environmental law. The term does usefully capture an increasingly used process of moving slowly toward the formalization of obligations or of setting goals, that is, toward “harder” laws that are intended to have some authoritative status (the EU Seveso Directive on the Prevention of Chemical Accidents, which went through three versions requiring progressively increased obligations, is a good example of this). Furthermore, soft law provides legal measures of environmental protection not only in the form of treaties but also in evolving legal concepts and principles.

10.3.4 Regulation of hazardous chemicals

Among the principal treaties currently addressing the trade and/or use of hazardous chemicals are:

- 1 The 1989 Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal;
- 2 The 1998 Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides on International Trade; and
- 3 The 2001 Stockholm Convention on Persistent Organic Pollutants (POPs) (regulating production, use, disposal, trade, and release of POPs).

These UN-based multilateral environmental agreements are discussed briefly below, and the reader is referred to Selin (2015) for a more detailed description. The success of the first two treaties depends crucially on the existence and availability of information about the toxicity, persistence, and other properties of the chemicals in question, and also on the system known as the Prior Informed Consent (PIC) procedure, under which exports of hazardous waste, and trade in hazardous chemicals and pesticides, are allowed only if both the exporter country and the importer country come to an agreement and certain conditions are met.

10.3.4.1 The 1989 Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal

The transfer of hazardous waste is now covered by the 1989 Basel Convention. Transboundary movement and disposal of hazardous and “other” waste are prohibited unless there is written consent by all countries involved, including transit countries. Further, the exporting nation must be certain that wastes will be managed by the receiving country in an environmentally sound manner. However, the lack of enforcement and verification mechanisms, and inadequate provisions for responsibility and liability for inappropriate disposal of wastes, are major weaknesses (Hilz 1992).

As of December 2017, 186 states and the European Union were parties to the Basel Convention. Haiti and the United States have signed the convention but not ratified it. Dissatisfaction with the 1989 Basel Convention led to an amendment known as the Basel Convention Ban Amendment. It bans hazardous waste exports from a list of developed (mostly OECD) countries to developing countries. The Basel Ban applies to export for any reason, including recycling. Because of a continuing desire of some countries to maintain the economically valuable trade in hazardous waste, ratification of the Ban Amendment

has been slow (Selin 2015, p. 265). The PIC procedure, mandatory since 2006, applies only to parties who have ratified the international agreements.

10.3.4.2 The 1998 Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides on International Trade

The Rotterdam Convention covers pesticides and industrial chemicals that have been banned or severely restricted for health or environmental reasons by parties to the convention. As of 2018, the convention covered fifty chemicals, some of which are also controlled by other agreements on persistent organic pollutants (POPs), discussed below. The two basic features of the Rotterdam Convention are the PIC system for ensuring informed consent, and an information exchange that is intended to provide sufficient information about chemicals to allow meaningful consent and encourage environmentally sound use of these chemicals.

The United States was one of the original signatories of the convention but was not among the 160 countries that had ratified it as of 2018. Although the U.S. does not have its own comprehensive system for disseminating information on hazardous exports, some early attempts were made to establish notification schemes under existing laws (Ashford and Ayers 1985). Seven U.S. federal statutes forbid the export of certain banned or significantly restricted substances unless the recipient country has been notified of the regulatory status of the substance in the U.S. These statutes apply to toxic substances in general, pesticides, pharmaceuticals, consumer products, flammable fabrics, and waste. The United States has also been implementing the UN's Globally Harmonized System (GHS) for Classification and Labeling of Chemicals,* which includes a harmonized set of classification criteria for physical, health, and environmental hazards and a comparable set of hazard-communication tools (label elements and safety data sheets for workers).† Most countries have adopted the system.

In 2008, a large majority of the European Parliament supported a new regulation on classification, labeling, and packaging of substances and mixtures (Directive 2008/112/EC and European Regulation (EC) No 1272/2008) known as the CLP (classification, labeling, and packaging) Regulation. Its purpose is to align EU legislation with the GHS, and thus to help ensure that the same hazards will be described and labeled in the same manner throughout the world. In essence, the CLP Regulation makes the GHS – a voluntary program for UN members – mandatory for EU member states. The use of internationally agreed classification criteria and labeling elements, it is thought, facilitates trade while also contributing to global efforts to protect humans and the environment from hazardous effects of chemicals. This CLP Regulation also complements the REACH Regulation on the registration, evaluation, authorization, and restriction of chemicals.

10.3.4.3 The 2001 Stockholm Convention on Persistent Organic Pollutants

The Stockholm Convention, which entered into force in 2004 and is managed by the United Nation Environmental Program (UNEP), specifically addresses persistent organic pollutants (POPs), substances that are known to persist in the environment and thought to be particularly toxic to humans and animals. As of 2017, the convention covered some 25 chemicals, among them PCBs, pesticides, and suspected endocrine disrupters, as well

* See the UNECE, Globally Harmonized System of Classification and Labelling of Chemicals (GHS), www.unece.org/trans/danger/publi/ghs/ghs_welcome_e.html (accessed December 9, 2017).

† See U.S. Department of Labor, OSHA, The Globally Harmonized System for Hazard Communication, www.osha.gov/dsg/hazcom/global.html (accessed December 9, 2017).

as unintentionally produced chemicals, such as dioxins and furans, that result from industrial processes and from combustion (for example, municipal and medical waste incineration and backyard burning of trash).*

Although most developed nations have taken strong action to control POPs, a great number of developing nations have only fairly recently begun to restrict their production, use, and release. The U.S. was one of the original signatories of the Stockholm Convention, but it was not among the 182 countries that had ratified the convention as of 2018. The role of parties to the Stockholm Convention is to eliminate or restrict the production and use of the intentionally produced POPs, prohibit and eliminate production and use or import of POPs, conduct research, identifying areas contaminated with POPs, and provide financial support and incentives for the Convention. The process of becoming a party begins with a state or regional economic integration organization submitting a means of ratification, acceptance, approval, or accession to the depositary. Official contact points and national focal points are nominated to carry out administrative, communications, and information exchange procedures (EPA 2017).

The Stockholm Convention prohibits trade in POPs that parties have eliminated from production and use. Such POPs may be exported only for environmentally sound disposal. Those POPs that one or more parties continue to produce or use pursuant to specific exemptions may be exported only to those parties that have an allowed use exemption under the Convention and those non-parties that provide certification that they will minimize or prevent environmental releases and destroy or dispose of the POPs in an environmentally sound manner.

In addition to the three treaties highlighted above, there are a number of other international conventions dealing with POPs and/or Pesticides (UNEP 2017):

- **Convention on Long-Range Transboundary Air Pollutants, Protocol on Persistent Organic Pollutants.** The aim of the convention is that parties shall endeavor to limit and, as far as possible, gradually reduce and prevent air pollution including long-range transboundary air pollution. The aim of the protocol on POPs is to control, reduce, or eliminate discharges, emissions, and losses of persistent organic pollutants. The protocol entered into force in 2003.[†]
- **Globally Harmonized System (GHS) for Classification and Labelling of Chemicals.** As discussed above, this is a harmonized system for classifying and labeling chemicals, sponsored by the UN, which seeks to promote standard criteria for classifying chemicals according to their health, physical, and environmental hazards. It entered into force in 1999.[‡]
- **International Convention on the Control of Harmful Anti-fouling Systems on Ships.** The aim of this convention is to prohibit the use of harmful organotoxins in anti-fouling paints. It entered into force in 2008.[§]
- **The Vienna Convention for the Protection of the Ozone Layer & The Montreal Protocol on Substances that Deplete the Ozone Layer.** These treaties, discussed in more detail below, aim to protect the ozone layer by phasing out the production of a number of substances believed to be responsible for ozone depletion. They entered into force in 1988 and 1989, respectively.[¶]

* For a current list of substances covered by the convention, see www.pops.int (accessed December 9, 2017).

† Read more about the convention at www.unece.org/env/lrtap/ (accessed December 9, 2017).

‡ Read more about the GSH at www.unece.org/trans/danger/publi/ghs/ghs_welcome_e.html (accessed December 9, 2017).

§ Read more about the convention at www.imo.org/conventions/mainframe.asp?topic_id=529 (accessed December 9, 2017).

¶ Read more about these conventions at <http://ozone.unep.org/en/treaties-and-decisions> (accessed December 9, 2017).

10.3.4.4 General considerations

Protection that is premised on notification systems alone assumes that the countries that have been notified and receive exports will fulfill their implied responsibility to ensure that technology is transferred with minimum risk to the health of their citizenry and the environment. This applies broadly to the importation of products, facilities, and equipment and to blueprints for manufacturing facilities, energy facilities, and transportation systems that might be indiscriminately used to construct systems inappropriate for the recipient country.

And even where prior informed consent is also required, the importing country will not be able to fulfill its responsibility to its citizens in practice without access to appropriate information systems/databases corresponding to those available to exporting countries or international organizations. Such access can facilitate the assessment of the efficacy, health, and environmental effects of various technologies, taking into consideration the national demographics and unique environment of the recipient country. Further, if the importing country is to make full use of these information systems, adequate capability in risk assessment is essential. In addition, the information systems in the recipient countries must be flexible and capable of keeping pace with rapid growth rates in developing countries. But risk assessment alone will not be sufficient.

The undertaking of technology options analysis (see Section 9.8 in Chapter 9) to identify alternative technologies rather than import hazardous ones will also be essential. This means exploring choices of inputs; final products; manufacturing, industrial, and agricultural processes; and transportation and energy systems. Identifying superior technologies that could be adopted or developed, rather than doing damage control by performing assessment of existing technologies in use, is a necessary proactive approach and one not currently required by national or international regulations.

In general, if the above described international agreements are to be effective, people and regulators have to have access to essential information. In the U.S. context, this is referred to as the “right to know” (see Section 9.6.3.1 in Chapter 9). In the EU and international context, the Århus Convention on access to information, public participation in decision-making, and access to justice in environmental matters – a UN Convention that has also been incorporated into EU law – further promotes and ensures the role of the public in making decisions about the environment by providing it access to information.* See Section 10.3.9 for a detailed discussion of the Århus Convention.

10.3.5 Polluting the international commons

Both climate change and the destruction of stratospheric ozone are environmental effects that go beyond trans-frontier pollution. They are an international version of the tragedy of the commons. The Vienna Convention for the Protection of the Ozone Layer, initially signed in 1985 and effective in 1988, and the Montreal Protocol on Substances That Deplete the Ozone Layer (specifically addressing chlorofluorocarbons), initially signed in 1987 and effective in 1989, address both of these problems. The EU environment ministers agreed in 1994 to phase out hydrochlorofluorocarbons (HCFCs) and methyl bromides faster than the timetable called for in the November 1992 Copenhagen Amendments to the Montreal Protocol. In 1995, representatives of the 149 countries that had ratified the Montreal Protocol drafted a series of recommendations for strengthening the protocol and agreed to phase out methyl bromide† by 2010 and HCFCs by 2020.

* See the Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters, www.unece.org/fileadmin/DAM/env/pp/documents/cep43e.pdf (accessed December 9, 2017).

† See Gullino et al. (2003) for a discussion of the production and use phase-out schedules for methyl bromide under the EU Regulations 3093/1994 and 2037/2000.

One of the most pressing global environmental issues – and one that poses extraordinary problems for securing international consensus on action – is the impact of greenhouse gases like CO₂ on climate change, and thus on all aspects of human existence. Although the Framework Convention on Climate Change was initiated during the 1992 Rio Earth Summit, controversy attended the implementation of the 1997 Kyoto Protocol, the first international accord dedicated to resolving, mitigating, and adapting to the anthropogenic impact on the earth's climate. Although the U.S. under President George W. Bush withdrew from the Kyoto Accord in 2001, throwing the future of the convention into doubt, the agreement received sufficient support in the Marrakesh Accords that same year, and came into force in 2005. As of June 2018, it had been ratified by 192 countries. The Kyoto Agreement required specific commitments by its parties to reduce greenhouse gases but allowed considerable flexibility in how to achieve them.*

The Kyoto Agreement was followed by the Copenhagen Accord of 2009 and the Cancun Agreement in 2010. The Cancun Agreement called for the increase in global average temperature to be held to below 2 degrees Celsius above pre-industrial levels and established a process for reviewing the adequacy of that target and for considering an alternative 1.5-degree Celsius goal for the future. See Betsill (2015) for a detailed history of these earlier attempts.

Under the leadership of President Obama, the Paris Accords on Climate Change were signed in 2015 and came into force in 2016. This agreement was negotiated within the United Nations Framework Convention on Climate Change (UNFCCC), and it attracted many developing nations which had been reluctant to sign or ratify previous agreements, resulting in a total of 195 signatories. The agreement calls for mitigation (reductions in greenhouse gas emissions and concomitant increases in carbon absorption techniques such as reforestation), adaptation (developing institutional mechanisms for adapting to climate change), and initiatives to ensure adequate financing, all beginning in 2020. The Paris agreement retains the goal of keeping a global temperature rise this century well below 2 degrees Celsius above pre-industrial levels and to pursue efforts to limit the temperature increase even further to 1.5 degrees Celsius. Under the agreement, each country determines, plans, and regularly reports the contribution it should make in order to mitigate global warming. There is no mechanism to force a country to set a specific target by a specific date, but each target should go beyond previously set targets. As of June 2018, 197 countries had become a party to the agreement and 178 had ratified the agreement.† In 2017, however, President Trump announced his intent to withdraw the U.S. from the Paris Accords, causing widespread condemnation both internationally and domestically. Under the agreement, the earliest effective date of withdrawal for the U.S. is November 2020.

10.3.6 Preserving biodiversity and endangered species

Although sustainable development goals are said to favor continual, though sustainable, economic expansion, this may not be compatible with ecosystem integrity. Instead, it can lead to “competitive displacement” of non-human life by humankind, resulting in the contraction and extinction of other species (Rees 2017), and the concomitant diminution of a sustainable ecosystem. See Rosendal (2015) for an extensive discussion of

* See UNFCCC, Status of Ratification of the Kyoto Protocol, http://unfccc.int/kyoto_protocol/status_of_ratification/items/2613.php (accessed June 5, 2018).

† See UNFCCC, The Paris Agreement, <https://unfccc.int/process/the-paris-agreement/status-of-ratification> (accessed June 5, 2018).

biodiversity and the several treaties addressing the many activities of nations that impact biodiversity.

The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) is an international agreement to ensure that international trade in specimens of wild animals and plants does not threaten their survival. Ideas for CITES were first formed in the 1960s when international discussion of the regulation of wildlife trade for conservation purposes was something relatively new, and CITES came into formal being in 1975. As the website for CITES explains:

Annually, international wildlife trade is estimated to be worth billions of dollars and to include hundreds of millions of plant and animal specimens. The trade is diverse, ranging from live animals and plants to a vast array of wildlife products derived from them, including food products, exotic leather goods, wooden musical instruments, timber, tourist curios and medicines. Levels of exploitation of some animal and plant species are high and the trade in them, together with other factors, such as habitat loss, is capable of heavily depleting their populations and even bringing some species close to extinction. Many wildlife species in trade are not endangered, but the existence of an agreement to ensure the sustainability of the trade is important in order to safeguard these resources for the future.*

As of June 2018, some 5,800 animal species and 30,000 plant species have been listed by CITES as endangered, and these are divided into three different groups according to the extent to which they are deemed to be threatened by international trade. Protection of these species in any given country, however, depends on the laws of the country. As further explained on the CITES website:

CITES is an international agreement to which States and regional economic integration organizations adhere voluntarily. States that have agreed to be bound by the Convention (“joined” CITES) are known as Parties. Although CITES is legally binding on the Parties – in other words they have to implement the Convention – it does not take the place of national laws. Rather it provides a framework to be respected by each Party, which has to adopt its own domestic legislation to ensure that CITES is implemented at the national level.

Habitat loss and biodiversity challenges are not only important national concerns but have serious global implications that are likely to lead to “system collapse” if they are not addressed.

10.3.7 Food safety

Recent problems related to global food production, processing, distribution, and preparation are creating an increasing demand for food-safety oversight in order to ensure a safer global food supply. Two international organizations are central to this goal: the Codex Alimentarius Commission (CCA) and the World Trade Organization (WTO). The CCA is a second-generation international organization created as a connecting organization

* Source: The Convention on International Trade in Endangered Species of Wild Fauna and Flora, *What Is CITES?* Available at www.cites.org/eng/disc/what.php (accessed December 9, 2017).

between the UN's World Health Organization and the Food and Agriculture Organization. Some 165 countries are represented in the CCA, whose objective

consists in defining international standard[s], codes of usage and other guidelines and regulations regarding agricultural and fish products, food products, additives and contaminants, animal feed, veterinary medicine and pesticide residues as well as labeling, methods of certification and inspection, sampling and analysis methods, codes of ethics and good agricultural procedures.

(Battaglia 2006, p. 3, n. 7)

The WTO, on the other hand, administers two 1994 agreements that limit trade restrictions on the exchange of food-related items: the Sanitary and Phytosanitary (SPS) Agreement (discussed below), and the Technical Barriers to Trade (TBT) Agreement (discussed in Chapter 11).

As described by the Office of the U.S. Trade Representative (2010), the SPS Agreement:

recognizes the right of each WTO member to adopt an "appropriate level of protection" (ALOP) of trade-restricting measures to protect human, animal, and plant life and health, but insists that such measures be based on a scientific assessment of the risks, be applied only to the extent necessary to achieve public health or environmental goals, and not discriminate between domestic and foreign products or threats. The WTO SPS Agreement is credited with increasing the transparency of countries' SPS regulations, spurring regulatory reforms, and providing a means for settling SPS-related trade disputes. The U.S. has used the SPS Agreement to challenge a number of other countries' SPS import measures in the WTO, including the EU's ban on imports of beef from cattle treated with hormones and Japan's restrictions on imported apples based on unfounded concerns over Fire blight disease.*

Within the SPS agreement, there are three international standard-setting bodies: the CCA, discussed above, which sets food safety standards to protect human health; the Organization for Animal Health, which sets standards to protect animal health; and the International Plant Protection Convention, which sets standards to protect plant health. See Chapter 11 for further discussion of trade-related food issues.

10.3.8 Biotechnology

The application of modern biotechnology can result in genetically modified food products, such as corn and soy, or trade or transport of living modified organisms (LMOs) in plants, vaccines, drugs, and commercial products. Considerable scientific uncertainty attends the effects of GMOs with regard to both the environment (reflecting concern with genetic contamination via GMO crops) and human health (through food and also via possible antibiotic resistance) (Rosendal 2015, p. 297).

The Cartagena Protocol on Biodiversity (CPB) of the Convention on Biological Diversity came into force in 2003. It permits import restrictions of living modified organisms (LMOs) based upon the precautionary principle and requires advanced informed consent for the first importation (Rosendal 2015, p. 298). In contrast, the WTO trade rules under the Sanitary and Phytosanitary (SPS) agreement requires any restrictions to be based on "sound science," thus creating tension between the two agreements.

* Source: Office of the U.S. Trade Representative, 2010 Report on Sanitary and Phytosanitary Measures, [https://ustr.gov/sites/default/files/SPS%20Report%20Final\(2\).pdf](https://ustr.gov/sites/default/files/SPS%20Report%20Final(2).pdf) (accessed December 9, 2017).

As of 2018, the CPB had been ratified by 171 parties, including the European Union, but not by the United States. Eight countries (including the U.S., but not the EU) would subordinate the CPB to the WTO trade agreements, arguing that GMO products are “substantially equivalent” to non-modified counterparts. Thus, two different approaches are clearly in conflict, the precautionary principle of the CPB and one reflected in the WTO SPS agreement based on sound science and dependent on risk assessment. For additional commentary, see Cors (2000), Strauss (2008), de Sadeleer (2015), and Kritikos (2018), and Section 11.2.8 in Chapter 11 for a fuller discussion and implications of biotechnology for international trade.

10.3.9 The public’s right to access information and to participate in environmental, health, and safety matters

The international community is increasingly recognizing the public’s right to information regarding environmental, health, and safety issues and, furthermore, the public’s right to participate actively in government and business decisions. The right to participate in decision-making is increasingly considered a fundamental human right in democratic society, and although not explicitly stated in the Universal Declaration of Human Rights or other human rights documents, it is understood that the basic rights to clean water, sufficient food, and good health are directly compromised by environmental degradation.

The principle of public participation in environmental decision-making was defined and endorsed by the international community at the 1992 Earth Summit, specifically in terms of three “access” rights: (1) access to the environmental information needed to understand a decision; (2) access to the decision-making process itself; and (3) access to judicial redress if a dispute arises or a decision needs to be challenged (Mock et al. 2003).

The transparency provided by these access rights makes noncompliance with environmental standards more apparent to the public, NGOs, and other countries and makes it easier for international and domestic actors to take actions to encourage and enforce accountability and compliance. The public availability of information concerning the nature and extent of environmental issues can affect national behavior and thus support the effectiveness of international environmental treaties. In addition, as the international legal system shifts away from a state-centered, hierarchical, and static model to a system of networks composed of state and non-state actors in a nonhierarchical and dynamic framework, citizens and NGOs gain greater influence over international as well as domestic behavior (de Sadeleer 2002, pp. 192–195). Pressure from NGOs and the public is an important mechanism for promoting implementation of and compliance with treaty obligations. Furthermore, NGOs often possess specialized information that government officials use both to monitor compliance and to prosecute violations (Goldschmidt 2002).

The most progressive policy initiative toward full public access and participation in environmental issues is the UN’s 2001 Aarhus Convention, titled “Access to Information, Public Participation, and Access to Justice in Environmental Matters,” which establishes a number of rights of the public (citizens and their associations) with regard to the environment.* Public authorities (at the national, regional, or local level) are

* See the Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters, https://treaties.un.org/Pages/ViewDetails.aspx?src=IND&mtdsg_no=XXVII-13&chapter=27&clang=_en (accessed December 9, 2017).

to contribute to enabling these rights to become effective. The convention enunciates three basic rights:

- **Access to environmental information:** The right of everyone to receive environmental information that is held by public authorities. This can include information on the state of the environment, but also on policies or measures taken, or on the state of human health and safety where this can be affected by the state of the environment. Citizens are entitled to obtain this information within one month of the request and without having to say why they require it. In addition, public authorities are obliged, under the Convention, to actively disseminate environmental information in their possession.
- **Public participation in environmental decision-making:** The right to participate from an early stage in environmental decision-making. Arrangements are to be made by public authorities to enable citizens and environmental organizations to comment on proposals for projects affecting, or plans and programs relating to, the environment. These comments are to be taken into due account in decision-making, and information on the final decisions and the underlying rationale are to be provided to the public.
- **Access to justice:** The right to challenge, in a court of law, public decisions that have been made without respecting the two aforementioned rights, or in violation of environmental law in general.

Described by former UN secretary general Kofi Annan as “the most ambitious venture in the area of environmental democracy” undertaken under the auspices of the United Nations,[†] the Århus convention is the first multinational environmental agreement that focuses exclusively on obligations of nations to their citizens and NGOs, thus occupying the province of human rights law, as well as environmental law.

As with all multilateral international conventions, the convention had to be signed and to receive the requisite number of parliamentary ratifications of the signatories to the convention. Further, the provisions of this convention were required to be transposed into individual country laws or, in the case of the EU, transposed into EU community law and subsequently transposed into individual country laws. Most of the early ratifying nations were not Western European countries, but rather the Eastern European, Caucasus and Central Asia (EECCA) countries – formerly a part of the Soviet Union. All EU countries however, were signatories to the convention and participated in its subsequent development. Nonetheless, the non-Western European nations were its strongest proponents, making up for prior denial of democratic institutions and avenues for participation in government.

In the EU, the initial effort to implement the Århus Convention came with the issuance of three EU directives, each of which corresponds to one of these three rights. The first right is embodied in EU Directive 2003/04/ EC.[‡] This directive calls for the creation of lists and registers of environmentally relevant information (for example, legislation, environmental plans, emissions/effluents, toxicity, and exposure information), preferably using electronic databases. In addition, EC Regulation 166/2006 established, as of 2007, a European Pollutant Release and Transfer Register (PRTR), harmonizing rules under

* Source: European Commission, The Århus Convention, <http://ec.europa.eu/environment/aarhus/index.htm> (accessed December 9, 2017).

† See Kravchenko (2007).

‡ See the European Commission, *The EU & the Århus Convention: in the EU Member States, in the Community Institutions and Bodies*, available at <http://ec.europa.eu/environment/aarhus/legislation.htm> (accessed December 9, 2017).

which the member states are to regularly report information on pollutants to the European Union Commission.

The convention's second right anticipates public participation in decision-making in a timely manner, that is, "from the start" of plans and programs. The convention "invites the parties to promote public participation in the preparation of environmental policies as well as standards and legislation that may have a significant effect on the environment." The EU took the first step toward the implementation of this participatory ideal with the promulgation of Directive 2003/35/EC. While this directive provides expansive access to information and decision processes for the making of environmental laws and regulations, access to the courts specifically to facilitate review of legal decisions taken by government (that is, judicial review) is limited to those processes provided by individual EU member states.

The third right – access to justice (through access to the courts and to judicial, or at least governmental, review of decision-making) – met with considerable initial resistance. In many European nations with parliamentary governments, regulations and laws are not usually challenged through review in the courts. Indeed, the convention itself recognizes that national law can limit the extent of legal challenge – and/or require the challenging party to demonstrate a sufficient interest in the controversy or allege a sufficient impairment of a right – if national administrative law regards these as a precondition. Nonetheless, the EU did eventually adopt this right in Directive 2005/370/EC. As with the first two rights, however, the EU allows member states to limit the extent to which these participatory rights are extended to their citizens. Accordingly, executive-branch rule-making may continue to operate behind closed doors, especially in parliamentary systems.

In general, these participatory rights are more firmly in place in the United States, where citizens have a right to participate in the administrative process and to comment on proposed regulations. Further, "citizen suits" – both against an agency to seek implementation of the law and against polluters to compel compliance with the law – are an accepted part of the federal regulatory process and are a key element of stakeholder participation and procedural rights.

The participatory mechanisms in the Århus Convention are the first of their kind and may create a precedent for future multilateral agreements. Whether the lofty goals of the Århus text are realized remains to be seen and may depend on citizen and NGO pressure. The implementation of the Århus Convention is of high importance for all signatory countries because it contributes not only to the overall effort to improve environmental protection but also to the process of promoting human rights and democratization. Countries desiring to implement environmental or public health regulations will find it useful to harmonize both their legislation and their practices (of the public authorities, the judicial system, the mass media, research institutions, and other entities) with the standards set by the convention.

10.3.10 Worker health and safety

The World Health Organization provides the following facts on the occupational health and safety challenges faced by today's global workforce:^{*}

- In many countries more than half of workers are employed in the informal sector with no social protection for seeking health care and lack of regulatory enforcement of occupational health and safety standards.

^{*} Source: WHO, *Protecting Workers' Health*, November 2017, www.who.int/mediacentre/factsheets/fs389/en/ (accessed December 9, 2017).

- Occupational health services to advise employers on improving working conditions and monitoring the health of workers cover mostly big companies in the formal sector and more than 85 percent of workers in small enterprises, informal sector, agriculture, and migrants worldwide do not have any occupational health coverage.
- Certain occupational risks, such as injuries, noise, carcinogenic agents, airborne particles, and ergonomic risks account for a substantial part of the burden of chronic diseases: 37 percent of all cases of back pain, 16 percent of hearing loss, 13 percent of chronic obstructive pulmonary disease, 11 percent of asthma, 8 percent of injuries, 9 percent of lung cancer, 2 percent of leukemia, and 8 percent of depression.
- Annually 12.2 million people, mostly in developing countries, die from noncommunicable diseases while still of active working age.
- Work-related health problems result in an economic loss of 4–6 percent of GDP for most countries. The basic health services to prevent occupational and work-related diseases cost on average between USD 18 and USD 60 (purchasing power parity) per worker.
- About 70 percent of workers do not have any insurance to compensate them in case of occupational diseases and injuries.
- Research has demonstrated that workplace health initiatives can help reduce sick leave absenteeism by 27 percent and health care costs for companies by 26 percent.

Most developed countries' national policies for protecting worker health and safety have the primary aims of guaranteeing common minimum standards of protection through harmonization of the recommendations on safety and health, and reducing the number of accidents at work and the number of cases of occupational diseases. Ideally all countries in the international community will take note of progressive strides to promote a safer and more healthful work environment. Policies on workplace health and safety must link up with work being done by international organizations, including active collaboration with the agencies of the United Nations, the World Health Organization (WHO), and the International Labour Organization (ILO), all of which have a similar role to play in improving the level of protection of workers' health and safety. The following section provides a brief overview of several international organizations that work on issues related to occupational health and safety and the environment. In Chapter 11, we discuss those institutions that focus on trade.

10.4 The importance of international institutions

The 1992 United Nations Conference on Environment and Development (UNCED) in Rio represented the world's most organized response to international environmental degradation. In addition to initiating conventions on greenhouse gases and biodiversity and adopting an implementation program in Agenda 21 (UN 1993), the conference also established a set of institutional and financial arrangements to support these changes. However, since the Rio Earth Summit, nations have become increasingly skeptical about the ability of the nation-state system to solve international environment problems. States are ultimately concerned with protecting national security and maintaining economic growth, and addressing environmental issues is less of a priority. Thus, stronger international institutions are needed to enforce environmental regulations.

Maurice Strong, secretary general of the UNCED, has argued

the need for international cooperation is inescapable and growing almost exponentially. This in turn has focused renewed attention on the principal instruments through which such cooperation is carried out. Most notable are the United Nations and its system of agencies, organizations, and programs. [. . .] These organizations

provide the indispensable structure and fora on which international cooperation depends. [...] They represent not the precursors of world government, but the basic framework for a world system of governance which is imperative to the effective functioning of our global society

(Strong 1990, p. 211)

Truly effective international environmental institutions would improve the quality of the global environment. However, they are still developing in their effectiveness, evolving as environmental issues evolve and scientific data change. Even given their rudimentary place in today's globalized society, these institutions can play important roles in protecting the environment, as well as health and safety. The response of governments to incentives and pressures from international institutions can prevent environmental degradation and reduce negative impacts on human health. Even on environmental issues that predominantly affect developing countries, national actions are guided by international institutional pressures.

Two major classes of problems confront nations with respect to international institutions. In the first, harm is directly transmitted from one set of countries to another via a physical or biological medium, where the consequences of activities in one country are felt in another (trans-boundary problems) or affect a resource that is outside the jurisdiction of any one country (a commons problem). Examples of such problems are stratospheric ozone depletion, European acid rain, marine oil pollution, and overfishing. A second class of issues involves environmental problems in which direct harm is felt only within national borders, and therefore mutual restraint is felt only within national borders, such as soil erosion, lack of safe drinking water from domestic sources, and use of pesticides (particularly in the developing world). Solutions for this latter class of problems require the development of concern within the countries where they occur and the development of the domestic political and administrative capacity to implement solutions. International institutions can provide information, skills, resources, and persuasion to resolve these types of issues. Both types of problems threaten human and ecosystem survival. Commons and trans-boundary problems affect the long-term sustainability of the planet's ecosystems, but national problems may affect more individuals in the future, especially in the developing world (Keohane et al. 1995).

Effective institutions can affect the political process at three key points in the sequence of environmental policy:

- 1 International institutions can contribute to the adoption of more appropriate agendas, reflecting the convergence of political and technical consensus about the nature and urgency of addressing environmental threats;
- 2 They can contribute to more comprehensive and specific international policies, agreed on through a political process whose foundation is intergovernmental negotiation; and
- 3 They can contribute to national policy responses that directly control sources of environmental degradation and to improving worker health and safety.

In addition, where possible, it is important that international institutions do not operate independently of each other but resolve issues cooperatively. In light of all that has been written about jurisdictional conflicts within the United Nations system, it is heartening to discover that cooperation among agencies is more prevalent than conflict. For example, with respect to chemical pesticides, the United Nations Environment Programme (UNEP) collaborated with the UN Food and Agriculture Organization (FAO). Coalitions of international institutions are also evident in the UN Regional Seas Programme, also coordinated by the UNEP. However, international cooperation notwithstanding, ultimately, it

is national decisions that affect environmental quality and worker health and safety, even though international measures may have been necessary to overcome initial national reluctance. Therefore, the role of international institutions in monitoring and enforcing compliance is critical in order to urge the laggards to accept and implement their commitments. Often, international institutions are required to use a combination of incentives to encourage national compliance, including a combination of binding international law and public exposure of noncompliance, persuasion, scientific argument, technical assistance, and investment (Keohane et al. 1995).

Given that the history of international cooperation regarding environmental and worker health and safety issues is relatively short, there is as yet no standard approach to negotiating these agreements, which can be waylaid by political, economic, and cultural implications, as will be explored in discussing the role of trade in Chapter 11. In the following sections we take a cursory look at the role of some major international institutions and their impact on international law in the way in which they create networks over, around, and within states that generate the means and incentives for effective cooperation. Those institutions directly connected with trade – e.g., the World Trade Organization (WTO) – will be discussed in Chapter 11. It seems likely that these organizations will increasingly seek to extend their role in environmental and worker health and safety issues by scrutinizing health hazards presented by chemicals, evaluating the environmental implications of energy production, and addressing trans-boundary pollution, for which the OECD developed the now-influential polluter pays principle (Birnie and Boyle 1992, p. 71; Birnie et al. 2009).

10.4.1 The International Labour Organization (ILO)

The International Labour Organization (ILO) is the specialized UN agency that seeks the promotion of social justice and internationally recognized human and labor rights.* It was founded in 1919 and is the only surviving creation of the Treaty of Versailles, which brought the League of Nations into being; it became the first specialized agency of the UN in 1946. The ILO is primarily responsible for improving working conditions and promoting the economic and social welfare of workers by creating a code of labor standards, working through an annual International Labour Conference, a 56-member Governing Body, the International Labour Office, and a secretariat. The ILO promotes tripartism among its constituents – representatives of government, employers, and workers (trade union representatives) – “by promoting a social dialogue between trade unions and employers in formulating, and where appropriate, implementing national policy on social, economic, and many other issues.”†

A number of international conventions set out by the ILO impose obligations to reduce exposures to occupational health and safety hazards. By 2018, the United States had ratified 14 of the 189 labor conventions, compared with Germany, which has ratified 85; the United Kingdom, 87; Brazil, 96; and the Netherlands, 109.

The ILO formulates international labor standards in the form of conventions and recommendations that articulate basic labor rights: freedom of association; the right to organize; collective bargaining; abolition of forced labor; equality of opportunity and

* See the International Labour Organization, “About the ILO,” available at www.ilo.org/global/about-the-ilo/lang—en/index.htm (accessed December 9, 2017).

† Source: The International Labour Organization, “How the ILO Works: Tripartism and Social Dialogue,” available at www.ilo.org/global/about-the-ilo/how-the-ilo-works/lang—en/index.htm (accessed December 9, 2017).

treatment; and other standards regulating conditions across the entire spectrum of work-related issues, including health and safety. It provides technical assistance primarily in the following fields:

- Vocational training and vocational rehabilitation;
- Employment policy;
- Labor administration;
- Labor law and industrial relations;
- Working conditions;
- Management development;
- Cooperatives;
- Social security; and
- Labor statistics and occupational safety and health.

The ILO promotes the development of independent employers' and workers' organizations and provides training and advisory services to those organizations. Within the UN system, the ILO has a unique tripartite structure in which workers and employers participate as equal partners with governments in the work of its governing organs. Ehrenberg (2003) has recommended a merger of the ILO and the WTO, thus bringing a tripartite structure to the latter (see Chapter 13).^{*} See Section 2.5 in Chapter 2 for a discussion of the positive tensions between the 1944 Declaration of Philadelphia (developed by the ILO), the 1972 Stockholm and 1992 Rio declarations, and other relevant documents such as Agenda 21, which provide a comprehensive formulation of the notion of sustainable development.

10.4.2 *The United Nations (UN)*

The formation of the United Nations (UN) in 1945 changed the international system.[†] In terms of international law, under Article 102 of the Charter of the United Nations, "Every treaty and every international agreement entered into by any Member of the United Nations after the present Charter comes into force shall as soon as possible be registered with the UN and published by it." The charter includes commitments to "achieving international cooperation in solving international problems of an economic, social, cultural, or humanitarian character and in promoting and encouraging respect for human rights and for fundamental freedoms for all."[‡] The United Nations has become the key force and forum for nations to negotiate international agreements related all aspects of development, including environmental and humanitarian concerns.

Within the UN are many institutions, such as the General Assembly, the Security Council, the Economic and Social Council, the Secretariat, the International Law Commission (ILC), and the International Court of Justice (ICJ). Since the 1972 Stockholm Conference on the Human Environment, the General Assembly has increasingly expressed recommendations and resolutions on a number of environmental issues (see Chapter 2). In

* See Baccaro and Mele (2010) for a critical discussion of the shift in the ILO over the last twenty years from standard-setting to a focus on principles such as "decent work for all" and an involvement of civil society organizations (e.g., NGOs) in regulatory activities echoing a "corporatist approach" to labor issues.

† See the United Nations, "About the UN," available at www.un.org/en/about-un/ (accessed December 9, 2017).

‡ Source: United Nations, *Charter of the United Nations*, available at www.un.org/en/charter-united-nations/index.html (accessed December 9, 2017).

addition, the role of the UN's Economic and Social Council in environmental issues is expanding, and it can make recommendations for the purpose of promoting respect for and observance of human rights and fundamental freedoms, which may be expanded to include environmental rights (Birnie and Boyle 1992; Birnie et al. 2009).

The ILC is tasked with codification and progressive development of the law. The ICJ, which sits at The Hague in the Netherlands, acts as a world court. It decides, in accordance with international law, disputes of a legal nature submitted to it by states. In addition, certain international agencies are entitled to call on it for advisory opinions.

Decisions within the UN are adopted by a voting system. Voting procedures in the UN Security Council require the affirmative vote of nine of its fifteen members but are also subject to the veto power of each of the five permanent members. Nonbinding recommendations can be adopted by a majority, which enables international bodies to influence the conduct of all states participating in the institution concerned, even if they cannot be obliged to act in a particular way, and contributes to the process of lawmaking.

With regard to enforceability, it is important to recognize that states are concerned with protecting their own sovereignty and may seek to restrict the independent international power of an authority such as the UN. Often at issue is whether environmental action should be taken at the international, regional, or national level. To protect their sovereignty, states may either restrict the adoption of environmental measures or inhibit their goals. The UN has campaigned to champion issues such as climate change within its scope by designating the issue a matter of "common concern." The European Commission has sought to clarify this problem in its series of Action Programmes on the Environment by allocating actions to the appropriate level, with emphasis on the national level. Challenges to UN proposed actions can be referred to the ICJ's dispute-settlement procedures (Birnie and Boyle 1992; Birnie et al. 2009). As environmental and worker health and safety issues become predominant drivers of law – as they are likely to be, given the exacerbation of health and economic problems brought about by a history of relentlessly ignoring these matters – it is hoped that the UN will be able to provide more enforceability through adopting successful schemes, such as the Action Programmes operating in the EU or those achieving success elsewhere, to encourage increased national participation in addressing these concerns.

The following sections look more closely at three organizations within the UN system that have a direct connection with the environment and development – the UN Environment Programme (UNEP), the UN Industrial Development Organization (UNIDO), and the UN Development Program (UNDP).

10.4.2.1 The United Nations Environment Programme (UNEP)

The UN has yet to create an institution wholly responsible for the environment. Instead, the United Nations Environment Programme (UNEP) provides guidance on environmental issues rather than enforceability of resolutions. UNEP describes itself as the "leading global environmental authority that sets the global environmental agenda, promotes the coherent implementation of the environmental dimension of sustainable development within the United Nations system and serves as an authoritative advocate for the global environment."^{*} It is seen as the voice for the environment within the UN system and a catalyst for advancing the global environmental aspects of sustainable development.

An example of how the UNEP plays a key role in coordinating UN environmental initiatives is the Environment Management Group (EMG), which is chaired by the UNEP's

* Source: United Nations Environment Programme, "Overview," available at <http://web.unep.org/about/who-we-are/overview> (accessed December 9, 2017).

executive director.* Formed in 1999 by UN General Assembly Resolution 53/242, the EMG consists of all UN agencies and secretariats of multilateral environmental agreements (MEAs), the Bretton Woods institutions, and the World Trade Organization. The primary objective of the group is to share information about its members' current and future plans and activities in the area of the environment and human settlements, with the aim of creating an agreed set of priorities to which all members can contribute. It is hoped that the work of the EMG can lead to a more rational and cost-effective approach to environmental and human settlements initiatives within the UN system, which are often poorly interconnected and duplicative. Hence, the extent to which interagency policy coherence and collaboration has been achieved will indicate whether the EMG's objectives are being realized.

Since its formation in 1972, the UNEP's main role has been environmental assessment, research, and monitoring, but it also played an important role in placing the link between environment and development on the international agenda. Attempts to address environmental concerns on a global scale reflected the increasing awareness by international organizations and states of changes in the ecosystem and the destruction of natural resources.

Although the UNEP and other UN partners have largely succeeded in promoting environmental programs within and outside the UN system (UN EMG 2006), the capability of the UNEP to manage and lead the UN's growing environmental agenda has not grown significantly since the program's formation over four decades ago. The principal reasons for this are seen to be the following: (1) the UNEP remains a program rather than a specialized agency; (2) the UNEP's governance structure has biased its focus toward the needs/demands of member states rather than advancing its overall mission; (3) the UNEP's financial structure limits its ability to finance activities for the common good; and (4) the location of the UNEP in Nairobi, away from centers of political activity, limits its ability to coordinate the initiatives of environment-related agencies (Ivanova 2005).

In 2012, the UN General Assembly voted to strengthen and upgrade the UNEP and establish universal membership of its governing body. UN Resolution 67/213 also calls for "stable, adequate and predictable financial resources" for UNEP from the regular budget of the UN, and for other UNEP donors to increase their voluntary funding. Achim Steiner, United Nations Under-Secretary-General and UNEP Executive Director, stated the resolution

reaffirms UNEP's role as the UN's authority on the environment, and provides the mandate to enhance our ongoing work on bringing the latest science to policy-makers, directly supporting national and regional environmental efforts, improving access to technology, and other key areas.†

10.4.2.2 *The United Nations Industrial Development Organization (UNIDO)*

Established in 1966, the United Nations Industrial Development Organization (UNIDO) is tasked with promoting industrial development throughout the developing world.‡ To

* See the United Nations Environmental Management Group, www.unemg.org/ (accessed December 9, 2017).

† Source: UNEP Newscentre, *United Nations Environment Programme Upgraded to Universal Membership Following Rio+20 Summit*, <http://web.unep.org/newscentre/united-nations-environment-programme-upgraded-universal-membership-following-rio20-summit> (accessed December 9, 2017).

‡ See the United Nations Industrial Development Organization, www.unido.org/ (accessed December 9, 2017).

achieve this mandate, the UNIDO acts as a global forum for generating and disseminating knowledge relating to industrial matters and as a technical cooperation agency that supports the industrial development plans of its clients (which consist of governments, business associations, and individual companies).

With the emergence of the international concern for the environment during the 1960s and 1970s and for sustainable development during the 1980s and 1990s (see Chapter 2), UNIDO embarked on an ambitious reform process in 1990 that focused on integrating environmental considerations into the organization's technical cooperation programs (R. A. Luken 2009). This process, often referred to as the "greening of the UNIDO," led to a shift in the organization's strategic focus to strengthening industrial capacities and promoting cleaner and sustainable industrial development, particularly in least developed regions such as Africa.

Before the Earth Summit in 1992, around 2 percent of the UNIDO's technical cooperation program was directed at environmental initiatives (R. A. Luken 2009). The primary focus of these initiatives was addressing water pollution from the leather-tanning and finishing subsector. However, by the end of 2004, the "greening of the UNIDO" meant that environmental programs and projects now constituted around 60 percent of the organization's technical delivery (*ibid.*).

Since the UNIDO's initial awakening to environmental concerns in the 1990s, some of its most notable accomplishments have included its joint effort with the UNEP, the UNDP, and the World Bank to phase out CFCs under the Montreal Protocol, the organization's creation of over thirty national cleaner production centers, and its growing number of international water and climate-related projects (R. Luken and Hesp 2006; R. Luken et al. 2003). Interestingly, the experience the UNIDO gained from its reform or greening process is now being used to help the broader UN reform process. Today, UNIDO has "fully committed to contributing to the achievement of the SDGs, while delivering on its mandate to support Member States in achieving inclusive and sustainable industrial development (ISID)."^{*} To meet this commitment, UNIDO has identified specific activities under each of the seventeen SDGs.

10.4.2.3 The United Nations Development Programme (UNDP)

The United Nations Development Programme (UNDP), founded in 1966, is perhaps one of the most influential organizations within the UN system for promoting sustainable development. The UNDP views itself as the UN's global development network. Its broad mission is to help "achieve the eradication of poverty, and the reduction of inequalities and exclusion." Further, it helps "countries to develop policies, leadership skills, partnering abilities, institutional capabilities and build resilience in order to sustain development results."[†]

As the lead UN development agency, UNDP will play a critical role in the implementation of the SDGs. Like UNIDO, UNDP has structured its activities around the seventeen SDGs. This comprehensive approach to sustainability is further enhanced by its strategic focus on democratic governance and peacebuilding, climate and disaster resilience, gender equality, crisis response, and development impact.

The UNDP is operational in 170 countries, where it helps governments attract and use development aid and supports national activities to formulate solutions to global and

^{*} Source: UNIDO, *2030 Agenda and the SDGs*, www.unido.org/who-we-are/unido-sustainable-development-goals (accessed December 9, 2017).

[†] United Nations Development Programme (UNDP), "About Us," available at www.undp.org/content/undp/en/home/about-us.html (accessed December 9, 2017).

national development challenges. In the first published history of the UNDP, Murphy (2006) describes a number of key aspects of the organization that support its success in the development arena. First, since its formation, the UNDP has become “the development programme of the developing countries” (ibid., p. 8). Murphy (ibid.) documents how the UNDP’s responsiveness to the needs of developing nations has made it the most trusted international organization throughout the developing world. A key element of its responsiveness has been its “resident representatives” in more than 150 country offices, whose nuanced understanding of national and regional development needs makes them welcomed partners.

Second, Murphy (2006, p. 5) argues that the UNDP has “the most extensive and most consistent presence of the entire UN system throughout the world.” This international presence has meant that the UNDP’s resident representatives are often responsible for coordinating the development activities of the entire UN system within a country, including the work of specialized agencies such as the ILO, the FAO, and Bretton Woods agencies. Murphy (2006) describes how the UNDP’s coordination of field activities was sometimes matched by a responsibility to coordinate the development activities of organizations within the UN system.

Finally, and most impressively, the UNDP has managed to become a learning organization. To achieve this, the UNDP’s founders created a fundamentally new organization. As Murphy (2006, pp. 18–19) describes,

Unlike most development agencies, UNDP (broadly understood) is not simply a bureaucratic hierarchy of nested roles and their related obligations. It is, instead, a decentralized complex of relatively autonomous (and creative) people and organizations involving independent experts, short-term alliances, and joint projects. It is at once public and private, international and national, bilateral and multilateral. This complex organization is held together by personal bonds, by professional norms and the external professional associations in which they are embodied, and by complex multi-directional webs of communication linking every corner of the globe. Its glue is not just messages going up and down simple chains of command, nor is it primarily money, either as an incentive to staff members or as a conditional promise to clients. [...] This, it turns out, is a kind of organization that can learn.

The UNDP’s ability to learn is reflected in its influence on shaping the structure of the current UN system. Murphy (2006, p. 7) describes how approximately one-third of the ninety entities that form the UN system were once part of, funded by, or staffed by members of the UNDP. In many ways, the UNDP is a model for institutional innovation that could inform the reform of other institutions looking to become more flexible, adaptable, and responsive in a complex, dynamic, and interconnected world.

One of the most visible initiatives of the UNDP is its annual Human Development Report (HDR), which was first published in 1990. The HDRs have

introduced a new approach for advancing human wellbeing. Human development – or the human development approach – is about expanding the richness of human life, rather than simply the richness of the economy in which human beings live. It is an approach that is focused on people and their opportunities and choices.

(UNDP 2017)

To measure development progress, the Human Development Index (HDI) was introduced in the first HDR (see Section 1.1.1 in Chapter 1). The HDI consists of three indicators: (1) life expectancy at birth; (2) educational attainment; and (3) real GDP (or income) (UNDP 1995). The index is obtained by taking a simple average of the three

indicators. Today, the HDRs include four additional indexes to capture gender imbalances and income disparities across nations. In addition to measuring development progress, the topics of each HDR have been influential in opening debates on critical issues such as gender equality and cultural liberty – advancing concerns at the center of sustainable development. Further, alongside the global HDRs, the UNDP sponsors regional and national human development reports that reflect specific challenges facing a region or nation.

In summary, the UNDP's ability to mobilize in-country skills and resources shapes the international development debate through objective research and publications, and creating and shaping global development institutions makes it a significant player in international and sustainable development.

10.4.3 The World Health Organization

The main aim of the World Health Organization (WHO) is “is to build a better, healthier future for people all over the world.”* Because the environment and working conditions affect human health, WHO has an interest in controlling environmental factors that adversely affect health, such as air pollution, polluted water and sanitation conditions, and unsafe human contact with chemicals. WHO develops and administers international health regulations and collects and disseminates information on health issues and also those related to the environment and worker health and safety. WHO is also actively promoting the Convention on Biodiversity, as well as the International Council for Exploration of the Sea (ICES), addressing the concern of marine pollution.

10.5 Global governance

Some scholars, international lawyers, and policy makers argue that enforcement of international environmental, health, and safety agreements should use coercive measures, such as sanctions, to ensure compliance. Conversely, others advocate for an approach that relies less on coercive mechanisms and more on the effects of public participation and transparency in persuading nations to comply with their international treaty obligations (Goldschmidt 2002). However, ultimately, it is likely that effective global governance will have to be a compromise of both coercion and public participation to achieve effective implementation of international environmental, health, and safety accords and agreements.

In 1970, George Kennan recommended the creation of an “International Environmental Agency” that would have great prestige and authority and would overcome resistance from individual governments and powerful interests. In the Rio Summit in 1992, governments had the forum and the opportunity to discuss environmental governance, or the idea of strengthening international environmental governance by centralizing the current system under one umbrella institution, but instead bypassed the UNEP in the new climate-change convention and created the Commission on Sustainable Development.

Global environmental governance was again raised at the 2002 Johannesburg World Summit on Sustainable Development (WSSD). Environmentalists sought an international agency that could stand up to the GATT, contending that solving the conflict of trade and the environment would necessitate not only a greening of trade rules but also a stronger organization of environmental governance. Although the multitude of public-private partnerships announced at the summit represented a positive development in international and multisector collaboration, these commitments cannot currently substitute for coordinated intergovernmental action at a global level.

* Source: WHO, “About WHO,” available at www.who.int/about/en/ (accessed December 9, 2017).

At the 2012 Rio+20 summit, five options were considered for establishing an institutional framework for sustainable development. These options focused on (Bernstein and Brunnée 2011, p. 1):

- 1 Enhancing UNEP;
- 2 Establishing a new umbrella organization for sustainable development;
- 3 Establishing a specialized agency such as a world environment organization;
- 4 Reforming the United Nations Economic and Social Council (ECOSOC) and the United Nations Commission on Sustainable Development (CSD); and
- 5 Enhancing institutional reforms and streamlining existing structures.

The delegates at the summit decided to enhance UNEP rather than establish a new framework, by stabilizing its funding and establishing universal membership of its governing body. While this action is likely to enhance the capacity for UNEP to implement existing MEAs and improve its environmental science and policy making functions, it does little to integrate the three pillars of sustainability across the UN system. This task of integration is now central to the 2015 SDGs that are considered to be more integrated/interconnected than the previous MDGs (see Section 2.4.4 in Chapter 2 for a discussion of the MDGs and SDGs).

The current threats to the environment across the world indicate that existing environmental policies and regulations are inadequate (WWF 2016). While UNEP may now have some capacity to address this challenge, it may not have the influence that a Global Environmental Organization (GEO) or World Environmental Organization (WEO) might have. Advocates of a new WEO are not proposing full centralization, or that all environmental governance needs to be in one organizational entity, but rather that all environmental governance mechanisms that exist in each country and city in the world need to be centralized. Full centralization is impossible because no other international regulatory regime is fully centralized either. The WTO is the core of the trade regime, but many trade agencies and bodies of law lie outside it, such as the United Nations Conference on Trade and Development (UNCTAD), the World Customs Organization, the International Trade Centre, the trade directorate of the OECD, the UN Convention on Contracts for the International Sale of Goods, and other agreements on trade in food, endangered species, hazardous waste, and other items. WHO is the center of the health regime, but many health agencies and bodies of law lie outside its ambit as well.

A practical plan would centralize some but not all environmental agencies. However, the costs of reorganization are substantial, whereas the gains are speculative. In addition, the environmental regime has probably benefited from the diversity of entities that conduct environmental work. Policy makers would have to be careful not to lose the capacity for innovation in considering the implementation of such a global environmental entity. Compared with the current arrangements, a WEO would improve environmental governance by making it more coherent, for example, by better coordination among the UNEP treaties (UNEP 2005), MEAs, the WTO, WHO, the ILO, and the UN. However, many obstacles would have to be overcome to put such a global entity in place, including surmounting current practical, political, economic, and logistical barriers. One major issue is that industrialized countries that have strong economies can afford to emphasize environmental protection, whereas developing countries do not have that ability when they are solving development issues. A possible model for a WEO could be WHO, which has been successful in solving problems of world health because of its stature in the international community, its broad mandate, and its fee assessment on member states. It also has a structure of regional offices that has created an atmosphere of cooperation with its members that has enabled WHO to further global health programs (Farr 2000).

10.6 Conclusions

International environmental, health, and safety law has made significant strides in recent decades. However, some critics argue that these laws remain predominantly “soft” in character, unsystematic, insufficiently comprehensive in scope, and weak in enforcement and implementation. Nevertheless, these skeptics overlook the significance of the broad framework for further development of the law to protect the environment that has now been established, and they fail to consider the considerable achievements of the past few decades. They also overlook the laws that have been established in a piecemeal approach in response to environmental, health, and safety disasters, such as Chernobyl or unprecedented weather-related events thought to relate to climate change. Although international law may still be striving toward basic principles and codification, there are examples of realistic and workable laws in place in many countries that are combating the environmental, health, and safety issues we face in our everyday lives. Even if in practice environmental law has not been the subject of much judicial review or elaboration or of widely accepted principles, it has exercised an influence, both in structuring the resolution of environmental disputes and as a basis for negotiation of treaty regimes. The UN General Assembly has a specific mandate to promote further development of international environmental law and to examine the feasibility of the “general rights and obligations of states, as appropriate, in the field of environment, and taking into account relevant existing international legal instruments” (Birnie and Boyle 1992, pp. 544–545).

Although there may appear to be a general consensus on the principles of international environmental law, the limited participation of developing countries in international environmental agreements is a source of political conflict between developed and developing countries. An exception, which could pave the way to greater developing countries’ participation in the future, is in the accord reached in the Paris Climate Agreement, in which most world nations pledged to limit their emissions to lessen global climate change. However, despite the generally low level of participation of developing countries in other international agreements, international treaties have been moderately successful in changing the basis and perspective of international environmental, health, and safety law, accommodating a preventive or precautionary approach. The problems of environmental lawmaking and enforcement are predominantly political and institutional. As Hurrell and Kingsbury (1992, p. 6) argue,

Collective environmental management poses a severe, and therefore, politically sensitive challenge because it involves the creation of rules and institutions that embody notions of shared responsibilities and shared duties, that impinge very heavily on the domestic structures and organization of states, that invest individuals and groups within states with rights and duties, and that seek to embody some notion of a common good for the planet as a whole.

The international control of environmental, health, and safety law requires a variety of instruments and approaches. What these problems have in common is that the solutions lie in the appropriate national and international regulation of a variety of products and practices, industries, societies, and political and economic forces, as well as consumption patterns for goods and services. Commerce and trade and health, safety, and the environment are interlinked, and solutions must address those linkages. Regulation of hazardous technologies is not sufficient. Environmental, worker health and safety, development, and trade policies must be integrated wherever possible. This need will be explored further in the discussion of trade regimes in Chapter 11.

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Part V

International trade and energy

Before growth in trade became important for increasing sectoral or national revenues – and before globalization in its various manifestations began to affect national systems of innovation (see Chapter 4), environmental policies, and employment – countries were content to focus on *national* policies affecting the productiveness of the economy, environment, and employment. Trade and globalization has changed this.

While there is no International Department of Commerce or International Ministry of Trade, the emergence of voluntary trade regimes – predominantly, but not exclusively, overseen by the World Trade Organization (WTO) – has sought to regularize international economic activity by establishing rules of conduct for trade and commerce, mechanisms for dispute resolution, and forums for discussion of issues of concern about the global economy. Other problems of globalization have been addressed in prior chapters. Chapter 5 explored the problems of globalization and trade in the context of their *effects* on the three pillars of sustainability. Chapter 10 explored the potential of multilateral environmental and labor agreements to harmonize environmental and labor practices and standards through the mechanisms of international law.

The first of two chapters in Part V – Chapter 11 – focuses on the legal issues related to environment and employment in the context of trade regimes. Looking ahead, we recognize four distinct approaches for coordinating, if not integrating, our threefold concern on a global scale: (1) strengthen and coordinate the existing international environmental and labor regimes and secure their ratification and implementation by all major trading partners; (2) create a world environment organization to counterbalance the International Labor Organization (ILO) and the WTO, or alternatively endow UNEP with expanded authority; (3) change the trade instruments and agreements administered by the WTO, so that they explicitly accommodate concerns for environment and employment; and (4) negotiate side agreements on environment and labor in various (especially regional) trade regimes, such as those found in NAFTA. In Chapter 11 we explore (3) and (4). The difficulty of achieving (1) was already addressed in Chapter 10. Approach (2) will be addressed in the final chapter of this work (Chapter 13).

The second chapter in Part V – Chapter 12 – focuses on *energy*, which is argued by some to be the real currency of industrial states, rather than dollars or euros. Here, we discuss a number of mythologies which must be dispelled in order to make substantial progress on reducing global climate disruptions, which require both national and multilateral initiatives. The two chapters in this part are connected in an important way. Some have called for a uniform carbon tax to internalize the environmental harms caused by energy exploration, transmission, and use, but in addition, border adjustments (tariffs) on products that are unnecessarily energy-intensive might be an important response. Such tariffs would target nations that are receiving economic advantages by free riding on the work of other nations making measurable progress on decreasing their energy use.



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11.1 Introduction

Since the publication of the first edition of this book, significant developments have occurred in the area of trade. Attempts to negotiate the multilateral Trans-Pacific Partnership (TPP) and the Transatlantic Trade and Investment Partnership (TTIP) between the U.S. and the EU have met with serious and widespread resistance. In the latter case, not only have differences in regulatory approaches to health, safety, and environment been contentious between the parties (for example the EU has also recently altered its directives for GMO cultivation), but also resistance from environmental and labor groups to

the EU's idea of an independent investment dispute resolution tribunal grew. The proposed Investor State Dispute Settlement (ISDS) provision would have given investors the right to appeal against countries or the EU whose regulations and practices disadvantage them economically (see the discussion in Section 4.3.4 in Chapter 4). At the same time, the number of bilateral Free Trade Agreements (FTAs), such as the EU–Canada and EU–Japan agreements, has grown significantly. The focus of this chapter is on the role of the U.S. in the several agreements administered by the World Trade Organization (WTO) and to a lesser extent in the North American Free Trade Agreement (NAFTA).

Before growth in trade became important for raising sectoral or national revenues and before globalization in its various manifestations began to influence development in individual nations (see Chapter 4), environmental policies, and employment, countries were content to focus on domestic policies affecting competitiveness (here meaning the productiveness of the economy), environment, and employment. Trade and globalization have changed this. Although there is no International Department of Commerce or International Ministry of Trade, voluntary trade regimes have sought to regularize international economic activity by establishing rules of conduct for trade and commerce, mechanisms for dispute resolution, and forums for discussion of issues of concern about the global economy. Other problems of globalization have been addressed in prior chapters. Chapter 5 explored the problems of globalization and trade in the context of their effects on the three pillars of sustainability. Chapter 10 explored the potential of multi-lateral environmental and labor agreements to harmonize environmental and labor practices and standards through the mechanisms of international law.

The fragmentation of efforts to coordinate or integrate the components of sustainable development characterizes the international, as well as the national, economic order. In this chapter, we delve into the strengths and weaknesses of the trade regimes themselves – principally the World Trade Organization (WTO) and the North American Free Trade Agreement (NAFTA) – as vehicles for coordinating or integrating these concerns. Other regional trade regimes exist, of course, such as the Association of Southeast Asian Nations (ASEAN) and evolving regimes like MERCOSUR, involving Argentina, Brazil, Paraguay, and Uruguay, for South America.

Looking ahead, we recognize four distinct approaches for coordinating, if not integrating, our threefold concern on a global scale: (1) strengthen and coordinate the existing international environmental and labor regimes and secure their ratification and implementation by all major trading partners; (2) create a world environment organization to counterbalance the International Labor Organization (ILO) and the WTO, or endow the United Nations Environment Programme (UNEP) with expanded authority; (3) change the trade instruments and agreements administered by the WTO so that they explicitly accommodate concerns for the environment and employment; and (4) negotiate side agreements on the environment and labor in various (especially regional) trade regimes, such as those found in NAFTA. In this chapter, we explore (3) and (4). The difficulty of achieving (1) has already been addressed in Chapter 10. Approach 2 will be addressed in the final chapter of this work (Chapter 13).

11.1.1 Trade as a driver of growth*

Although modern development theory emphasizes technological innovation as the “engine of economic growth,” trade also contributed to advancing industrializing nations during the nineteenth and twentieth centuries. Now trade is increasingly described as a

* An expanded version of this text is found in Section 4.4 in Chapter 4. This section is included here to discuss the possible benefits and risks of trade in an economic and political context.

major engine of economic growth, both for advanced economies with “excess productive capacity” and saturated domestic markets and for less industrialized countries with unused natural resources increasingly needed by the industrialized economies. For both, outward-looking strategies are being fashioned for more participation in world markets. The purpose of this section is to articulate why trade is seen as an important driver of development.

The rationale for trade can be traced back to David Ricardo’s (1996 [1817]) theory of *comparative advantage* in the nineteenth century and more recently to Heckscher and Ohlin’s *factor-endowment trade theory* (Heckscher 1949 [1919]; Ohlin 1933). The Heckscher–Ohlin model of trade suggests that countries should specialize in the production of commodities for which they have an advantage in resource endowments and/or productive capabilities and exchange any surplus home-produced commodities for those more easily produced by others (Todaro and Smith 2015).^{*} For example, according to the neoclassical theory of supply and demand, if a country is endowed with labor, the price of labor will be relatively cheap compared with countries where labor is scarce, *ceteris paribus*. Therefore, the labor-endowed country is described as having a *comparative advantage* in relation to the cost of labor. From the Heckscher–Ohlin model, it follows that labor-endowed countries should focus on the production of labor-intensive commodities (such as agricultural goods, raw materials, and minerals) and export any surplus in exchange for imports of capital-intensive commodities.

Conversely, if a country is endowed with capital, it will have a relative advantage in the production of manufactured goods (such as automobiles, trains, aircraft, and electronic equipment) that require large capital investments in technology/equipment compared with labor (Todaro and Smith 2015). Thus, in the Heckscher–Ohlin model, capital-endowed countries should focus on the production of capital-intensive commodities and export any surplus in return for imports of labor-intensive commodities. In effect, the Heckscher–Ohlin model brings the neoclassical price mechanism into the realm of (international) trade theory.

By understanding which productive factors are required to manufacture commodities and relating this information to the relative endowments and factors of production of each country, factor-endowment trade theory encourages countries to *specialize* in commodities in which they have a comparative advantage. Hence, the most efficient (worldwide) allocation of resources will be achieved if all countries specialize in their relative strengths and trade their surplus for needed commodities that are more easily produced by others. This view of trade ultimately leads to the integration of regional and national markets, increasing the importance of transnational corporations and the need to transport resources and commodities between nations (Korten 2001).

* The early theories of comparative advantage were based on a set of static (endowment/core) factors – namely, labor, natural resources, land, and population size. However, comparative advantage is now understood to be more of a dynamic process (Dicken 1994). Possibly the best-known description of the factors that determine a nation’s competitiveness is Porter’s (1990) “diamond of competitive advantage.” Porter’s diamond consists of four interacting factors: factor conditions (such as resources, labor, and infrastructure); demand conditions (that is, demand from customers); related and supporting industries; and industry strategy, structure, and rivalry (that is, the factors that influence an industry’s/firm’s attitude toward competition and innovation). These factors can combine to generate new advanced factor endowments (such as a high-technology sector or a large pool of skilled labor) that determine a nation’s competitive advantage. A clear omission from Porter’s (1990) theory, however, is the failure to include government as a factor (Dicken 1994). Instead, government is described as having a proactive “influence” on the four endowment/core factors. See also Section 3.1.2 in Chapter 3 on factor endowments necessary for economic development.

Behind the majority of arguments in support of international trade is a form of “economic rationalism.” Dryzek (1997)* describes an economic rationalist as someone who believes in the (free) market† and the rational pursuit of material self-interest. Advocates of pure economic rationalism believe that the free market can provide society with more of the products and services it needs and reduce the role of government in promoting a competitive economy. Thus, an economic rationalist is primarily concerned with removing barriers to competition, reducing government spending, expanding the privatization of public services (such as public transportation), and the deregulation of heavily regulated markets/industries. Economic rationalists, for example, might construct the problem of unsustainable development through the lens of inadequate property rights. They would argue that if property rights were reassembled in a more appropriate manner, environmental resources would be “treated as inputs to the social machine,” resulting in more sustainable forms of development (ibid., p. 114).

Economic rationalists believe that governments should act in the best interests of the public, although their actions should be defined in economic rationalist terms. However, Dryzek (1997) notes that this type of economic rationalism is an inadequate mechanism to protect or enhance the environment. A major problem is that economic rationalists respond to consumer preferences and ignore citizen preferences (Sagoff 1988), thereby undermining the democratic process and the well-being of the disadvantaged. Therefore, a more moderate position tends to be adopted by those (neoclassical economists) in support of trade that recognizes the need for government to account for (that is, internalize) the environmental and social costs (or negative externalities) of the market (Driesen 2001).‡ This position aligns well with environmental and resource economics, which attempts to place appropriate market valuations on goods and services by internalizing negative externalities.§

Interestingly, those who oppose international trade recognize that the removal of trade barriers and the integration of national economies have the *potential* to improve the well-being of humans, especially for the poor (Stiglitz 2002). Further, private enterprise, rather than government intervention, is seen as an effective mechanism for creating wealth (Soros 2002). This indicates that potential solutions to the problems raised above will lie in balancing the role of government with the benefits of the market.

Although the case that international trade can stimulate economic growth is relatively clear, the challenge is to ensure that this growth supports rather than undermines

* An approach to the concept of sustainable development that is a valuable alternative to the description of the emergence of sustainable development in Chapter 2 is found in John Dryzek’s (1997) book *The Politics of the Earth: Environmental Discourses*. Instead of taking a historical approach to describe sustainable development, Dryzek uses discourses to address the concept from the full range of positions and arguments – many of which are touched on in this chapter.

† Dryzek (1997) questions the use of the term “free” market and argues that a “market is a market; so why does it need to be called a free market, especially given that markets can only operate if government supplies a supportive legal context?” (ibid., p. 114). Thus “free” market is used as a rhetorical device to represent the removal of barriers to trade in protected or insulated products and services. To many, the concept of a free market also means the elimination or minimization of “oppressive” health, safety, and environmental regulation that may hamper the free flow of goods or the conduct of commerce, or the absence of wage constraints and other restrictions on the conditions and terms of employment, characterized as a nation’s industrial relations system.

‡ A major challenge faced by governments is that these environmental and social costs tend to have a long maturation time, which is “at odds with political democracy, which does not tend to favor long-term planning, especially if it is costly in the short-term” (Hutter 2002, p. 14).

§ Part and parcel of economic rationalism is a commitment to rational choice theory, which argues that government (like the private sector) should base its decisions on cost–benefit analysis.

sustainable forms of development.* In Chapter 9, the argument is made that more stringent environmental regulation is likely to result in either an incremental/radical improvement in the *existing* trajectory (that is, better versions) of technology (the weak form of the regulation-induced innovation hypothesis) or a disrupting change (the strong form of the regulation-induced innovation hypothesis), whereby new products, product-services, and processes enter the market and displace dominant technologies. The discussion in Chapter 9 continues this line of argument by stating that if progress is to be made toward sustainable development, we need to go beyond incremental product and process innovations and search for ways to facilitate dramatic changes in products/processes, shifts to product services, or further still, *system changes*. Two corollary questions arise: (1) how are strategies designed to encourage disrupting change likely to affect international trade? and (2) how do various trade strategies affect the nature of technological change (see the discussion of Charles and Lehner (1998) below)?

The introduction of more stringent standards (designed to facilitate dramatic and/or possibly disruptive technological change) is likely to increase production costs and might encourage industries to relocate to countries with more lenient standards.† However, in practice, it appears that environmental compliance has not yet reached a level of stringency where it influences trade flows or firm location decisions (Steininger 1994). A major concern here is that although more stringent environmental regulation regarding production is likely to improve the national environment, it might also lead to a reduction in a nation's share of international production. Steininger (1994) makes a convincing case

* As an interesting aside, the effectiveness of trade measures in pursuing environmental goals was a question posed by Congress to the [now defunct] Office of Technology Assessment (OTA) in 1992. The final report, *Trade and Environment: Conflicts and Opportunities*, concluded that "trade measures (especially import restrictions), and the threat of such measures, can potentially further environmental goals in various ways. They can help convince a country to join an international environmental agreement or to behave according to certain environmental norms; deny a country economic gain from failing to follow such norms; prevent a country's actions from undermining the environmental effectiveness of other countries' efforts; and remove the economic incentive for certain environmentally undesirable economic activity" (OTA 1992, p. 42). Examples of such measures can be found in the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), established to ensure that international trade in specimens of wild animals and plants does not threaten their survival, and the Basel Convention on the control of transboundary movements of hazardous waste and its disposal (see Chapter 10).

† Dicken (1994) provides an insightful discussion of the complex relationship that exists between international firms and nation-states. On the one hand, the international firm "seeks to maximize its freedom to locate its production chain components in the most advantageous locations for the firm as a whole in its pursuit of global profits or global market share" (*ibid.*, p. 117). On the other hand, the state "wishes to maximize its share of value adding activities" (*ibid.*). Therefore, the outcome of firm-state interactions is predictably uneasy, one of conflict and/or collaboration. Further, firm-state interactions are also influenced by whether the international firm is based in its home country or is a guest in a host country. On the topic of regulatory structures, Dicken (1994) argues that international firms are primarily interested in access to markets and the rules of operations. What they seek would seem to be the "removal of all barriers to entry, whether to imports or to direct presence; freedom to export capital and profits from local operations; freedom to import materials, components, and corporate services; [and] freedom to operate unhindered in local labor markets" (*ibid.*, p. 119). Dicken (1994) suggests that the variation in regulatory structures between nation-states enables firms to engage in a form of "regulatory arbitrage," whereby firms move activities in search of more profitable operations. Such activity might be construed as a race to the bottom where environmental and health and safety standards are concerned. What Dicken does not address, however, is whether more stringent regulatory structures might, in fact, provide firms with an opportunity to capture markets through the creation of advanced (possibly disrupting) technology (Oye and Foster 2002; White 1989). Porter argues that countries, as well as firms, enjoy "first-mover" advantages (Porter and van der Linde 1995; but see also Nehrt 1998).

that if countries are to implement more stringent environmental standards, the threat of competitive disadvantage must be removed. He argues that concerns for the competitiveness of national industries could be addressed if one or both of two counterbalancing measures were incorporated in trade agreements:

- the implementation of countervailing duties on countries with more lenient regulations (the lax standard could be seen as an unfair [. . .] subsidy), and/or
 - the implementation of domestic subsidies for environmental control costs.
- (ibid., p. 28)

Steininger (1994) argues that implementing such changes to trade laws would encourage the unilateral introduction of more stringent environmental regulations that are necessary to bring economies within appropriate ecological limits. These changes, which can lead to the harmonization of environmental standards, possibly through the participation of trading nations in multilateral environmental agreements, seek to equalize environmental burdens and responsibilities.*

Correcting sustainability-driven concerns by harmonizing environmental or occupational health and safety standards is one thing, but different trade strategies themselves can affect the kinds of innovation that an economy or sector undertakes. Presumably, trade is directed toward increasing revenues in a globalized economy. Charles and Lehner (1998) compare policies that seek to maintain national competitiveness by relying on innovation-driven strategies with those that rely on cost-cutting revenue enhancement.

The challenge facing government is how to develop industrial policies that support innovation-driven strategies for competitiveness in trade. Charles and Lehner (1998) argue that identifying the appropriate role for government is a complex task that is plagued with uncertainty; however, they suggest a couple of ways in which innovation-driven strategies can be supported. First, industrial policies should be designed to incorporate differences across firms and industries. The challenge is to strike the right balance between the welfare of industries, regions, and the nation and create a regulatory framework that enables competition and cooperation. Second, new forms of state intervention are required. In particular, Charles and Lehner (1998) suggest that such intervention should support networks of innovation and play an active role in managing the dynamics of new interdependencies between the nation–state, regions, and the international economy. However, a note of caution is offered: too much intervention might be self-defeating.

Finally, if it is possible to create a leading-edge economy based on environmentally focused, innovation-driven strategies that facilitate disrupting change, this outcome presents a significant opportunity to maintain/improve a nation's competitiveness while encouraging more sustainable forms of development.† Although it is difficult to know how disruptive change might affect international trade, there are likely to be improvements in the environmental performance of products and services that are traded.

* Equalizing environmental (or safety and health) performance is likely to impose similar but not entirely equal financial burdens on all producers. Pollution-control and safety equipment will cost about the same in all countries, but human resource inputs may be relatively cheaper in developing countries. Even labor cost differences that simply equalize purchasing power, and thereby impose lower costs on developing countries, reflect an increasing concern about outsourcing labor to developing countries by industrialized nations.

† Interestingly, the former Obama administration had announced that it would focus on creating green jobs, encourage the greater production of automobiles produced domestically, and spur energy innovation. In contrast, the current Trump administration lowered the corporate tax rate, arguing that it would spur innovation in general and create jobs.

11.1.2 Overview of the agreements administered by the World Trade Organization

In Section 4.3.1 in Chapter 4, we introduced the WTO and its agreements designed to promote a liberalized trade agenda focused on goods, services, and intellectual property. The agreements secure individual countries' commitments to lower customs tariffs and other trade barriers, to minimize or eliminate subsidies, to open and keep open services markets, and to adhere to procedures for settling disputes. The agreements are often called the WTO's trade rules, and the WTO is often described as "rules-based." The "rules" are agreements that governments have negotiated, which can be renegotiated or further clarified through the resolution of trade disputes. The legal texts consist of about sixty agreements, annexes, decisions, and understandings. The main agreements fall into a simple structure with six main parts, as depicted in Table 11.1: an umbrella agreement (the Agreement Establishing the WTO); agreements for each of the three broad areas of trade that the WTO covers (goods, services, and intellectual property); dispute settlement; and reviews of governments' trade policies.

The original version of the General Agreement on Tariffs and Trade (GATT) came into existence in 1947, but it has changed considerably since its first inception. The World Trade Organization took over the administration of the GATT when it was established in 1995, when trade in merchandise was around fourteen times that of 1950. The WTO has a membership of more than 160 nations, comprising 98 percent of world trade; roughly three-quarters of its members are developing or least developed countries.

A central focus of the WTO has been the discouragement of dumping (selling goods below their production cost or below their domestic sales price) and the elimination of subsidies and tariff/non-tariff trade barriers so as to facilitate fairer worldwide trade in manufactured products and eventually in agricultural products.* Victims of unfair trade practices and injured parties in trade can institute anti-dumping measures and anti-subsidy measures and can adopt limits on imports as "safeguards" that preserve their markets. Interference by one country in another country's trade with a third country is also discouraged. In other words, the WTO/GATT seeks to facilitate unencumbered trade and encourage international commerce, giving producers and exporters assurances that foreign markets will remain open to them.

However, importing nations may have a special interest in protecting human health and the environment from hazardous imports and harmful practices of importers and are allowed to do so under the exceptions articulated in Article XX of the GATT.

ARTICLE XX: GENERAL EXCEPTIONS

Subject to the requirement that such measures are not applied in a manner which would constitute a means of arbitrary or unjustifiable discrimination between countries where the same conditions prevail, or a disguised restriction on international trade, nothing in this Agreement shall be construed to prevent the adoption or enforcement by any contracting party of measures:

[...]

- (b) necessary to protect human, animal or plant life or health; . . .
- (d) necessary to secure compliance with laws or regulations which are not inconsistent with the provisions of [the GATT]; . . .
- (g) in relation to conservation of exhaustible natural resources [both living and nonliving, for example, minerals].

* Central to the goal of free(r) trade among the signatories to the GATT are nondiscrimination vis-à-vis the treatment of imports and domestically produced goods (i.e., the so-called uniformity-of-treatment requirement of the GATT) and treatment of all imported/exported goods that is the same as treatment of those of the most favored nation (MFN).

Table 11.1 The World Trade Organization (WTO)

<i>Umbrella</i>	<i>Agreement establishing the WTO</i>		
Areas of trade	Goods	Services	Intellectual property
<i>Basic principles</i>	GATT	GATS	TRIPS
<i>Additional details</i>	Other goods agreements and annexes	Services annexes	
<i>Market access commitments</i>	Countries' schedules of commitments	Countries' schedules of commitments (and MFN exemptions)	
<i>Dispute settlement</i>		DISPUTE SETTLEMENT	
<i>Transparency</i>		TRADE POLICY REVIEWS	

GATS = General Agreement on Trade in Services

GATT = General Agreement on Tariffs and Trade

MFN = most favored nation

TRIPS = Trade-Related Aspects of Intellectual Property

The evolving law under the WTO and other agreements administered by the WTO (see below) addresses the tensions between the environment/public health and safety and trade. Although the exceptions may include worker health and safety, other aspects of sustainability having to do with employment, for example, wages and some conditions of work, are not clearly addressed (see the later discussion in Section 11.3.1).

In order to operationalize Article XX(b) or (g), the “measures” on imports may include bans, other import restrictions or regulations, or countervailing tariffs (taxes).^{*} What is unclear is whether imported goods made by employing environmentally destructive practices affecting only the exporting countries can be actionable.[†] It is also doubtful whether an importing country can give preferences to environmentally superior goods, because Article XX speaks of exceptions that are measures “necessary to protect human, animal or plant life or health,” but also states that these measures must satisfy the uniformity-of-treatment and MFN requirements. In other words, what would in effect be subsidies through discounting of the prices of environmentally superior imports would not be allowed.[‡] However, financial assistance or technical advice provided by any nation to its exporters to improve or secure its exports’ health, safety, or environmental characteristics in compliance with law or regulation are no longer allowed by the WTO rules as “non-actionable subsidies” under the GATT.

^{*} Bamberger and Guzman (2008) address the increased importation of unsafe goods (e.g., drugs, foods, and toys) from abroad whose foreign-based producers are either unreachable under U.S. law or unknown. Acknowledging that a permanent ban of Chinese toys would probably not survive scrutiny as a permissible exception under Article XX(b), Cortez (2008) argues for a temporary ban to pressure China to manufacture safer products. In contrast, rather than ineffectual regulation that might be imposed under Article XX(b), Bamberger and Guzman (2008) rely on Article XX(d) to justify the protection of domestic consumers from unsafe foreign products by imposing strict tort liability with larger penalties for importers and sellers than for their domestic counterparts. They argue that more onerous liability than is imposed on domestic producers is justified (as a necessary and least trade-restrictive approach) under XX(d) in order to create equivalent incentives to ensure more prevention, resulting in a safe product, and that this escapes violation of the “less favorable treatment” requirement vis-à-vis domestic products.

[†] This is related to the “process and production methods” (PPM) debate concerning Article XX discussed later in this chapter (see Section 11.2.2).

[‡] Although some commentators are correct in noting that all inefficiencies due to negative externalities or positive spillovers could be “corrected” by taxes or subsidies, respectively (see LeClair and Franceschi 2006; Plofchan 1992), not all of these “inefficiency corrections” are allowed under Article XX of the GATT.

In order to successfully avail itself of Articles XX(b) and (g), among other requirements, an importer must demonstrate that its restrictive measure falls under one of the allowable exceptions. An importing nation can unilaterally and autonomously establish the level of protection deemed necessary according to its own values, although a multilateral approach – for example, evidenced by the existence of a multilateral (or bilateral) agreement on the issue – is strongly preferred but is not a prerequisite.* In addition, the restrictive measure must not constitute “a means of arbitrary or unjustifiable discrimination between countries where the same conditions prevail” and must not be “a disguised restriction on international trade.” Finally, the measure needs to be either necessary for the protection of human, animal, or plant life or health (Article XX(b)) or in relation to the conservation of natural resources (Article XX(g)).†

Aside from the GATT, the General Agreement on Trade in Services (GATS), and the Agreement on Trade Related Aspects of Intellectual Property Rights (TRIPS), additional agreements relevant to health, safety, and the environment include the following:

- The Agreement on Subsidies and Countervailing Measures;
- The Agreement on Technical Barriers to Trade (TBT); and
- The Agreement on Sanitary and Phytosanitary Measures (SPS).

The key aspects of these agreements are found in the appendix to this chapter. After a discussion of dispute resolution in the WTO in the next section, each of these agreements is described in the remainder of this chapter.

11.1.3 Dispute resolution under the WTO

The WTO has an elaborate system for resolving disputes among trading partners. The WTO describes the system as follows:‡

UNDERSTANDING THE WTO: SETTLING DISPUTES

A unique contribution

Dispute settlement is the central pillar of the multilateral trading system, and the WTO’s unique contribution to the stability of the global economy. Without a means of settling disputes, the rules-based system would be less effective because the rules could not be enforced. The WTO’s procedure underscores the rule of law, and it makes the trading system more secure and predictable. The system is based on clearly-defined rules, with timetables for completing a case. First rulings are made by a panel and endorsed (or rejected) by the WTO’s full membership. Appeals based on points of law are possible.

However, the point is not to pass judgment. The priority is to settle disputes, through consultations if possible. By January 2008, only about 136 of the nearly 369 cases had reached the full panel process. Most of the rest have either been notified as settled “out of court” or remain in a prolonged consultation phase - some since 1995.

* Winter (2000, p. 241) comments that this is a dictum rather than a binding holding of the shrimp–turtle case discussed in Section 11.2.2.

† The requirements articulated in this paragraph derive both from the language of Article XX and from cases following Appellate Body review of panel decisions interpreting that article that has become WTO law. See the excerpt from the panel decision on asbestos in Section 11.2.3. See also WTO (2017a), “WTO Rules and Environmental Policies: GATT Exceptions,” Available at www.wto.org/english/tratop_e/envir_e/envt_rules_exceptions_e.htm (accessed December 26, 2017).

‡ WTO. “Understanding the WTO: Settling Disputes, A Unique Contribution.” Available at www.wto.org/english/thewto_e/whatis_e/tif_e/disp1_e.htm (accessed December 26, 2017).

Principles: equitable, fast, effective, mutually acceptable

Disputes in the WTO are essentially about broken promises. WTO members have agreed that if they believe fellow-members are violating trade rules, they will use the multilateral system of settling disputes instead of taking action unilaterally. That means abiding by the agreed procedures, and respecting judgments.

A dispute arises when one country adopts a trade policy measure or takes some action that one or more fellow-WTO members considers to be breaking the WTO agreements, or to be a failure to live up to obligations. A third group of countries can declare that they have an interest in the case and enjoy some rights.

A procedure for settling disputes existed under the old GATT, but it had no fixed timetables, rulings were easier to block, and many cases dragged on for a long time inconclusively. The Uruguay Round agreement introduced a more structured process with more clearly defined stages in the procedure. It introduced greater discipline for the length of time a case should take to be settled, with flexible deadlines set in various stages of the procedure. The agreement emphasizes that prompt settlement is essential if the WTO is to function effectively. It sets out in considerable detail the procedures and the timetable to be followed in resolving disputes. If a case runs its full course to a first ruling, it should not normally take more than about one year – 15 months if the case is appealed. The agreed time limits are flexible, and if the case is considered urgent (for example, if perishable goods are involved), it is accelerated as much as possible.

The Uruguay Round agreement also made it impossible for the country losing a case to block the adoption of the ruling. Under the previous GATT procedure, rulings could only be adopted by consensus, meaning that a single objection could block the ruling. Now, rulings are automatically adopted unless there is a consensus to reject a ruling, that is, any country wanting to block a ruling has to persuade all other WTO members (including its adversary in the case) to share its view.

Although much of the procedure does resemble a court or tribunal, the preferred solution is for the countries concerned to discuss their problems and settle the dispute by themselves. The first stage is therefore consultations between the governments concerned, and even when the case has progressed to other stages, consultation and mediation are still always possible.

How long to settle a dispute?

These approximate periods for each stage of a dispute settlement procedure are target figures, that is, the agreement is flexible. In addition, the countries can settle their dispute themselves at any stage. Totals are also approximate.

60 days	Consultations, mediation, etc.
45 days	Panel set up and panelists appointed
	6 months Final panel report to parties
3 weeks	Final panel report to WTO members
	60 days Dispute Settlement Body adopts report (if no appeal)
Total = 1 year	(without appeal)
60–90 days	Appeals report
30 days	Dispute Settlement Body adopts appeals report
Total = 1y 3m	(with appeal)

How are disputes settled?

[See Figure 11.1 for a visual road map.] Settling disputes is the responsibility of the Dispute Settlement Body (the General Council in another guise), which consists of all WTO members. The Dispute Settlement Body has the sole authority to establish “panels” of experts to consider the case, and to accept or reject the panels’ findings or the results of an appeal. It monitors the implementation of the rulings and recommendations, and has the power to authorize retaliation when a country does not comply with a ruling.

- **First stage:** consultation (up to **60 days**). Before taking any other actions the countries in dispute have to talk to each other to see if they can settle their differences by themselves. If that fails, they can also ask the WTO director-general to mediate or try to help in any other way.
- **Second stage:** the panel (up to **45 days** for a panel to be appointed, plus 6 months for the panel to conclude). If consultations fail, the complaining country can ask for a panel to be appointed. The country “in the dock” can block the creation of a panel once, but when the Dispute Settlement Body meets for a second time, the appointment can no longer be blocked (unless there is a consensus against appointing the panel).

Officially, the panel is helping the Dispute Settlement Body make rulings or recommendations. But because the panel’s report can only be rejected by consensus in the Dispute Settlement Body, its conclusions are difficult to overturn. The panel’s findings have to be based on the agreements cited.

The panel’s final report should normally be given to the parties to the dispute within six months. In cases of urgency, including those concerning perishable goods, the deadline is shortened to three months.

The agreement describes in some detail how the panels are to work. The main stages are:

- **Before the first hearing:** each side in the dispute presents its case in writing to the panel.
- **First hearing:** the case for the complaining country and defense, the complaining country (or countries), the responding country, and those that have announced they have an interest in the dispute, make their case at the panel’s first hearing.
- **Rebuttals:** the countries involved submit written rebuttals and present oral arguments at the panel’s second meeting.
- **Experts:** if one side raises scientific or other technical matters, the panel may consult experts or appoint an expert review group to prepare an advisory report.
- **First draft:** the panel submits the descriptive (factual and argument) sections of its report to the two sides, giving them two weeks to comment. This report does not include findings and conclusions.
- **Interim report:** The panel then submits an interim report, including its findings and conclusions, to the two sides, giving them one week to ask for a review.
- **Review:** The period of review must not exceed two weeks. During that time, the panel may hold additional meetings with the two sides.
- **Final report:** A final report is submitted to the two sides and three weeks later, it is circulated to all WTO members. If the panel decides that the disputed trade measure does break a WTO agreement or an obligation, it recommends that the measure be made to conform with WTO rules. The panel may suggest how this could be done.

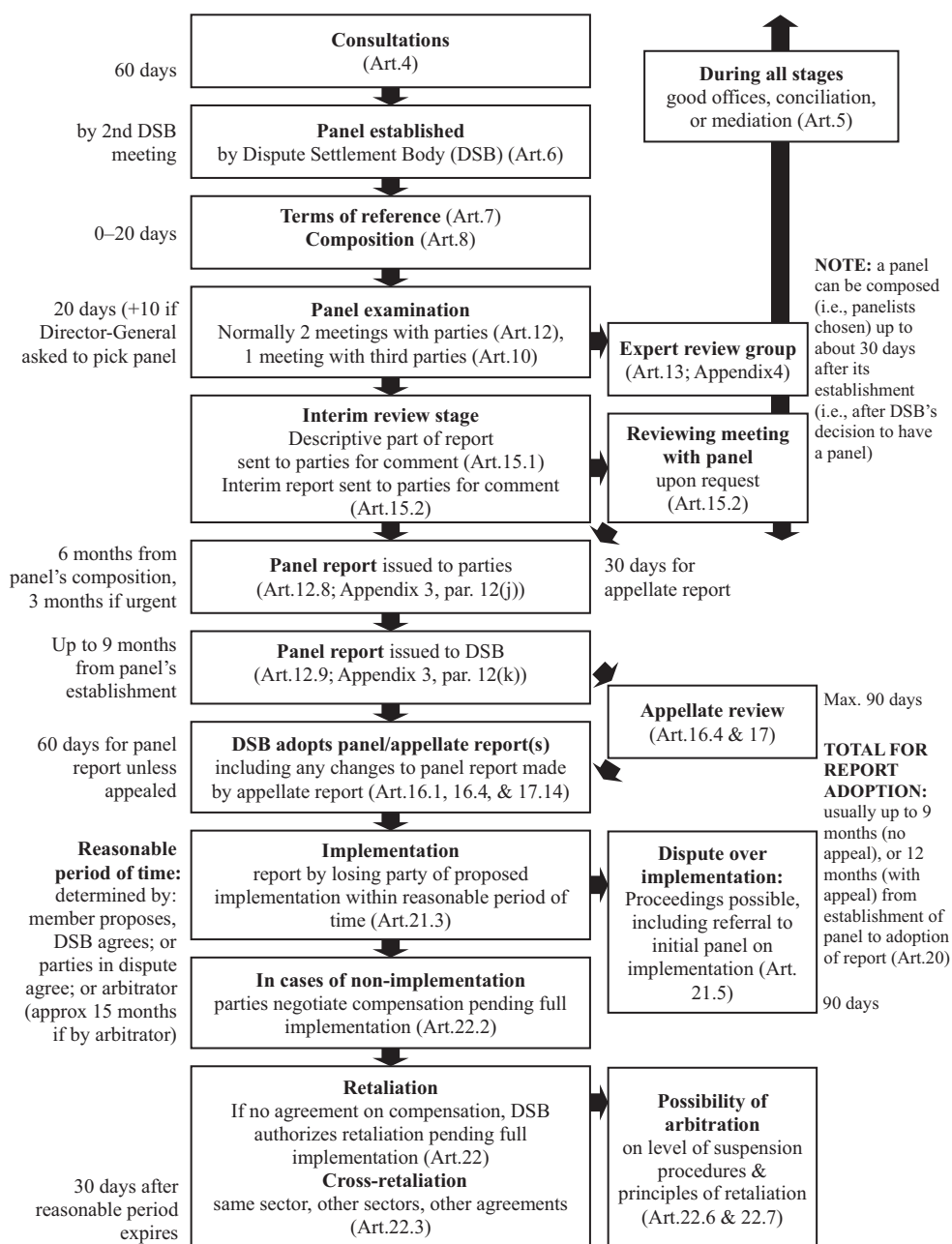


Figure 11.1 Schematic of the WTO dispute-resolution process

Note: Some specified times are maximums, some are minimums; some are binding, some are not.

Source: Adapted from WTO (2011).

- **The report becomes a ruling:** The report becomes the Dispute Settlement Body's ruling or recommendation within 60 days unless a consensus rejects it. Both sides can appeal the report (and in some cases both sides do).

Panels

Panels are like tribunals. But unlike in a normal tribunal, the panelists are usually chosen in consultation with the countries in dispute. Only if the two sides cannot agree does the WTO director-general appoint them.

Panels consist of three (possibly five) experts from different countries who examine the evidence and decide who is right and who is wrong. The panel's report is passed to the Dispute Settlement Body, which can only reject the report by consensus.

Panelists for each case can be chosen from a permanent list of well-qualified candidates, or from elsewhere. They serve in their individual capacities. They cannot receive instructions from any government.

Appeals

Either side can appeal a panel's ruling. Sometimes both sides do so. Appeals have to be based on points of law such as legal interpretation - they cannot re-examine existing evidence or examine new issues.

Each appeal is heard by three members of a permanent seven-member Appellate Body set up by the Dispute Settlement Body and broadly representing the range of WTO membership. Members of the Appellate Body have four-year terms. They have to be individuals with recognized standing in the field of law and international trade, not affiliated with any government.

The appeal can uphold, modify or reverse the panel's legal findings and conclusions.^[*] Normally appeals should not last more than 60 days, with an absolute maximum of 90 days.

The Dispute Settlement Body has to accept or reject the appeals report within 30 days and rejection is only possible by consensus.

The case has been decided: what next?

[. . .] If a country has done something wrong, it should swiftly correct its fault. And if it continues to break an agreement, it should offer compensation or suffer a suitable penalty that has some bite-although this is not actually a punishment: it's a "remedy", the ultimate goal being for the country to comply with the ruling.

The priority at this stage is for the losing "defendant" to bring its policy into line with the ruling or recommendations. The dispute settlement agreement stresses that "prompt compliance with recommendations or rulings of the DSB [Dispute Settlement Body] is essential in order to ensure effective resolution of disputes to the benefit of all Members."

If the country that is the target of the complaint loses, it must follow the recommendations of the panel report or the appeals report. It must state its intention to do so at a Dispute Settlement Body meeting held within 30 days of the report's adoption. If complying with the recommendation immediately proves impractical, the member will be given a "reasonable period of time" to do so. If it fails to act within this period, it has to enter into negotiations with the complaining country (or countries) in order

* Unlike U.S. courts of appeal, remanding the decision to the panel for reconsideration because of an error in law is not possible. See the later discussion in Section 11.2.5, where there was a difference of opinion between the panel and the Appellate Body regarding the appropriate trade law to apply.

to determine mutually-acceptable compensation – for instance, tariff reductions in areas of particular interest to the complaining side.

If after 20 days, no satisfactory compensation is agreed, the complaining side may ask the Dispute Settlement Body for permission to for permission to retaliate (“suspend concessions or obligations”).^[*] This is intended to be temporary, to encourage the other country to comply. It could for example take the form of blocking imports by raising import duties on products from the other country above agreed limits to levels so high that the imports are too expensive to sell - within certain limits. The Dispute Settlement Body must grant this authorization within 30 days after the “reasonable period of time” expires unless there is a consensus against the request.

In principle, the sanctions should be imposed in the same sector as the dispute. If this is not practical or if it would not be effective, the sanctions can be imposed in a different sector of the same agreement. In turn, if this is not effective or practicable and if the circumstances are serious enough, the action can be taken under another agreement. The objective is to minimize the chances of actions spilling over into unrelated sectors while at the same time allowing the actions to be effective.

In any case, the Dispute Settlement Body monitors how adopted rulings are implemented. Any outstanding case remains on its agenda until the issue is resolved.

The EU has suggested a new system based on the WTO dispute settlement mechanism (which decides on trade issues, but not on investment issues): a permanent international public investment court would deal with international investment disputes through a transparent process based on jurisprudence and with the possibility to appeal rulings.[†] The CETA (Comprehensive Economic and Trade Agreement) between the EU and Canada is the first agreement in which this arbitration system for the resolution of investment disputes is included.[‡]

11.1.4 The prohibition against subsidies

Subsidies by government or by industry in the domestic or national context are widely acknowledged to distort the market and, in the case of industry subsidies, sometimes give rise to violations of anti-trust law in the U.S. (called anti-competition or anti-monopoly law in the EU). Within a nation, they take the form of government aid to promote a product or service market (e.g., electronics or energy) or are motivated by industry subsidies to lower costs in order to monopolize or profit in a market through the practice of “dumping” or selling below actual cost.

Different countries have different tolerances for these distortions. For example, Microsoft was prosecuted by the EU for the very same activities in the EU that were tolerated in the U.S. markets.[§]

* There is an argument that financial compensation (or the posting of financial bonds with a third party) is preferable to trade sanctions. Trade sanctions, while compensatory in nature, do not promote free trade unless they lead to a reduction in the offending initial tariffs or trade discrimination. Compensatory fines serve as a deterrent purpose and provide an efficiency benefit. Finally, some countries may not have significant market power to affect prices and hence may not be able to achieve sufficient deterrence (or gain sufficient revenues) by imposing countervailing tariffs. See Limao and Saggi (2006).

† See Section 4.3.4 in Chapter 4 and the European Commission, *The Multilateral Investment Court Project*, <http://trade.ec.europa.eu/doclib/press/index.cfm?id=1608> (accessed February 14, 2018).

‡ See Government of Canada, Canada–European Union Comprehensive Economic and Trade Agreement (CETA), www.international.gc.ca/trade-commerce/trade-agreements-accords-commerciaux/agr-acc/ceta-aecg/index.aspx?lang=eng (accessed February 14, 2018).

§ Jennings, J. (2006). “Comparing the US and EU Microsoft Antitrust Prosecutions: How Level is the Playing Field?” *Erasmus Law and Economics Review* 2(1): 71–85. Available at www.eler.org/include/getdoc.php?id=70 (accessed February 14, 2018).

In the area of international trade for manufactured products, subsidies and trade distortions consume a large part of the actions brought under the WTO dispute settlement procedure (see Section 11.1.3 above). Under the WTO Agreement on Subsidies and Countervailing Measures, a country can use the WTO dispute resolution settlement procedure “to seek the withdrawal of the subsidy or the removal of its adverse effects. Or the country can launch its own investigation and ultimate charge extra duty (‘countervailing duty’) on subsidized imports that are found to be hurting domestic producers.”*

However, the so-called DOHA round of many negotiations intended to regularize practices in agricultural products through a specific trade agreement like the GATT or the GATS, has not been sufficiently successful in curbing subsidies by the EU and U.S. in response to complaints brought about by developing countries.

The WTO Agreement on Subsidies and Countervailing Measures† provides prohibitions against “specific subsidies,” which are “a subsidy available only to an enterprise or industry or groups of enterprises or industries within the jurisdiction of the authority granting the subsidy” in the context of export activities. The subsidies are “actionable,” that is, subject to the WTO dispute machinery, if they are larger than certain minimal levels.

After 1999, section 8 of the agreement dealing with “nonactionable subsidies” was removed (Charnovitz 2014). They had included either nonspecific subsidies or “specific subsidies involving assistance to industrial research and pre-competitive developmental activity, assistance to disadvantaged regions, or certain types of assistance for adapting existing facilities to new environmental requirements imposed by law and/or regulations.” Unlike environmental policies that operate through regulation, green subsidies (creating positive externalities) are fiscal policies that operate through the market (Charnovitz 2014, p. 3). They may work on the (consumer) demand side through “market-pull” interventions or the supply side through “technology-push” initiatives (see Section 6.2. in Chapter 6). Prohibited or actionable subsidies must in fact cause adverse economic effects. Although section 8 was removed, non-sector- or firm-specific subsidies that support research in basic science and the development of technology, or technical training, in general are not considered actionable. Subsidies to an enterprise that sells/trades only services (and are generally covered under GATS) are not prohibited or actionable, provided they are not discriminatory (Charnovitz 2014, p. 44).

The new green industrial policies, which are sector or technology-specific, sometimes also include trade restrictions to tilt the playing field in favor of cosseted domestic green industries (Charnovitz 2014, p. 8). According to Charnovitz (2014, p. 9), “the most popular emerging instrument appears to be (discriminatory) local-content requirements (LCRs) linked to government investment.” However, these have recently run afoul of WTO anti-subsidy rules (see the discussion of solar panels below).

Finally, economics does recognize that governments that tolerate domestic environmental damage or harm to their workers without consequences in the process of export-oriented economic activities **are effectively subsidizing** these activities, even if this is not technically recognized as subsidization under WTO law.

As of early September 2016, and since former President Obama was inaugurated in 2009, the U.S. Trade Representative in his administration filed twenty-three enforcement complaints, all successful, more than any other WTO member.‡ Given the current admin-

* WTO. “Subsidies and Countervailing Measures.” Available at www.wto.org/english/tratop_e/scm_e/scm_e.htm (accessed February 14, 2018). For a chronological list of trade dispute settlement cases, see www.wto.org/english/tratop_e/dispu_e/dispu_status_e.htm (accessed February 14, 2018).

† See also Appendix 11-A.

‡ See *United States Prevails as WTO Panel Finds EU Subsidies to Airbus Break WTO Rules*. Available at <https://ustr.gov/about-us/policy-offices/press-office/press-releases/2016/september/united-states-prevails-wto-panel> (accessed December 26, 2017).

istration's anti-trade sentiments, it is difficult to predict what legal or political actions it will take.

11.1.4.1 Foreign sales corporations advantaging automobile exports

The United States used a 1984 law establishing the mechanism of foreign sales corporations to exempt a portion of income from foreign sales of its exports from tax. In 1997, the EU brought a complaint against the United States that the measures in the law constituted a prohibited subsidy under the GATT, and the dispute worked its way through a tortuous pathway provided by the WTO dispute-resolution system and remains unresolved. The United States lost the first round through the panel and appellate processes and was ordered to revise its law. The United States revised its law in 2000, but not to the satisfaction of the EU or the WTO, because some critics alleged that the prohibited subsidy remained. In 2004, the United States repealed the newer law, but the EU argued that this did not bring the U.S. tax scheme into conformity with its WTO obligations; the Appellate Body agreed and cleared the way for the EU to apply \$4 billion annually in retaliatory countervailing duties on U.S. products. This case serves as a good example of the complexity and cumbersome nature of the WTO dispute-resolution system. For an equally rocky process in the U.S.–EU steel wars, see Liebman and Tomlin (2008).

11.1.4.2 Aircraft

In a trade war reminiscent of the dispute between the U.S. and the EU over bananas, the biggest trade dispute between the U.S. and the EU involved allegedly illegal subsidies to the production of competing aircraft (Reuters, August 16, 2016). Failure of both manufacturers to withdraw the subsidies was greeted by countervailing responses: \$10–12 billion in countervailing duties are at issue for both. More than money is at stake. Tens of thousands of aerospace jobs are affected in this biggest test of a multilateral system for resolving trade disputes since the founding of the WTO in 1995. On November 28, 2016, the EU won its complaint against prohibited subsidies of \$5.7 billion by Boeing (see DS316, DS317, DS347, DS353, and DS487).^{*} A compliance panel report, which began work in 2012 and was submitted in June 2017, concluded that the EU failed to establish many alleged adverse economic effects, although some were established, and the U.S. had failed to comply with the DSB recommendations and rulings to bring it into required conformity. The case is under appeal from both sides.

11.1.4.3 Solar panels

The global competition for solar panels is fierce and getting more intense with dramatic changes in technology leading to great reductions in cost. The emergence of the COP21 agreement in Paris in 2015 is expected to increase world demand. The U.S. successfully brought a complaint against China for dumping the panels (selling below cost) and applied large tariffs on their importation; the action is likely to benefit Malaysia, the second-largest exporter of solar panels to the U.S. (NYTimes 2014). The EU had also

^{*} Summary US–Large Civil Aircraft (2nd Complaint) – DS353 Available at www.wto.org/english/tratop_e/dispu_e/cases_e/1pagesum_e/ds353sum_e.pdf (accessed February 14, 2018). See also https://www.wto.org/english/tratop_e/dispu_e/cases_e/ds353_e.htm (accessed May 1, 2018).

placed anti-dumping tariffs on the panels (Crowley and Song 2015), but settled their dispute with China on July 27, 2013.*

In September 2016, the WTO Appellate Body found in favor of the United States in a dispute challenging India's "localization" rules discriminating against imported solar cells and modules under India's National Solar Mission.† The appellate report affirmed a February 2016 WTO panel report finding that India's domestic content requirements discriminate against U.S. solar cells and modules by requiring solar power developers to use Indian-manufactured cells and modules, in breach of international trade rules.

While global cooperation on reducing greenhouse gases is needed, if not absolutely necessary to succeed, these cases reveal the thorny problems in trade relationships in countries achieving that goal.

11.1.5 Other anti-competitive practices: rare earths from China

The so-called rare earths are seventeen elements with unusual and valuable properties that form essential components of modern electronics, metal manufacturing and processing, and other critical uses. They include vanadium and tantalum. In addition, tungsten and molybdenum are similarly commercially valuable elements. To produce 1 kg of these elements, about 1,000 kg of earth has to be processed, and this leaves an overwhelming amount of waste unusable and the extraction activities require treatment to prevent significant environmental damage. Developed economies find it too expensive to address the resulting environmental problems and need for remedial action, leaving China – which does not deal properly with the waste or the extraction of earth – as sole producer of 97 percent of the world's supply of rare earths, 91 percent of tungsten, and 36 percent of molybdenum.

Lately, China restricted the amount of rare earths it would sell (at high prices) and the WTO found it in violation of international free trade rules. In spite of an adverse WTO ruling in response to an EU complaint, China refused to remove its export restrictions, e.g., export quotas, export duties, and price controls, and actually tightened them. In 2012, the EU was joined by the U.S. and Japan in a second successful challenge, which again ruled against China in March 2014. China unsuccessfully argued that it was conserving its exhaustible resources and thus protected under section XX(g) of the GATT (see the discussion above in Section 11.1.2). Its defense failed because no limitations were placed on its domestic production, which meant that China's actions were discriminatory. In May 2015, Beijing reported it had implemented WRO's recommendation bringing it into conformity with WTO rules, thus avoiding compliance proceedings (EU Parliament 2015).

11.1.6 Countervailing duties as a defensive measure

The WTO is not an international enforcement regime but allows retaliation (and counter-retaliation) by aggrieved parties to a trade dispute. This often begins with the placing of a countervailing duty on the products imported by the offending countries and can include a total ban on unrelated products. The offending party can complain of excessive retaliation and introduce counter measures. This gives rise to "trade wars," which either continue for long periods of time or are resolved by the parties. A recent example is the

* See *Financial Times*, "EU and China Settle Trade Fight Over Solar Panels." Available at www.ft.com/content/4e468c26-f6ab-11e2-8620-00144feabdc0 (accessed February 14, 2018).

† See SEIA, *WTO Ruling in US-India Trade Case Is a Step in the Right Direction*. Available at www.seia.org/news/wto-ruling-us-india-trade-case-step-right-direction (accessed February 14, 2018).

EU Commission's February 2018 imposition of anti-dumping duties on Chinese corrosion resistant steel.* The measures that will be in place for the next five years range from 17.2 percent to 27.9 percent. This follows anti-dumping duties the EU placed a week earlier on cast iron products from 15.5 percent to 38.1 percent.†

11.2 Trade and the environment (trade regimes as constraints on national health, safety, and environmental policies)

The relationship between trade, undertaken for economic benefit, and the environment is a complex one. Although most trade treaties do not have an overlap with environmental issues, those that do represent about 10 percent of all multilateral environmental agreements (MEAs) in force. We considered several of these in the previous chapter, where some treaties could actually be termed "environmental trade agreements." These MEAs trade measures are a means to achieve health, safety, and environmental objectives. These include treaties addressing trade in hazardous products, dangerous equipment and machinery, and hazardous waste; protection of endangered species; protection of the ozone layer; and climate change, most recently through the Paris Agreement. In this chapter, we focus on those agreements that foster trade undertaken primarily for economic benefit, but that may require modification of otherwise free-trade practices for health, safety, or environmental reasons.

The WTO has long had a Committee on Trade and Environment (CTE) whose task is to make recommendations to the WTO's governing body in order to reconcile two sometimes opposing goals: economic benefit through trade and protection of health, safety, and the environment.‡ The balance of these two universally accepted goals is different in different trade agreements. Some are predominantly trade enhancing (like the GATT or the TBT), while others vary from containing a fair consideration of both to being mainly environmental (CITES). The committee has long struggled with issues that are still somewhat unresolved, such as whether a valid/actionable environmental concern of one country extends to the territory of another trading partner (extraterritoriality) and whether process and production methods (PPMs) are likewise actionable if they restrict trade.§ Also, a continuing point of contention is whether the precautionary principle applies to all trade agreements or just to some – that is, whether the precautionary principle is a recognized principle of international law that trumps specific trade agreements.

Aside from environmental, health, and safety provisions in the trade agreements themselves, a key issue is the legal importance of MEAs for resolving trade disputes in agreements like the GATT or the TBT. MEAs that recognize the existence of a hazard – or establish specific levels of protection – could defeat the assertion by a party who had signed the MEA, but denied the existence of a bona fide actionable concern claimed by

* See the European Commission, *Trade Defence: Commission Imposes Definitive Anti-Dumping Duties on Chinese Corrosion Resistant Steel*. Available at <http://trade.ec.europa.eu/doclib/press/index.cfm?id=1794> (accessed February 14, 2018).

† See the European Commission, *Commission Imposes Measures on Cast Iron Products from China*. Available at <http://trade.ec.europa.eu/doclib/press/index.cfm?id=1790> (accessed February 14, 2018).

‡ Unfortunately, the WTO insists that it is not in the business of environmental protection. At its website, it states: "The WTO is only competent to deal with trade. In other words, in environmental issues its only task is to study questions that arise when environmental policies have a significant impact on trade. The WTO is not an environmental agency. Its members do not want it to intervene in national or international environmental policies or to set environmental standards. Other agencies that specialize in environmental issues are better qualified to undertake those tasks." WTO, *The Environment: A Specific Concern*. Available at www.wto.org/english/thewto_e/whatis_e/tif_e/bey2_e.htm (accessed May 18, 2010).

§ The CTE did prepare a report in 1996 that it presented at the meeting in Singapore arguing the pros and cons of these issues and recommending that the WTO resolve the opposing viewpoints, which, of course, it never has done explicitly (WTO 1996). However, this equivocal report did little more than identify the issues and did not lead to any policy actions.

its opponent as a matter of trade law. On the other hand, even if neither of the parties to the trade dispute signed the MEA, its mere existence may provide relevant (and rebuttable) evidence that the health, safety, or environmental concern is a bonafide actionable concern. Winter (2000) argues that only if the party attempting to use one of the Article XX exceptions has signed an MEA can the MEA be used to establish the bona fide nature of the health or environmental concern, but this ignores the fact that the mere existence of an MEA is evidence that a recognized and bona fide environmental problem exists, irrespective of whether both parties or either party signed the agreement. The evidence is, of course, rebuttable, but a *prima facie* case will have been made in any event.

The principle of *stare decisis* in law requires a legal tribunal (such as those resolving disputes in the WTO) to follow precedent (or depart from precedent with adequate explanation) in subsequent cases. Although this principle is not a procedural requirement under the GATT, the WTO seems to be following it (Carranza 2007–2008). Thus, the evolution of cases involving the resolution of disputes should give guidance to the resolution of future disputes and the development of clear environmental policy vis-à-vis trade. The reliance on precedent reflects the practice of case-law development, of law characteristic of the Anglo-Saxon legal systems originally derived from England, as opposed to the code-based Napoleonic or French legal systems used predominantly on the European Continent and francophone countries. The panel discussion in the asbestos case discussed below is replete with recitations of legal principles built on prior WTO cases. Thus, in order for one to “know what the trade law is” at any moment, one must refer to three sources: (1) the actual cases; (2) commentary and interpretation of those cases in the WTO websites and published documents; and (3) the writings of legal experts, predominantly in law-review articles, especially where issues are somewhat unresolved and not yet adjudicated in dispute resolution cases.

11.2.1 Thailand-Cigarettes

Thailand’s placement of discriminatory taxes on American cigarettes invoking the section XX(b) exception for public health reasons were held in violation of WTO trade rules (DS10/R-37S/200), and this 1990 panel decision is often cited for the principle that treating imports differently than a country’s like domestic products is *per se* prohibited. In addition, Thailand did not have an active anti-smoking campaign and this was regarded as evidence that Thailand was not using the least burdensome option to decrease tobacco-related death and disease. As a result, Thailand’s taxes were not considered necessary to protect its people. Ironically, it was later revealed that, unlike Thailand, American cigarette manufacturers have added nicotine to its tobacco products to compensate for the fact that nicotine – which is the addictive component in tobacco – is removed in tobacco processing, and American cigarettes are intentionally made to be much more addictive. This could have supported the conclusion that U.S. cigarettes and Thailand cigarettes are not like products, and hence would support differential taxation.

11.2.2 The shrimp-turtle dispute and Article XX(g) of the GATT (conservation of natural resources)

Although several environmental disputes were brought under Article XX(g), most never became full decisions of the WTO because they did not secure unanimous endorsement of the WTO members required under the so-called old rules of the GATT. The most recent and significant case brought under Article XX(g) involved the so-called shrimp-turtle dispute. Box 11.1 provides a capsule summary of the case.*

* See WTO, *The Process – Stages in a Typical WTO Dispute Settlement Case*. Available at www.wto.org/english/tratop_e/dispu_e/dispu_settlement_cbt_e/c6s1p1_e.htm (accessed February 14, 2018).

Box 11.1 United States – import prohibition of certain shrimp and shrimp products

WTO case Nos. 58 (and 61). Ruling adopted on 6 November 1998

Seven species of sea turtles have to date been identified. They are distributed around the world in subtropical and tropical areas. They spend their lives at sea, where they migrate between their foraging and nesting grounds.

Sea turtles have been adversely affected by human activity, either directly (their meat, shells and eggs have been exploited), or indirectly (incidental capture in fisheries, destruction of their habitats, pollution of the oceans).

In early 1997, India, Malaysia, Pakistan and Thailand brought a joint complaint against a ban imposed by the U.S. on the importation of certain shrimp and shrimp products. The protection of sea turtles was at the heart of the ban.

The U.S. Endangered Species Act of 1973 listed as endangered or threatened the five species of sea turtles that occur in U.S. waters, and prohibited their “take” within the U.S., in its territorial sea and the high seas. (“Take” means harassment, hunting, capture, killing or attempting to do any of these.)

Under the act, the U.S. required that U.S. shrimp trawlers use “turtle excluder devices” (TEDs) in their nets when fishing in areas where there is a significant likelihood of encountering sea turtles.

Section 609 of U.S. Public Law 101–102, enacted in 1989, dealt with imports. It said, among other things, that shrimp harvested with technology that may adversely affect certain sea turtles may not be imported into the U.S. – unless the harvesting nation was certified to have a regulatory programme and an incidental take-rate comparable to that of the U.S., or that the particular fishing environment of the harvesting nation did not pose a threat to sea turtles.

In practice, countries that had any of the five species of sea turtles within their jurisdiction, and harvested shrimp with mechanical means, had to impose on their fishermen requirements comparable to those borne by U.S. shrimpers if they wanted to be certified to export shrimp products to the U.S. Essentially this meant the use of TEDs at all time.[. . .]

In its report, the Appellate Body made clear that under WTO rules, countries have the right to take trade action to protect the environment (in particular, human, animal or plant life and health) and endangered species and exhaustible resources. The WTO does not have to “allow” them this right.

It also said measures to protect sea turtles would be legitimate under GATT Article 20 (i.e. XX) which deals with various exceptions to the WTO’s trade rules, provided certain criteria such as nondiscrimination were met.

The U.S. lost the case, not because it sought to protect the environment but because it discriminated between WTO members. It provided countries in the western hemisphere – mainly in the Caribbean – technical and financial assistance and longer transition periods for their fishermen to start using turtle-excluder devices.

It did not give the same advantages, however, to the four Asian countries (India, Malaysia, Pakistan and Thailand) that filed the complaint with the WTO.

The ruling also said WTO panels may accept “amicus briefs” (friends of the court submissions) from NGOs or other interested parties.

Legally speaking . . .

The Panel considered that the ban imposed by the U.S. was inconsistent with GATT Article XI (which limits the use of import prohibitions or restrictions), and could not be justified under GATT Article XX (which deals with general exceptions to the rules, including for certain environmental reasons).

Following an appeal, the Appellate Body found that the measure at stake did qualify for provisional justification under Article XX(g), but failed to meet the requirements of the chapeau (the introductory paragraph) of Article XX (which defines when the general exceptions can be cited).

The Appellate Body therefore concluded that the U.S. measure was not justified under Article XX of GATT (strictly speaking, “GATT 1994”, i.e. the current version of the General Agreement on Tariffs and Trade as modified by the 1994 Uruguay Round agreement).

At the request of Malaysia, the original panel in this case considered the measures taken by the United States to comply with the recommendations and rulings of the Dispute Settlement Body. The panel report for this recourse was appealed by Malaysia. The Appellate Body upheld the panel’s findings that the U.S. measure was now applied in a manner that met the requirements of Article XX of the GATT 1994.[. . .]

What the Appellate Body said

“185. In reaching these conclusions, we wish to underscore what we have *not* decided in this appeal. We have *not* decided that the protection and preservation of the environment is of no significance to the Members of the WTO. Clearly, it is. We have *not* decided that the sovereign nations that are Members of the WTO cannot adopt effective measures to protect endangered species, such as sea turtles. Clearly, they can and should. And we have *not* decided that sovereign states should not act together bilaterally, plurilaterally or multilaterally, either within the WTO or in other international fora, to protect endangered species or to otherwise protect the environment. Clearly, they should and do.

“186. What we *have* decided in this appeal is simply this: although the measure of the United States in dispute in this appeal serves an environmental objective that is recognized as legitimate under paragraph (g) of Article XX of the GATT 1994, this measure has been applied by the United States in a manner which constitutes arbitrary and unjustifiable discrimination between Members of the WTO, contrary to the requirements of the chapeau of Article XX. For all of the specific reasons outlined in this Report, this measure does not qualify for the exemption that Article XX of the GATT 1994 affords to measures which serve certain recognized, legitimate environmental purposes but which, at the same time, are not applied in a manner that constitutes a means of arbitrary or unjustifiable discrimination between countries where the same conditions prevail or a disguised restriction on international trade. As we emphasized in *United States – Gasoline* [adopted 20 May 1996, WT/DS2/AB/R, p. 30], WTO Members are free to adopt their own policies aimed at protecting the environment as long as, in so doing, they fulfill their obligations and respect the rights of other Members under the *WTO Agreement*.

Source: WTO (2011), *India etc. versus US: ‘Shrimp–Turtle.’* Available at www.wto.org/english/tratop_e/envir_e/edis08_e.htm (accessed February 14, 2018).

This case is important on several fronts and has been the focus of much commentary. First, the Appellate Body dodged the broad question whether a country could claim an environmental “interest” even though the exporters’ actions that brought about the restrictive import restrictions occurred in international waters. Thus, unlike the earlier tuna–dolphin cases, it did not address whether the “extraterritorial” nature of the objectionable consequences for nature conservancy was a reason to nullify the importer’s restrictive measures.* The United States sought to have exporting nations agree to adopt turtle-saving devices in their own laws – in other words, to adopt U.S. law (along the lines of the Endangered Species Act) into their legal system. Because turtles found in international waters are also found in U.S. domestic waters, the Appellate Body simply found a reasonable nexus, stating that if a nexus was required, it existed under the facts of the case.†

Second, although the practices of the exporters involved PPMs (process and production methods) and not the export of a harmful product per se, this did not nullify the importer’s restrictions on the exporters’ products. (The U.S. importer lost the case simply because the United States had not sought to negotiate the adoption of turtle-saving technology by other importers, giving rise to non-uniform treatment of [“unjustifiable discrimination” vis-à-vis] other nations.) Read in the broadest possible terms, the case brings PPM actions “under the umbrella of protection” of Article XX.

What is not decided is whether environmental damage restricted to the exporter’s environment alone – as opposed to having a nexus with the international environment – is actionable. Further, if it is the exporter’s workers’ health that would be compromised, will this broad interpretation of the reach of Article XX(g) extend to worker and human health and safety under Article XX(a)? If this case is to have the expected precedential value in WTO case-law evolution (under the principle of *stare decisis*), it would seem difficult to argue against this logical extension of allowable protections. Indeed, Charnovitz (2002) has made a most persuasive case on this point.

11.2.3 Asbestos and Section XX(b) of the GATT (protection of human and animal life and health)

Reproduced below is an excerpt (bolded in places to facilitate emphases for pedagogical purposes) from the Panel Opinion on *Chrysotile Asbestos*,‡ perhaps the most important decision regarding the reach of Section XX(b) of the GATT. Note the panel’s recitation of many prior decisions, such as *Thailand-Cigarettes* and *United States-Gasoline*, in the opinion, evidencing the emergence of case-based precedent in WTO lawmaking. Note also that no risk assessment or direct evidence of the carcinogenicity of chrysotile asbestos was

* These cases involved the United States prohibition of imports of tuna caught in international waters using techniques that also snared dolphins, an endangered species. In the first tuna–dolphin case, it was decided that the extraterritorial nature of the catch put the activity beyond the reach of United States import sanctions, but the second case did not use this rationale as a disqualifying action on the part of the United States. Neither case ever became WTO law because under the rules at the time, the required unanimous assent of all the members of the WTO to the decisions of the dispute resolution panels was not secured.

† See Howse (2002, p. 504), who argues that “the purpose of a territorial nexus is to prevent a state that lacks legitimate concern from using a global environmental problem as a pretext for protectionist intervention.” Of course, the crucial question is what constitutes a “legitimate concern.”

‡ See WTO, *DS135: European Communities – Measures Affecting Asbestos and Products Containing Asbestos*. Available at www.wto.org/english/tratop_e/dispu_e/cases_e/ds135_e.htm (accessed February 14, 2018). The carcinogen asbestos is acknowledged to be the most notorious example of an occupational health hazard. The product is banned in several countries and severely restricted in others.

performed by France, because the basis of the French ban using a Section XX(b) exception allowed a precautionary approach that relied on the well-documented carcinogenicity of amphibole asbestos, a closely related but not identical form of asbestos. Finally, note that the EU takes on the role of representing an EU member country in WTO proceedings rather than have the country represent itself. This practice of the EU being the relevant party having standing in international treaty negotiations and disputes is a feature of evolving EU law (see Chapter 10).

*WORLD TRADE ORGANIZATION WT/DS135/R 18 September 2000
(00–3353) EUROPEAN COMMUNITIES – MEASURES AFFECTING
ASBESTOS AND ASBESTOS-CONTAINING PRODUCTS*

*Report of the Panel on European Communities – Measures Affecting Asbestos
and Asbestos-Containing Products [excerpt]*

4. Applicability of Article XX of the GATT 1994

a. Arguments of the parties

8.160 The European Communities contend that the Decree falls under the exception provided in Article XX of the GATT 1994. Thus, the Decree is **necessary** to achieve the French Government's public health goals under Article XX(b) and is not applied in such a manner as to constitute a means of **arbitrary or unjustifiable discrimination between countries** where the same conditions prevail **or a disguised restriction on international trade**, within the meaning of the introductory clause of Article XX.

8.161 Canada notes that, in accordance with panel and Appellate Body practice, Article XX permits a limited and conditional exception from the obligations set out in the other Articles of the GATT and must be interpreted narrowly. Although **the European Communities assert that they have the right to establish the level of protection they desire**, in so doing they must comply with their obligations [. . .] **Moreover, it is up to the European Communities to demonstrate that the Decree falls under Article XX(b).**

8.162 The European Communities argue that asbestos fibres and products containing them are a proven hazard for human health. The risks linked to the use of these fibres are recognized both by scientists and international organizations. By prohibiting the marketing and use of asbestos and asbestos-containing products, the Decree seeks to halt the spread of these risks, in particular for people occasionally and often unwittingly exposed to asbestos, and thereby reduce the number of deaths among the French population. It is the only measure capable of preventing the spread of the risks due to asbestos exposure. **According to the EC, the review in the light of Article XX cannot be allowed to undermine the health protection goal set by the Member concerned. Its sole purpose must be to assess whether the trade measure adopted is necessary to attain that goal. This test concerns the trade measure and not the level of protection set by the Member.**

8.163 [Omitted here.]

8.164 Canada is of the opinion that the current uses of chrysotile do not constitute a detectable risk to human health. [. . .] Contrary to what the EC appear to believe, controlled use substantially reduces exposure. As a result of pre-fabrication, pre-machining, the use of fittings and compliance with work

standards, workers are not subjected to high levels of exposure, as the EC claim.

- 8.165 Canada considers that [. . . a] ban is not “necessary” because high-density chrysotile products do not pose any detectable risk. On the other hand, controlled use indisputably constitutes an alternative to a total ban that is significantly less restrictive for international trade.

b. Approach adopted by the Panel and burden of proof

(i) *Introductory remarks concerning the approach adopted by the Panel*

[. . .]

- 8.168 First of all, as regards Article XX(b), we find that [. . .] nothing in the GATT 1994 shall be construed to prevent the adoption or enforcement by any Member of measures

“(b) necessary to protect human [. . .] life or health”

- 8.169 The Panel notes that in *United States-Gasoline*, the Panel stipulated that with respect to Article XX(b), the party invoking that provision must prove:

- (a) That the policy in respect of the measures for which Article XX is invoked falls within the range of policies designed to protect human life or health; and
- (b) the inconsistent measures for which the exception is invoked are necessary to fulfil the policy objective.

- 8.170 As regards subparagraph (a), we consider that, inasmuch as they include the notion of “protection,” the words “policies designed to protect human life or health” imply the existence of a *health risk*. We must therefore determine, on the basis of the relevant rules of evidence, whether chrysotile-asbestos, in the various forms we have considered so far, poses a risk to human life or health.

- 8.171 This said, we note that the panel in *United States-Gasoline* also made clear that it did not have to examine the necessity of the policy goal. In other words, we do not have to assess the choice made by France to protect its population against certain risks, nor the level of protection of public health that France wishes to achieve. We must simply determine if the French policy of prohibiting the use of chrysotile asbestos falls within the range of policies designed to protect human life or health,

- 8.172 As regards the criterion of the *necessity* of the measure (subparagraph (b) of paragraph 8.169), we note that previous panels that had to assess the “necessity” of a measure under Article XX(b) appear to have done so solely in relation to the existence of other measures consistent or less inconsistent with the GATT in the light of the health objective pursued. Thus, in *Thailand-Cigarettes*, the Panel ruled that:

“The import restrictions imposed by Thailand could be considered to be “necessary” in terms of Article XX(b) only if there were no alternative measure consistent with the General Agreement, or less inconsistent with it, which Thailand could reasonably be expected to employ to achieve its health policy objectives.”

- 8.173 In this particular case, the public health objectives pursued by Thailand were confirmed by a WHO expert and accepted by the parties to the dispute. In the present case, Canada does not deny that France’s goal, namely to protect the health of workers and consumers, is a public health objective, but it disputes the existence of a public health problem in relation to chrysotile.

Thus, Canada denies that chrysotile fibre poses a public health risk in its applications because once in place chrysotile-cement does not release any fibres and because it is possible to work with chrysotile-cement products in a safe or controlled fashion. [. . .]

(ii) *Burden of proof*

[. . .]

Considerations specific to the burden of proof as regards the scientific aspects

8.181 [. . .] in relation to the scientific information submitted by the parties and the experts, **the Panel feels bound to point out that it is not its function to settle a scientific debate, not being composed of experts in the field of the possible human health risks posed by asbestos. Consequently, the Panel does not intend to set itself up as an arbiter of the opinions expressed by the scientific community.**

8.182 Its role, taking into account the burden of proof, is to determine whether there is sufficient scientific evidence to conclude that there exists a risk for human life or health and that the measures taken by France are necessary in relation to the objectives pursued. **The Panel therefore considers that it should base its conclusions with respect to the existence of a public health risk on the scientific evidence put forward by the parties and the comments of the experts consulted within the context of the present case. The opinions expressed by the experts we have consulted will help us to understand and evaluate the evidence submitted and the arguments advanced by the parties. The same approach will be adopted with respect to the necessity of the measure concerned.**

(c) Application of Article XX(b) of the GATT 1994 to the Decree

(i) *“Protection of human life and health”*

[. . .]

8.189 We note [. . .] that Canada makes a distinction between chrysotile fibres and chrysotile encapsulated in a cement matrix. In fact, Canada challenges the Decree insofar as it prohibits, *inter alia*, the use of chrysotile-cement products. In this connection, we note that the experts consulted by the Panel agreed that the risks of fibres being dispersed due to the degradation of chrysotile-cement were limited. However, the experts acknowledged that working with non-friable products containing chrysotile might result in the dispersion of large quantities of fibres and that those fibres pose a definite health risk. The experts also noted that even though the risk might be lower than for production or processing workers, it concerned a much larger group.

[. . .]

8.193 The Panel [. . .] considers that the evidence before it tends to show that handling chrysotile cement products constitutes a risk to health rather than the opposite. Accordingly, a decision-maker responsible for taking public health measures might reasonably conclude that the presence of chrysotile cement products posed a risk because of the risks involved in working with those products.

8.194 [. . .] **The Panel concludes therefore that the French policy of prohibiting chrysotile asbestos falls within the range of policies designed to protect human life or health, within the meaning of Article XX(b) of the GATT 1994.**

8.195 Accordingly, the Panel will now turn to the question of whether the measure is “necessary” within the meaning of Article XX(b).

(ii) "Necessary"

The ban on chrysotile asbestos in its various forms

[. . .]

8.198 We note that in *Thailand-Cigarettes* the Panel defined the test of necessity applicable under Article XX(b):

"The import restrictions imposed by Thailand could be considered to be 'necessary' in terms of Article XX(b) only if there were no alternative measure consistent with the General Agreement, or less inconsistent with it, which Thailand could reasonably be expected to employ to achieve its health policy objectives." [. . .]

8.202 [. . .] **The experts confirm the position of the European Communities according to which it has not been possible to identify any threshold below which exposure to chrysotile would have no effect.** [. . .]

8.207 [. . .] **We therefore find that in order to determine whether a measure is necessary it is important to assess whether consistent or less inconsistent measures are reasonably available.** [. . .]

8.217 **We [. . .] conclude that the European Communities have shown that controlled use is neither effective nor reasonably available. [. . .] Accordingly, controlled use does not constitute a reasonable alternative to the banning of chrysotile asbestos.** [. . .]

Conclusion

8.222 [. . .] **the Panel concludes that the EC has made a prima facie case for the non-existence of a reasonably available alternative to the banning of chrysotile and chrysotile-cement products.** [. . .]

[The panel went on to find that the ban was not a means of imposing arbitrary or unjustified discrimination (1) between countries, (2) a[n intended] disguised restriction on international trade, or (3) between domestic and imported products.]

5. Conclusion

[. . .]

8.241 In the light of the above, the Panel concludes that the provisions of the Decree which violate Article III:4 of the GATT 1994 are justified under Article XX(b).

11.2.4 Trade and standards under the WTO agreements

It should be reemphasized that the GATT is a trade regime and that the governments that participate in WTO deliberations, as well as those that make up specific panels to resolve trade disputes and the Appellate Body itself, are committed first and foremost to promoting unencumbered trade. To this end, regularizing and harmonizing trade practices receive major attention. One aspect of this harmonization is the adoption of voluntary health, safety, and environmental guidelines and standards, as well as occasional binding standards (that is, regulations).^{*} Although Section XX(b) and (g) exceptions to non-tariff

* The tension between voluntary guidelines and mandatory health, safety, and environmental standards in the United States is discussed in Chapter 9. For example, the American National Standards Institute (ANSI), the National Fire Protection Association (NFPA), and the American Conference of Governmental and Industrial Hygienists (ACGIH) are U.S.-based independent standards-negotiating bodies created to harmonize industrial practices, partly to promote minimum liability of the private sector for harm by establishing minimally acceptable codes of conduct. These standards are largely industry standards.

trade barriers clearly allow each nation to establish the degree of health, safety, and environmental protection for itself even if trade is consequently hampered,* this runs afoul of the overwhelming desire of industry, and the government trade representatives they influence, to prefer uniform minimum protection. This is evidenced in the shrimp–turtle dispute discussed earlier, where the WTO Appellate Body expressed preferences for the imposition of international standards instead of unilateral practices.

The tension between encouraging harmonization and allowing individual nations to adopt their own protection philosophies unilaterally also finds expression in contradictions among the various agreements under the WTO umbrella regarding the role of scientific uncertainty and the extent to which the precautionary approach is tolerated. These contradictions are particularly acute among the GATT and the TBT and SPS agreements.

The WTO states:†

Article XX of the General Agreement on Tariffs and Trade (GATT) allows governments to act on trade in order to protect human, animal or plant life or health, provided they do not discriminate or use this as disguised protectionism. In addition, there are two specific WTO agreements dealing with food safety and animal and plant health and safety [the SPS agreement], and with product standards in general [the TBT agreement]. Both try to identify how to meet the need to apply standards and at the same time avoid protectionism in disguise. [. . .] In both cases, if a country applies international standards, it is less likely to be challenged legally in the WTO than if it sets its own standards. [. . .]

The *Sanitary and Phytosanitary Measures Agreement (SPS)* sets out the basic rules. It allows countries to set their own standards. But it also says regulations must be based on science. They should be applied only to the extent necessary to protect human, animal or plant life or health. And they should not arbitrarily or unjustifiably discriminate between countries where identical or similar conditions prevail.

Member countries are encouraged to use international standards, guidelines and recommendations where they exist. When they do, they are unlikely to be challenged legally in a WTO dispute. However, members may use measures which result in higher standards if there is scientific justification.[‡] They can also set higher standards based on appropriate assessment of risks so long as the approach is consistent, not arbitrary. And they can to some extent apply the “precautionary principle,” a kind of “safety first” approach to deal with scientific uncertainty. Article (5.7) of the SPS Agreement

However, they have often been adopted into law (see especially Section 9.6.2.1 on their adoption under the Occupational Safety and Health Act as minimum federal standards). But beyond these standards, the Department of Labor is expected to establish more protective standards through government regulatory processes in which the beneficiaries of those standards – i.e., workers – as well as affected industries can participate. New standards are almost always more protective and create greater burdens for industry. Independent standard-setting organizations exist at the international level as well, e.g., the International Standards Organization (ISO), known for its voluntary environmental standard ISO 14000 and its voluntary workplace standard ISO 9000.

* In addition to differences in the extent of protection preferred among nations, nations also differ in their application of a precautionary approach when there is scientific uncertainty about the nature of the harm that protection targets. See Section 9.5.2 in Chapter 9 for a discussion of the precautionary principle.

† WTO. “Understanding the WTO: The Agreements, Standards and Safety.” Available at www.wto.org/english/thewto_e/whatis_e/tif_e/agrm4_e.htm (accessed February 14, 2018).

‡ For a good description of the SPS and TBT agreements and a general defense of the view to act on trade in order to protect human, animal or plant life or health, provided they do not discriminate or use this as disguised protectionism, see Lugard and Smart (2006); see also Fisher (2006). In addition, there are two specific WTO agreements dealing with food safety and animal and plant health and safety, which state that standards should be based on strong science (and not the precautionary principle).

allows temporary “precautionary” measures.[* . . .] The agreement complements that on technical barriers to trade [TBT].

Technical regulations and standards are important, but they vary from country to country. Having too many different standards makes life difficult for producers and exporters. If the standards are set arbitrarily, they could be used as an excuse for protectionism. Standards can become obstacles to trade. But they are also necessary for a range of reasons, from environmental protection, safety, national security to consumer information. And they can help trade. Therefore the same basic question arises again: how to ensure that standards are genuinely useful, and not arbitrary or an excuse for protectionism.

The Technical Barriers to Trade Agreement (TBT)^[†] tries to ensure that regulations, standards, testing and certification procedures do not create unnecessary obstacles. However, the agreement also recognizes countries’ rights to adopt the standards they consider appropriate – for example, for human, animal or plant life or health, for the protection of the environment or to meet other consumer interests.

Moreover, members are not prevented from taking measures necessary to ensure their standards are met. But that is counterbalanced with disciplines. A myriad of regulations can be a nightmare for manufacturers and exporters. Life can be simpler if governments apply international standards, and the agreement encourages them to do so. In any case, whatever regulations they use should not discriminate.

The agreement also sets out a code of good practice for both governments and non-governmental or industry bodies to prepare, adopt and apply voluntary standards. Over 200 standards-setting bodies apply the code.

The agreement says the procedures used to decide whether a product conforms with relevant standards have to be fair and equitable. It discourages any methods that would give domestically produced goods an unfair advantage. The agreement also encourages countries to recognize each other’s procedures for assessing whether a product conforms. Without recognition, products might have to be tested twice, first by the exporting country and then by the importing country.

Manufacturers and exporters need to know what the latest standards are in their prospective markets. To help ensure that this information is made available conveniently, all WTO member governments are required to establish national enquiry points^[‡] and to keep each other informed through the WTO – around 900 new or changed regulations are notified each year. The Technical Barriers to Trade Committee is the major clearing house for members to share the information and the major forum to discuss concerns about the regulations and their implementation.

Lugard and Smart (2006, p. 70) characterize the SPS and TBT agreements as follows

Two examples of these specialized agreements on trade in goods are the *SPS Agreement* and the *TBT Agreement*. The *SPS Agreement*, in general terms, prohibits WTO Members from erecting trade barriers under the guise of food safety or pest control measures by requiring that such measures be based on scientific evidence and risk assessments. The *TBT Agreement* obligates each member country to not impose product standards that restrict trade more than is necessary to achieve a legitimate objective, such as

* The party that avails itself of interim precautionary protective measures is obligated to follow up by producing adequate scientific justification in a reasonable period of time.

† See also Appendix 11-A.

‡ A national enquiry point is a national office that disseminates information concerning the nation’s regulation of chemical products. See Menezes and de Souza Antunes (2005).

environmental protection or consumer safety. As such, these agreements impose disciplines on core domestic regulations to ensure that they are based on legitimate, objective, and scientific considerations.

11.2.5 The decision of the Appellate Body in the asbestos case and future uncertainty of the availability of Articles XX(b) and (g) exceptions

Although the Appellate Body agreed with the panel's decision (see Section 11.2.3) that France could ban Canadian asbestos under Section XX(b) of the GATT, it disagreed with the panel's conclusion of law that the ban on asbestos was not a "technical barrier to trade." The ban prohibited chrysotile asbestos as a component of a product, and the Appellate Body agreed with Canada that the ban addressed a "product characteristic" – even though it was a "negative characteristic" (a product containing chrysotile) – and was therefore, in its view, a "technical regulation." The panel, without making extensive findings regarding Canada's claim, dismissed consideration of this contention by Canada.

No risk assessment was performed by France, because the basis for its ban was claimed to be a Section XX(b) exception that allows a nation to adopt whatever health, safety, or environmental level of protection it deems desirable and also permits a "precautionary approach" in its consideration of scientific information, but the Appellate Body said that it would have required one* had the basis for the panel's decision been on the finding (correct in its view) that the asbestos ban was in fact a "technical regulation," and therefore the ban was a "technical barrier to trade." The Appellate Body opined that the obligations imposed under the TBT agreement were in addition to those imposed by the GATT, and therefore Canada's claim that the TBT agreement did apply should have been considered.

The WTO Appellate Body can reverse the panel's decision if errors of law were made, but the panel made no discernible findings on which the Appellate Body could base a judgment. Note that a peculiarity of the WTO appeal process is that the Appellate Body can reject or accept the panel's findings, but it cannot send the case back to the panel to reconsider findings of law. Thus, in this case, although the Appellate Body believed that the case should have been decided under the TBT agreement, as Canada argued, it had no power to require this after the panel decision was made.† However, future panels addressing disputes in cases involving other toxic substances could very well follow the Appellate Body's preferences.

Because permanent measures have to be based on "science" for measures taken under the TBT agreement, and because there is often great uncertainty concerning the toxicity/toxicology or epidemiology of chemicals, the use of TBT instead of the escape clause of Article XX(b) or (g) could render future attempts by nations to act in a precautionary manner moot.‡

The authors of this book argue strongly that the TBT agreement is meant to encourage the achievement of consensus regarding standards intended to harmonize safety concerns somewhat arbitrarily for commercial ease and uniformity of practice, for example, by agreeing on how much voltage variation is allowable in electrical devices. The historical origins of the TBT agreement were founded in attempts to develop voluntary consensus standards and do not reveal an intent that it was meant to be the vehicle for providing

* The discussion in Section 11.2.7, addresses the initial attempt of the EU to permanently ban importation of U.S. beef containing hormones, which failed precisely because the United States contested the uncertain science lacking a risk assessment that seemed to be required by the SPS agreement, like the TBT agreement.

† For a legal commentary disagreeing with this perspective, see Pauwelyn (2002).

‡ See WTO and WHO (2002).

maximum protection for health, safety, and environmental hazards. The U.S. counterparts, namely, the voluntary codes of ANSI, the NFPA, and the ACGIH, similarly were not meant to provide adequate standards, although they were adopted into worker protection standards as minimum initial protection when the OSH Act was first passed. Indeed, the original form of the TBT agreement was known as the Standards Code and came into force in 1980.

The new TBT agreement came into force in 1995 with the creation of the WTO and contained more stringent obligations. The inclusion of mandatory standards that are termed “technical regulations” in the new TBT agreement was most likely intended by industry to avoid aggressive health, safety, and environmental regulation by governments (see the discussion of trade and standards in Section 11.2.4). What is abundantly clear is that the chemical industry and exporters of chemicals would vastly prefer to avoid the application of Articles XX(b) and (g) and instead define their obligations around the TBT and SPS agreements, which do not accept a precautionary approach and which require scientific risk assessments. To the extent that the appointees to the Appellate Body are trade specialists and not health, safety, or environmental professionals, the future could be problematic for national safeguards.

11.2.6 Restricting oil imports into the EU from Canadian tar sands: a missed opportunity

The EU adopted the Fuel Quality Directive (FQD) in 2009 which would have allowed the EU to label, and subsequently ban, oil imports from Canadian tar sands as a “dirty” fuel based on its 20 percent increase in CO₂ emissions over conventional crudes (Reuters 2014). Had Canada done so, a trade dispute would have arisen in which a panel could have rendered an opinion decided under the XX(b) and XX(g) exceptions to the GATT, or alternatively under the TBT agreement, possibly with different results. Both the asbestos decision previously decided under XX(b) and the shrimp–turtle previously decided under XX(g) would have been relevant under a GATT rationale, involving the precautionary principle, extraterritorial concerns, product and process methods associated with tar sand oil production, and scientific uncertainty. These issues would likely have been addressed differently under the TBT agreement with possibly different outcomes.

However, in 2014, the EU abandoned its resistance to importing oil from Canadian tar sands, no doubt influenced by the EU’s desire to conclude an EU–Canada trade agreement and also by its concern for the geopolitical impacts of more dependence on Russian oil.

Whatever the outcome would otherwise have been, the trade dispute may have had serious ramifications for future attempts for energy-conservation committed nations to apply border taxes on imports of appliances and other imports which used excessive energy in their production. See the discussion of “carbon leakage” in Chapter 12.

11.2.7 Food safety: hormones in beef and the SPS agreement

The SPS Agreement was put to the test in *EC-Hormones* when the EU banned the import of beef treated with any of six growth hormones.* This especially affected the United States, where 90 percent of cattle are given growth hormones, and in 1997 the United States filed a complaint with the WTO. After a WTO panel decision, the Appellate Body in 1998

* See WTO, *DS26: European Communities – Measures Concerning Meat and Meat Products (Hormones)*. Available at www.wto.org/english/tratop_e/dispu_e/cases_e/ds26_e.htm (accessed February 14, 2018).

agreed with the panel, which ruled that there was not sufficient specific scientific evidence to justify a permanent ban but agreed that a provisional ban was permitted under Section 5.7 of the agreement and urged the EU to produce more definitive scientific justification in the form of appropriate risk assessments to justify a permanent ban. Initially, the EU did not comply. Consequently, the WTO authorized the United States and Canada to place a 100 percent import duty on certain EU agricultural and manufactured goods exports to the value of U.S. \$117 million and Canadian \$11 million, respectively.

The EU undertook a risk assessment for oestradiol-17 β , which the new panel accepted as justification of a permanent ban and ordered the United States to cease its retaliatory actions against EU product imports. On October 14, 2003, a new EU directive (2003/74/EC) was adopted based on "thorough scientific grounding" for the EU restrictions (a permanent ban on one of the hormones, oestradiol-17 β , and also restrictions on the use or sale of the other five hormones) because of evidence of sufficiently "potential detrimental effects" such that application of the precautionary principle allowed these restrictions.* The EU notified the United States of these measures in November 2003. The United States and Canada rejected the EU evidence and maintained their prior retaliatory sanctions, arguing that the proffered risk assessment did not quantify the risk and was based primarily on the fact of exposure to synthetic hormones. Two panels were subsequently created in response to the EU's November 2004 request for consultations.

A panel decision was issued on March 31, 2008, in which the panel condemned the United States and Canada for imposing the sanctions in breach of WTO rules in light of the EU's conduct of the required risk assessment(s). The panel also found that the EU directive did not comply with the SPS Agreement. The EU appealed this part of the decision – arguing that the panel did not have the jurisdiction to rule on the conformity of the directive – while the United States, which did not agree about the adequacy of the risk assessment for oestradiol-17 β and the other five hormones, appealed the panel decision of March 2008 as well.

On October 16, 2008, the Appellate Body issued a decision in which it was unable to resolve the scientific dispute concerning the new risk assessments. However, it was persuaded that the panel appointees had unacceptable conflicts of interest and reversed the panel findings that the provisional bans on the other five hormones were unjustified. The Appellate Body urged the United States and the EU to settle their differences through negotiation. Parts of the decision [WT/DS320/AB/R] are reproduced below:

736. For the reasons set out in this Report, the Appellate Body: [. . .]

- (d) As regards the Panel's consultations with the scientific experts, finds that the Panel infringed the European Communities' due process rights, because the institutional affiliation of Drs. Boisseau and Boobis compromised their appointment and thereby the adjudicative independence and impartiality

* For a strong argument in defense of the adequacy of the directive to satisfy the permanent EC restrictions under the SPS Agreement, see Chichester (2005). Chichester recommended that the United States and the EU use WTO procedures to reach an accommodation on their differences, an approach ultimately recommended by the latest Appellate Body decision (see below). After the establishment of the directive, in 2007, the European Food Safety Authority (EFSA) issued a report in which it saw no need to revise previous risk assessments that found risks to human health from residues in meat from hormone-treated cattle. Section 5 of the SPS requires signatories to "ensure that their [SPS] measures are based on an assessment [. . .] of the risks to human, animal or plant life or health, taking into account risk assessment techniques developed by the relevant international organizations." The EFSA report would seem to support the assertion that the EC submission satisfies this requirement.

of the Panel. Accordingly, the Panel failed to comply with its duties under Article 11 of the DSU.

- (e) As regards the consistency with Article 5.1 of the *SPS Agreement* of the European Communities' import ban on meat from cattle treated with oestradiol-17 β for growth promotion purposes, which is applied pursuant to Directive 2003/74/EC:
 - (a) finds that the Panel erred in its interpretation and application of Article 5.1 in relation to risks of misuse and abuse in the administration of hormones to cattle for growth-promotion purposes;
 - (b) finds that the Panel did not err in requiring the European Communities to evaluate specifically the risks arising from the presence of residues of oestradiol-17b in meat or meat products from cattle treated with the hormone for growth-promotion purposes;
 - (c) finds that the Panel did not err in its interpretation of Article 5.1 and paragraph 4 of Annex A of the *SPS Agreement* as regards quantification of risk;
 - (d) finds that the Panel erred in the allocation of the burden of proof in its assessment of the consistency of Directive 2003/74/EC with Article 5.1 of the *SPS Agreement*;
 - (e) finds that the Panel applied an incorrect standard of review in examining whether the European Communities' risk assessment satisfied the requirements of Article 5.1 and paragraph 4 of Annex A of the *SPS Agreement*, and thereby failed to comply with its duties under Article 11 of the DSU; and
 - (f) reverses the Panel's finding that the provisional import ban relating to testosterone, progesterone, trenbolone acetate, zeranol, and MGA does not meet the requirements of Article 5.7 of the *SPS Agreement*; however, the Appellate Body is unable to complete the analysis and therefore makes no findings as to the consistency or inconsistency of the European Communities' provisional import ban with Article 5.7 of the *SPS Agreement*.

737. Because we have been unable to complete the analysis as to whether Directive 2003/74/EC has brought the European Communities into substantive compliance within the meaning of Article 22.8 of the DSU, the recommendations and rulings adopted by the DSB in *EC-Hormones* remain operative. In the light of the obligations arising under Article 22.8 of the DSU, we recommend that the Dispute Settlement Body request Canada and the European Communities to initiate Article 21.5 proceedings without delay in order to resolve their disagreement as to whether the European Communities has removed the measure found to be inconsistent in *EC-Hormones* and whether the application of the suspension of concessions by Canada remains legally valid.

The resolution of the conflicts in law raised by the *EC-Hormones* dispute remains cloudy. In rejecting the use of the precautionary principle, the SPS Agreement is clearly at variance not only with the specific directive in question but also with regard to environmental, health, and safety protection in the EU as a whole, which is committed to maintaining both a "high level of protection" and the precautionary principle (see Section 9.5.2 in Chapter 9 and Section 10.3.2 in Chapter 10). Of course, arguments over the adequacy of risk assessments have plagued environmental law disputes in U.S. tribunals (see Chapter 9), and they now cloud international environmental law as well. Furthermore, the WTO cases dealing with GATT Articles XX(b) (the shrimp–turtle case) and (g) (*EC-Asbestos*) are at variance with SPS and TBT law as it is evolving. The corruption of the panels in the hormone cases and the trade bias of the WTO Appellate Body call for serious revision and

rationalization of the several WTO health, safety, and environmental agreements.* One possible avenue for at least a temporary reconciliation of the beef hormones dispute was the use of labeling of hormone-fed beef, non-hormone-fed beef, or both (see Sien 2007).

However, the dispute itself has been settled, at least temporarily. On May 13, 2009, the EC and the United States signed a memorandum of understanding on a temporary solution to the hormones dispute. According to this agreement, the United States will reduce the sanctions imposed on European products. At the same time, the EC will offer better market access for high-quality beef traditionally exported by the United States and produced from cattle that have not been treated with growth-promoting hormones. The United States said that the agreement with the EC demonstrated that there was a better way forward in this dispute than pursuing further litigation.† Of course, the legal quagmire in WTO law discussed above remains.

11.2.8 Biotechnology: genetically modified organism (GMO)-modified crops and food

The application of modern biotechnology can result in genetically modified food products, such as corn and soy, or trade or transport of living modified organisms (LMOs) in plants, vaccines, drugs, and commercial products. Either could come under the SPS Agreement or under the Convention on Biological Diversity (CBD).‡ As with the difference in approaches taken in the SPS Agreement and Articles XX(b) and (g) of the GATT, the SPS Agreement and the Cartagena Protocol on Biosafety are also inconsistent in their approach to the necessity of making a strong science-based case (that is, through a risk assessment) for their application and to the use of the precautionary principle (see Cors 2001; Strauss 2008; de Sadeleer 2015; Kritikos 2018).

Article 19 (paragraph 3) of the CBD anticipates the application of “advance informed consent” (AIC) – a process paralleling the prior informed consent (PIC) procedure for hazardous products and waste in other international conventions§ – for the transboundary movement of LMOs between contracting parties. The Cartagena Protocol on Biosafety reaffirms the precautionary approach, which places it in direct conflict with the SPS Agreement.

A WTO challenge to an EU five-year moratorium of approving GMO-engineered crops further demonstrated the continuance of the then-unresolved tension between the SPS Agreement and multilateral environmental agreements (Strauss 2008). The EU issued a GM Deliberate Release Directive (DRD 1990/220, succeeded by 2001/18) which failed to resolve the conflict between these agreements (Kritikos 2018; de Sadeleer 2015). Directive 2001/18 regulates the development and marketing of GMOs within the EU. It is

based on the key principle [. . .] that no GMO may be released into the environment for experimental purposes or subsequently marketed unless it has been previously

* Some commentators recommend incorporating the Article XX exceptions into the SPS Agreement or drafting a new set of exceptions, but not trying to solve the WTO trade conflict mechanisms (as in EC-Hormones) through negotiation suggested by the latest Appellate Body Decision. See Shapiro (2007).

† See European Commission (2009). *Europa, EU and Canada Settle WTO Case on Genetically Modified Organisms*. Available at http://europa.eu/rapid/press-release_IP-09-1142_en.htm (accessed February 14, 2018).

‡ Article 2 of the CBD defines biotechnology as “any technological application that uses biological systems, living organisms, or derivatives thereof, to make or modify products, or processes for specific use.” Article 8(g) of the CBD applies only to LMOs, while Article 19 (handling of biotechnology and distribution of its benefits) applies to both living and nonliving products. See www.who.int/foodsafety/areas_work/food-technology/faq-genetically-modified-food/en/ (accessed February 14, 2018).

§ See Section 10.3.4 in Chapter 10.

authorized by the competent authorities upon the conclusion of a scientific assessment. The subsequent marketing of a GMO is conditioned upon the requirement that it is “safe for human health and the environment.”

(de Sadeleer 2015, pp. 534–535)

Only two GM crops have been authorized by the European Commission during the last fifteen years: the Monsanto potato Amflora in 2010 (recently annulled) and varieties of the MON810 corn in 1997, cultivated in only five member states: Spain, the Czech Republic, Portugal, Romania, Poland, and Slovakia.

In 2015, almost 200 million hectares of GMO were cultivated worldwide, but only 114,624 hectares of these were located in the EU, of which 97,346 were located in Spain (Kritikos 2018, Chapter 1). In spite of a new directive (discussed below), wide scale cultivation of GM crops is not expected (Rabesandratana 2015). Even though the ban of MON810 on GM maize was overturned, Monsanto withdrew its sale in France responding to widespread European rejection of GMO crops.

EU Directive 2015/412 took force in April 2015 and allowed countries to bypass EU authorization and set their own rules (Rabesandratana 2015). Nicolas de Sadeleer (2015) and Mihail Kritikos (2018) have provided us with insightful and timely portrayals of the EU’s recent history of the evolution of EU Directives addressing the regulation of the cultivation of GMO crops culminating in the 2015 directive. The EU’s reliance on a naïve classic separation of risk assessment from risk management allowed the EU Commission to fashion its regulatory policy based on traditional expert scientific opinion devoid of any application of the precautionary principle which would have otherwise opened the determination of risk to alternative scientific interpretations, as well as consideration of non-scientific input from important stakeholders. At the same time, the 2015 directive allows the member states to “opt out” of permitting GMO cultivation in their territories – on “compelling grounds” which include environmental policy objectives – while (1) not allowing them to reject the [traditional and conservative] risk assessment based on “sound science” recommended by the European Food and Safety Authority (EFSA), or (2) necessitating their invoking the temporary escape mechanism provided by the safeguard clause of EU’s regulatory framework.

The risk assessment approach recommended by EFSA has effectively ossified a broadening of considerations that might flow from the application of the precautionary principle, or from non-scientific considerations incorporating member states’ ethical or local concerns. The long-term consequences of this approach, as applied for example to other applications of genetic engineering or to considerations of emerging technologies such as nanotechnology, could indeed be unfortunate. It would appear that by elevating the importance of risk assessment and exclusive reliance on expert scientific opinion that glosses over the well-known limitations of the risk assessment exercise, risk management decisions are left to implementation details rather than to include a consideration of policy options and social acceptability of risk.

The battle is apparently not yet over. In late January 2017, twelve member states voted against MON810 renewal, with ten in favor, and six abstaining. The vote did not meet the qualified majority bar, leaving the ultimate decision to the EU Commission. Voting against the EU Commission’s proposal to authorize the first new GM crops since 1998, this was also the case with two new applications with the vote 13/8/7.

Finally, all food products that make direct use of GMOs at any point in their production are subjected to labeling requirements, regardless of whether or not GM content is detectable in the end product.* Promises of increased crop yields and reduced pesticide

* See the European Commission, *GMO Legislation*, available at https://ec.europa.eu/food/plant/gmo/legislation_en and European Commission, *Genetically Modified Organisms – Traceability and Labelling*, available at <http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=LEGISSUM:l21170> (accessed February 14, 2018).

use as a result of GM-modified crops have not come to pass (Hakim 2016) and serious questions have been raised about the assertion that GMO-modified maize is “substantially equivalent” to ordinary maize (Mesnage et al. 2016).

11.2.9 *General agreement on trade in services**

In line with the general commitment to encourage global trade (open markets), uniformity in trade practices, and nondiscrimination and MFN treatment vis-à-vis national and foreign providers, the GATS promotes (but does not require) the liberalization (that is, privatization) of services, such as financial services, telecommunications, tourism, construction, and consultancies (professional services), and the elimination of disparities in the provision of services involving governments, consumers, and individuals. Movement of labor to advance the nondiscriminatory provision of services is to be encouraged, but without commitments for employment, citizenship, residence, or employment on a permanent basis.

Concerns have been raised that the GATS will encourage privatization in areas that are traditionally the province of government in some countries, such as health care and banking, and that regulatory safeguards will be challenged even where the services remain in the public sector.[†] Pollock and Price (2003, p. 1075) observe:

There is compelling evidence to show that GATS and the WTO involve national governments in trading some of their national sovereignty for the putative economic gains of liberalization. In the process, governments lose rights to regulate and to protect non-economic values and the principles that shape provision of public services.

The WTO refutes these claims and presents elaborate defenses on its website.

11.2.10 *The agreement on trade-related aspects of intellectual property rights‡*

The protection of intellectual property rights in printed materials, voice and musical recordings, design of manufactured goods, plant and animal varieties (including the results of genetic manipulation), industrial or agricultural processes, computers and software, and pharmaceuticals varies considerably across the world. The TRIPS Agreement seeks to harmonize these protections to promote innovation and the transfer of technology through fair trade, and to provide a forum for dispute resolution.[§]

The joint report of the WTO and the WHO Secretariat (2002, p. 38) provides:

The TRIPS Agreement requires WTO Members to establish minimum standards for protecting and enforcing intellectual property rights. Its objectives are set out in Article 7: The protection and enforcement of intellectual property rights should contribute to the promotion of technological innovation and to the transfer and dissemination of technology, to the mutual advantage of producers and users of

* See also Appendix 11-A.

† This is reminiscent of the worry that there will be a race to the bottom in the efforts to harmonize environmental and consumer product protection practices. Certainly, the recent revelation of the failure of governments globally to adequately regulate the financial industry and financial transactions gives ammunition to these concerns.

‡ See also Appendix 11-A.

§ See WTO, TRIPS, available at www.wto.org/english/tratop_e/trips_e/trips_e.htm (accessed February 14, 2018).

technological knowledge and in a manner conducive to social and economic welfare, and to a balance of rights and obligations.

Nondiscrimination vis-à-vis national treatment, MFN treatment, and balanced protection (of encouraging innovation and minimizing undue profit) are goals of the system. Unauthorized copying and use are regarded as “piracy.” International recognition of patents for both products and processes in almost all fields of technology (for “at least twenty years”) is envisioned. Access to technology is ensured in the TRIPS Agreement through the mechanism of compulsory licensing. International recognition of copyrights, trademarks, integrated circuit designs, and trade secrets is envisioned. Developing countries are given until 2013 to comply.

It is beyond the scope of this book to delve deeply into this important area, but one issue deserves special attention: the treatment of pharmaceuticals produced and sold “off patent” that are deemed of crucial health need for people in developing countries who cannot afford developed-country prices.* In 2015, the WTO Council for Trade-Related Aspects of Intellectual Property Rights agreed to extend a waiver allowing leased developed countries (LDCs) to avoid applying and enforcing IP rights on pharmaceutical products until 2033†. Connected to the issue of providing access to needed pharmaceuticals is the problem of counterfeit drugs, which, of course, result in harm to unwitting consumers both in poor countries and in wealthier nations.

Yale University has proposed the creation of a governments-supported health impact fund that, in lieu of having producers charge high prices for patented drugs, would pay a tiered set of royalties to pharmaceutical producers who voluntarily provide low-priced drugs at cost.‡ The schedule of fees would be calculated by the drugs’ share of positive health impacts in developing countries, and the fund thus would create incentives among producers for competition in providing better, more effective drugs for large numbers of the global poor.§

11.3 Trade and the environment (trade regimes as tools to promote advances in national and international environmental policies)

11.3.1 Trade as a positive force to improve environmental conditions

The GATT disputes discussed above highlight conflicts between environmental policies and trade rules. In some cases (for example, the shrimp–turtle case), these disputes centered on a deliberate application of a trade rule in the service of a national environmental policy. Some commentators who are staunch advocates of trade argue that most GATT rules generally have either no effect or a beneficial effect on national environmental standards. David Vogel is one such commentator who believes that trade

* See especially the relationship between TRIPS and public health in WTO and WHO (2002, pp. 38–47).

† Source: WTO news release, “WTO members agree to extend drug patent exemption for poorest members,” https://www.wto.org/english/news_e/news15_e/trip_06nov15_e.htm (accessed June 11, 2018).

‡ See Incentives for Global Health, “The Health Impact Fund: Making New Medicines Accessible for All,” available at http://healthimpactfund.org/Old/hif_book.pdf (accessed February 14, 2018).

§ This seems related to the idea of trading from the bottom of the pyramid. See Hart and Milstein (1999), London and Hart (2004), and Prahalad and Hart (2002).

agreements can actually enhance environmental goals. Excerpts from his writings are provided below.

David Vogel, "Chapter 1: National Regulation in the Global Economy," *Trading Up: Consumer and Environmental Protection in a Global Economy* (Cambridge, MA: Harvard University Press, 1995), pp. 1–23 (excerpted with permission)

National Regulation in the Global Economy

[. . .] A number of political scientists have explored the increasingly important role of international environmental agreements and treaties in affecting national regulatory standards. [. . .]

The role of trade and trade agreements in promoting both the regionalization and the globalization of regulatory policy-making are much more important. [. . .] Nations are thus increasingly importing and exporting standards as well as goods. [. . .] Consequently, many of the conflicts over environmental and consumer regulation that formerly took place exclusively within nations are now also taking place among them.

Third, a new set of constituencies, namely, consumer and environmental organizations, have become active participants in the making of trade policy.

Unlike producers or workers, these nongovernmental organizations (NGOs) are interested not in the economic impact of trade policies, but rather in the way they affect consumer health and safety and environmental quality in their own countries, and often in others as well. [. . .]

At the same time, consumer and environmental organizations are also playing a more important role in influencing the terms of particular trade agreements, attempting to make them more compatible with either the maintenance or strengthening of both domestic and international regulatory standards. [. . .]

The Impact of Regulation on Trade

Since many national regulations disadvantage importers – either intentionally or unintentionally – the steady growth of protective regulations over the last three decades has made trade more difficult.

Hence the growing number of trade disputes stemming from the alleged discriminatory impact of national environmental and consumer regulations on imports within the European Union and North America, and around the world. At the same time the undermining of trade liberalization by the expansion of environmental and consumer protection has also been limited by three factors: the role of international institutions, the power of internationally oriented producers, and the increasing number of international environmental agreements.

The international institutions created by the EU have played an especially important role in reducing the use of national protective regulations as trade barriers. The European Court of Justice (ECJ), the world's most powerful extra-national judicial body, has struck down numerous national regulations which protected producers rather than consumers or the environment. [. . .]

The removal of national regulations as obstacles to intra-Union trade remains incomplete. In some cases, the Union has simply been unable to arrive at a consensus regarding the level at which standards should be harmonized. Thus it has permitted members' states to maintain their own distinctive standards, even though they interfere with the single market. [. . .]

The "California Effect"

[. . .] The notion that economic competition among political jurisdictions will lead to a regulatory "race to the bottom" has been labeled the "Delaware effect." [. . .]

However, this book demonstrates that regulatory competition can lead to a rather different outcome. A number of national patterns of health, safety, and environmental regulation illustrate the "California effect," named for the state that has been on the cutting edge of environmental regulation, both nationally and globally, for nearly three decades. The California effect refers to the critical role of powerful and wealthy "green" political jurisdictions in promoting a regulatory "race to the top" among their trading partners. [. . .] The Delaware effect assumes that stricter regulatory standards represent a source of competitive disadvantage. But, in contrast to labor standards, the costs of complying with stricter consumer and environmental standards [have] not been sufficiently large to force political jurisdictions to lower their standards in order to keep domestic firms or plants competitive. On the contrary: in the case of many environmental and consumer regulations, stricter standards represent a source of competitive advantage for domestic producers, in part because it is often easier for them to comply with them. [. . .]

Equally significantly, when rich nations with large domestic markets such as the United States and Germany enact stricter product standards, their trading partners are forced to meet those standards in order to maintain their export markets. [. . .]

The impact of trade liberalization on regulatory standards is also affected by another factor: the degree of economic integration. The stronger the role of international institutions in promoting liberal trade policies, the more extensive the leverage of rich, powerful states over the regulatory powers of their trading partners. [. . .]

[. . .] But it is important not to equate stricter standards with more effective regulations. Many environmental and consumer regulations contribute little or nothing to enhancing consumer or environmental protection. To the extent that these regulations have been successfully challenged through trade agreements and treaties, public welfare has been enhanced. However, efforts to remove trade barriers to promote economic integration have at times prevented greener nations from establishing regulations as strict as [their] citizens and producers would prefer. [. . .]

At the same time, trade liberalization has also helped increase the leverage of NGOs and producers in greener countries over the regulatory policies of their trading partners. [. . .] Trade liberalization is most likely to strengthen consumer and environmental protection when a group of nations has agreed to reduce the role of regulations as trade barriers and the most powerful among them has influential domestic constituencies that support stronger regulatory standards. Thus, the stronger the commitment of nations to coordinate their regulatory policies, the more powerful is the California effect. Likewise, the weaker the institutions created by regional or international trade agreements or treaties, the weaker the California effect. [. . .]

Regulations and Trade Agreements

The concept of "proportionality" has frequently been employed to assess the legitimacy or legality of a regulation which restricts trade. This approach subjects national regulations that hamper the free movement of goods, but that do serve a legitimate public purpose, to a "balancing" or minimum-means test: it requires nations to select the means of achieving their regulatory objectives that do not "disproportionately" interfere with the free movement of goods. Accordingly, the benefits of a regulation must be weighed against the burdens it imposes on international commerce. [. . .]

Proportionality can be regarded as the international application of cost-benefit analysis, which governments have frequently employed to assess the value or legality

of domestic health, safety, and environmental laws. Both concepts seek to judge the value of a regulation by balancing its goals with its costs: cost-benefit analysis focuses on the costs of compliance to the domestic economy, proportionality on its costs to foreign producers and thus indirectly to domestic consumers as well.

Like cost-benefit analysis, however, the concept of proportionality is often difficult to apply in practice. For while the burdens imposed by a regulation on importers are readily apparent, assessing the value of a consumer or environmental regulation to the citizenry of the nation which enacted it often involves a more subjective judgment. [. . .]

Since there is rarely a consensus on the answers to these questions within nations, it is not surprising that there has often been substantial disagreement among the governments, firms, and citizens of different countries. [. . .]

David Vogel, "Chapter 4: Greening the GATT," *Trading Up: Consumer and Environmental Protection in a Global Economy* (Cambridge, MA: Harvard University Press, 1995), pp. 141–149 (excerpted with permission)

Conclusion

What has been the impact of the GATT on environmental standards? [. . .]

There are two ways in which the GATT might have served to weaken environmental standards. One has to do with the international equivalent of the Delaware effect. By reducing tariffs in general and preventing nations from taxing imported goods produced according to laxer regulatory standards, the GATT might have prevented greener nations from enacting regulatory standards as strict as their citizens preferred. The second has to do with the role of dispute settlement panels in finding national environmental regulations to be GATT-inconsistent. In fact, neither had a significant impact.

The Delaware effect has not materialized at the global level, in part because the costs of compliance with most environmental standards [have] not been sufficiently large to force greener governments to lower them in order to maintain the international competitiveness of domestic producers. [. . .] Nor have GATT restrictions on the use of regulations as non-tariff [trade] barriers to trade interfered with the steady strengthening of national, or in the case of the EU, regional environmental standards. [. . .] Nor do GATT rules prevent nations from acting to preserve natural resources located outside of their borders, providing these conservation efforts are taken in conjunction with domestic restrictions on either production or consumption. Neither has the GATT prevented a steady increase in the number and scope of international environmental agreements.

Thus to date, the GATT has been largely irrelevant to the steady strengthening of local, national, and international environmental standards.

While the number of trade disputes involving environmental regulations has recently increased, they still encompass only a small proportion of all trade conflicts that have come before the GATT. To date, [less than a dozen] out of the slightly more than one hundred trade disputes that have come before dispute panels have involved either environmental or consumer regulations. [. . .]

[. . .] if nations wish to strengthen one another's regulatory standards, they must do so outside the GATT framework, by signing international environmental agreements. [. . .] Moreover, while the EU's rules were rewritten in 1987 to facilitate the harmonization of regulatory standards by establishing a system of weighted voting, no comparable change has taken place within the global community; environment agreements still bind only the nations that sign them. [. . .]

The California effect does exist at the global level, as evidenced by the successful efforts of both the United States and the European Union to make access to their markets contingent upon changes in the environmental practices of their trading

partners. But current GATT rules do limit its scope. [. . .] “Greening the GATT” does not mean making the World Trade Organization into an international environmental regulatory agency. Rather, what it would essentially mean is giving the world’s greener powers wider latitude to enact regulations or trade policies that influence the environmental standards of other GATT signatories.

Beyond the GATT and the WTO, regional and bilateral trade agreements (free trade agreements or FTAs) have also begun to address environmental issues.* Canada, the EU, New Zealand, Japan and other nations have policies promoting the consideration of the environment in their FTAs (Colyer 2012, p. 4).

11.3.2 NAFTA and other U.S. bilateral trade regimes

In order to get labor and environmentalists’ support for NAFTA, President Clinton agreed to negotiate side agreements on labor and the environment, which were not addressed in the central NAFTA agreement that came into effect in 1993. In case of any inconsistency, the agreement gave precedence to three multilateral environmental agreements: CITES, the Montreal Protocol, and the Basel Convention (discussed in Chapter 10). The salient features of the environment side agreement (the North American Agreement on Environmental Cooperation, NAAEC) between the United States, Canada, and Mexico were the following:

- 1 A commitment of all three parties to effective enforcement of their environmental laws.
- 2 Establishment of the Commission for Environmental Cooperation (CEC), whose competence includes any environmental or natural resource issue that may arise among the three parties.
- 3 Establishment of a citizen submission (petition) process in which any private person may raise an issue that ultimately reaches the Council (made up of government environment heads) for its attention (however, with no private right of action or private remedy for the petitioner).
- 4 A dispute-resolution/arbitration process by which a party may raise the allegation that one of the parties has exhibited a “persistent pattern of failure . . . to effectively enforce its environmental law” (Studer 2010, p. 471).
- 5 Provision of means to levy an annual fee up to of \$20 million for such violations, and the imposition of trade sanctions if the fee is not paid.

As of early 2011, there had been no use of the dispute-resolution process. It is also noteworthy that in the NAAEC, there was no commitment to pursue the harmonization of environmental laws.

By 1997, the United States had concluded some eighteen bilateral and regional trade agreements (free trade agreements or FTAs) with environment side agreements modeled on the NAAEC). The U.S. was required by the Trade Promotion Act of 2002 to include a specified set of environmental provisions in its FTAs (Colyer 2012, p. 4). In May 2007, the Bipartisan Agreement on Trade Policy called for enhanced provisions of all future U.S. bilateral and regional trade agreements on several topics, including environmental and sustainable development (see Kennedy 2009 for a full discussion). NAFTA provoked discussion from its early days (Deere and Esty 2002) and continues to generate intense criticism (Cefiso 2010; Gallagher, Peters, et al. 2009). While President Obama had indicated his intent to reexamine NAFTA and presumably other bilateral and regional trade

* See Section 5.1.2 in Chapter 5 for a discussion of the adverse effects of free trade on the environment.

agreements, no action was taken during his presidency. President Trump has indicated his intent to withdraw or at least to renegotiate NAFTA. For a critical assessment of NAFTA, see Cefiso (2010) and Ganwatz (2011).

11.3.3 Other freetrade agreements (FTAs)

GATT started in 1947 with twenty-three members, has undergone several rounds of negotiations aimed at reducing barriers to trade, has expanded to encompass most of the world [164 countries in 2018, including Russia] and became the World Trade Organization (WTO) in 1994 (Colyer 2012, p. 1). Many FTAs have an article identical or similar to GATT's Article XX and/or mention a goal of protecting the environment in the preamble to the agreement (Colyer 2012, p. 4). There are now over 500 free trade agreements with 320 of them active (Griffith et al. 2017). However, the U.S. withdrawal from the two mega-trade agreements – TTIP and TTP – have changed the geopolitical landscape in unpredictable ways (Griffith et al. 2017). See the discussion in Section 4.3.3 in Chapter 4.

On December 8, 2017, the EU finalized its landmark Economic Partnership Agreement (EPA) with Japan – the largest and most comprehensive free trade agreement ever negotiated by the EU. Establishing an economic zone with 600 million people and approximately 30 percent of the world's GDP, the EPA removes the vast majority of the \$1.2 billion in duties paid annually by EU companies exporting to Japan, opens huge market opportunities for both sides, strengthens cooperation between the EU and Japan in a range of areas, and includes – for the first time – a specific commitment to the Paris Climate Agreement.* The agreement follows trade deals made with Vietnam in 2015 and Canada in 2016.

In 2018, the EU concluded a new FTA with Mexico. Practically all trade in goods between the EU and Mexico will now be duty-free, including in the agricultural sector. The agreement also lays down progressive rules on sustainable development, including a mutual agreement to effectively implement their obligations under the Paris Agreement on climate change. It will also be the first EU trade agreement to tackle corruption in the private and public sectors.†

11.4 Trade, employment, and labor standards

The literature on trade and labor is less developed than that on trade and the environment, but see Lee (1997), who discusses the impact of globalization on labor standards; Rodrik (1996), who provides an analysis of labor standards in North–South interests; and Caire (1994), who provides a summary of attempts and the rationale for including a “normative content” (labor standards) in trading relationships. See also the work of Scott (2002) who examines the evidence for the effect of trade on the U.S., and argues that trade explains at least 15 to 25 percent of the increase in income inequality, along with other factors, including deregulation, liberalization, and weak macroeconomic policies. Not all commentators agree that incorporating labor standards into trade agreements would benefit workers in either developing or developed countries. Stern and Terrell (2003) argue that there is no evidence that “allegedly low labor standards in developing countries have a significantly adverse effect on wages in industrialized countries” and that they are a main attraction for firms in advanced countries to shift their locus of production or services, or that they cause job and wage losses in industrialized countries. Instead, they argue that imposing higher labor standards on workers in developing countries “above the market

* See the European Commission, *EU and Japan Finalise Economic Partnership Agreement*. Available at <http://trade.ec.europa.eu/doclib/press/index.cfm?id=1767> (accessed February 14, 2018).

† For more information about the EU and Mexico trade agreement, see <http://trade.ec.europa.eu/doclib/press/index.cfm?id=1830> (accessed June 6, 2018).

‡ See Section 5.2.5 in Chapter 5.

value of their productivity” would cause those workers to suffer other negative consequences. Stern and Terrell (2003) recommend the adoption of other policies to expand opportunities (for example, thorough education and transitional adjustment policies) for workers in both developed and industrialized nations. This 2003 analysis may be dated or even incorrect, given the recent large loss of Northern jobs in both manufacturing and services to Asia, as well as the experience with NAFTA - see Faux (2007). Besides, the failure to find labor differentials between developing and industrialized countries does not mean that labor protections and wages have not fallen in both venues, which is likely.

The possible adverse effects of trade on employment have been addressed in prior chapters of this book.¹ Here we specifically address whether labor standards can alleviate those adverse effects. The easiest case for asserting that existing trade regimes encompass labor rights or unfair working conditions, as well as environmental and public health issues, can be made for health and safety. The *EC-Asbestos* case (discussed in Sections 11.2.3 and 11.2.5) addresses an avenue of protection for the receiving importer’s workers using Article XX(b) of the GATT. In addition, whether the shrimp–turtle case (discussed in Section 11.2.2) can be interpreted as protecting an importer’s workers by forcing an exporter to adopt superior process and production methods (PPMs) – thus eliminating the unjustified economic advantage of the exporter and reducing pressure to relax the importer’s labor standards or to lower wages to compensate – is, of course, by no means settled under WTO law.

However, beyond occupational health and safety, the status of employment protections through trade agreements is in doubt. Interestingly, the EU and the WTO have sharply contrasting views about the appropriateness of trade regimes incorporating employment concerns. The WTO states:^{*}

There is a clear consensus: all WTO member governments are committed to a narrower set of internationally recognized “core” standards – freedom of association, no forced labour, no child labour, and no discrimination at work (including gender discrimination). At the 1996 Singapore Ministerial Conference, members defined the WTO’s role on this issue, identifying the International Labour Organization (ILO) as the competent body to negotiate labour standards. There is no work on this subject in the WTO’s Councils and Committees. However the secretariats of the two organizations work together on technical issues under the banner of “coherence” in global economic policy-making. However, beyond that it is not easy for them to agree, and the question of international enforcement is a minefield.

Why was this brought to the WTO? What is the debate about?

Four broad questions have been raised inside and outside the WTO.

- **The analytical question:** if a country has lower standards for labour rights, do its exports gain an unfair advantage? Would this force all countries to lower their standards (the “race to the bottom”)?
- **The response question:** if there is a “race to the bottom,” should countries only trade with those that have similar labour standards?
- **The question of rules:** Should WTO rules explicitly allow governments to take trade action as a means of putting pressure on other countries to comply?
- **The institutional analytical question:** is the WTO the proper place to discuss and set rules on labour – or to enforce them, including those of the ILO?

^{*} See WTO, *Labour Standards: Consensus, Coherence and Controversy*, available at www.wto.org/english/thewto_e/whatis_e/tif_e/bey5_e.htm (accessed February 14, 2018).

In addition, all these points have an underlying question: whether trade actions could be used to impose labour standards, or whether this would simply be an excuse for protectionism. Similar questions are asked about standards, i.e. sanitary and phytosanitary measures, and technical barriers to trade.

The WTO agreements do not deal with labour standards as such.

On the one hand, some countries would like to change this. WTO rules and disciplines, they argue, would provide a powerful incentive for member nations to improve workplace conditions and “international coherence” (the phrase used to describe efforts to ensure policies move in the same direction).

On the other hand, many developing countries believe the issue has no place in the WTO framework. They argue that the campaign to bring labour issues into the WTO is actually a bid by industrial nations to undermine the comparative advantage of lower wage trading partners, and could undermine their ability to raise standards through economic development, particularly if it hampers their ability to trade. They also argue that proposed standards can be too high for them to meet at their level of development. These nations argue that efforts to bring labour standards into the arena of multilateral trade negotiations are little more than a smokescreen for protectionism.

At a more complex legal level is the question of the relationship between the International Labour Organization’s standards and the WTO agreements – for example whether or how the ILO’s standards can be applied in a way that is consistent with WTO rules.

What has happened in the WTO?

In the WTO, the debate has been hard-fought, particularly in 1996 and 1999. It was at the 1996 Singapore conference that members agreed they were committed to recognized core labour standards, but these should not be used for protectionism. The economic advantage of low-wage countries should not be questioned, but the WTO and ILO secretariats would continue their existing collaboration, the declaration said. The concluding remarks of the chairman, Singapore’s trade and industry minister, Mr. Yeo Cheow Tong, added that the declaration does not put labour on the WTO’s agenda. The countries concerned might continue their pressure for more work to be done in the WTO, but for the time being there are no committees or working parties dealing with the issue.

The issue was also raised at the Seattle Ministerial Conference in 1999, but with no agreement reached. The 2001 Doha Ministerial Conference reaffirmed the Singapore declaration on labour without any specific discussion.

In contrast, although the EU agrees that the ILO is the major institution for dealing with labor issues, it nonetheless states:

The Commission [...] suggests integrating core labour standards in its development policy and strengthening capacity in developing countries to apply core labour standards. It also suggests that core labour standards should have their place in bilateral agreements between Europe and third countries.*

The United States is also on record as favoring including core labor standards in trade agreements – at least, this was the case when it was necessary to get labor support for

* See the European Commission (2018), *Trade, Generalised System of Preferences (GSP)*. Available at <http://ec.europa.eu/trade/policy/countries-and-regions/development/generalised-scheme-of-preferences/> (accessed May 1, 2018). ec.europa.eu/rapid/press-release_IP-01-1029_en.pdf (accessed February 14, 2018).

NAFTA.* What is interesting is that incorporating core labor standards into trade regimes is routinely opposed by third-world countries. One might think that the primary reason is that developing countries fear that they might lose the advantages that low wages provide them in international markets. This is probably not the main reason (wage advantages are largely derived from currency advantages rather than from inequalities in purchasing power that the wages provide). It is more likely that core labor standards, which include the right to form a labor union, would upset the balance of power in authoritarian regimes.†

The salient features of the labor side agreement (the North American Agreement on Labor Cooperation, NAALC) are very similar, with some important exceptions, to those of the environment side agreement, with the creation of a Commission for Labor Cooperation (CLC) and with the added commitments of the parties (1) not to lower labor standards to attract investment and (2) to provide monetary sanctions (up to \$20 million) only as a final punitive measure, followed by trade sanctions only in the case of violations or lack of enforcement of worker health and safety, child labor, and minimum wage standards, but exempting fundamental labor relations protections, such as the right to organize or strike. Significantly, freedom of association and protection of the right to organize, the right to bargain collectively, and the right to strike were exempted (see Gitterman 2002).

Complaints of violations are to go to a national administrative office (NAO), rather than to the CLC. The parties agreed to cooperate on seven objectives, including improving working conditions and living conditions and promoting eleven labor principles to protect, enhance, and enforce workers' basic rights. The parties agreed to six (voluntary) obligations that define effective enforcement and hold one another accountable through the mechanisms of consultations, evaluation, and dispute resolution. There were no commitments to harmonize labor standards. Labor disputes were to be resolved only through informal coordination, and conflicts covered by the side agreement were to be resolved through dialogue and consultation, initially at the NAO and later at the ministerial level (Gitterman 2002). Also see Gantz (2011).

Trade regimes are premised on the assumption that trade benefits humankind, but what can be done about reconciling trade with other aspects of human welfare or human rights? Howse and Mutua (2000) observe:

There is no consensus on how trade liberalization affects human rights, nor even a well-developed methodology for determining the human impacts of trade agreements. [. . .] Both trade and human rights have been codified in highly-developed legal regimes, negotiated by governments since the end of World War II. These two legal regimes have developed however in splendid isolation from one another. [. . .] (p. 2)

The correct reading of the GATT text would permit a country to impose conditions on imports related to the labour practices involved in their production.

(p. 6)

The authors remind us:

The Preamble to the WTO Agreement takes notice that the objectives of the system are not free trade as such but, *inter alia* "ensuring full employment and a large and

* It was necessary to negotiate so-called side agreements on both labor and environment under NAFTA. However, their success has been called into question. see Garvey (1995) and Section 11.3.2.

† If people are not allowed to come together to meditate in China without facing the prospect of prison time, is it likely that the Chinese government would tolerate the formation of independent labor unions?

steadily growing volume of real income and effective demand” and “allowing for the optimal use of the world’s resources in accordance with the objective of sustainable development.”

(p. 32)

The reader should recollect that one of the exceptions in Article XX of the GATT is section XX(d):

Article XX: General Exceptions

Subject to the requirement that such [restrictive trade] measures are not applied in a manner which would constitute a means of arbitrary or unjustifiable discrimination between countries where the same conditions prevail, or a disguised restriction on international trade, nothing in this Agreement shall be construed to prevent the adoption or enforcement by any contracting party of measures:

[. . .]

- (g) necessary to secure compliance with laws or regulations which are not inconsistent with the provisions of [the GATT].

The UN Charter on Human Rights cites as one of its purposes to promote “higher standards of living, full employment, and conditions of economic and social progress and development” (Article 55a, UN Charter). Thus, there is an argument that human rights law trumps trade law – WTO trade law cannot be inconsistent with the UN Charter on Human Rights. This is so even if it were argued that environmental laws do not trump WTO law.

The European Union stands out for its attempt to reconcile trade policies with concerns for sustainable development, core human rights, and poverty reduction. Through an EU Council regulation, it has adopted an autonomous trade arrangement – the EC Generalised Scheme of Tariff Preferences – through which the EU provides nonreciprocal preferential access to the EU market to 176 developing countries and territories. These preferences – which take the form of duty-free access or reductions in otherwise applicable standard tariffs for thousands of tariff lines – act as an incentive for these developing countries to ratify and effectively implement a series of key international conventions in the fields of core human rights and labor standards, sustainable development, and good governance.*

* See the European Commission, *Generalised Scheme of Preferences (GSP)*. Available at <http://ec.europa.eu/trade/policy/countries-and-regions/development/generalised-scheme-of-preferences/> (accessed February 14, 2018).

Appendix 11-A

Selected WTO Agreements

The following excerpts provide information on selected WTP agreements.

Agreement on Subsidies and Countervailing Measures

The Agreement on Subsidies and Countervailing Measures is intended to build on the Agreement on Interpretation and Application of Articles VI, XVI and XXIII which was negotiated in the Tokyo Round.

Unlike its predecessor, the agreement contains a definition of subsidy and introduces the concept of a “specific” subsidy – for the most part, a subsidy available only to an enterprise or industry or group of enterprises or industries within the jurisdiction of the authority granting the subsidy. Only specific subsidies would be subject to the disciplines set out in the agreement.

The agreement establishes three categories of subsidies. First, it deems the following subsidies to be “prohibited”: those contingent, in law or in fact, whether solely or as one of several other conditions, upon export performance; and those contingent, whether solely or as one of several other conditions, upon the use of domestic over imported goods. Prohibited subsidies are subject to new dispute settlement procedures. The main features include an expedited timetable for action by the Dispute Settlement body, and if it is found that the subsidy is indeed prohibited, it must be immediately withdrawn. If this is not done within the specified time period, the complaining member is authorized to take countermeasures. (See the section on “Dispute Settlement” for details on the procedures).

The second category is “actionable” subsidies. The agreement stipulates that no member should cause, through the use of subsidies, adverse effects to the interests of other signatories, i.e. injury to domestic industry of another signatory, nullification or impairment of benefits accruing directly or indirectly to other signatories under the General Agreement (in particular the benefits of bound tariff concessions), and serious prejudice to the interests of another member. “Serious prejudice” shall be presumed to exist for certain subsidies including when the total ad valorem subsidization of a product exceeds 5 per cent. In such a situation, the burden of proof is on the subsidizing member to show that the subsidies in question do not cause serious prejudice to the complaining member. Members affected by actionable subsidies may refer the matter to the Dispute Settlement body. In the event that it is determined that such adverse effects exist, the subsidizing member must withdraw the subsidy or remove the adverse effects.

The third category involves non-actionable subsidies, which could either be non-specific subsidies, or specific subsidies involving assistance to industrial research and pre-competitive development activity, assistance to disadvantaged regions, or certain type of assistance for adapting existing facilities to new

environmental requirements imposed by law and/or regulations. Where another member believes that an otherwise non-actionable subsidy is resulting in serious adverse effects to a domestic industry, it may seek a determination and recommendation on the matter.

One part of the agreement concerns the use of countervailing measures on subsidized imported goods. It sets out disciplines on the initiation of countervailing cases, investigations by national authorities and rules of evidence to ensure that all interested parties can present information and argument. Certain disciplines on the calculation of the amount of a subsidy are outlined as is the basis for the determination of injury to the domestic industry. The agreement would require that all relevant economic factors be taken into account in assessing the state of the industry and that a causal link be established between the subsidized imports and the alleged injury. Countervailing investigations shall be terminated immediately in cases where the amount of a subsidy is *de minimis* (the subsidy is less than 1 per cent *ad valorem*) or where the volume of subsidized imports, actual or potential, or the injury is negligible. Except under exceptional circumstances, investigations shall be concluded within one year after their initiation and in no case more than 18 months. All countervailing duties have to be terminated within 5 years of their imposition unless the authorities determine on the basis of a review that the expiry of the duty would be likely to lead to continuation or recurrence of subsidization and injury.

The agreement recognizes that subsidies may play an important role in economic development programmes of developing countries, and in the transformation of centrally-planned economies to market economies. Least-developed countries and developing countries that have less than \$1,000 per capita GNP are thus exempted from disciplines on prohibited export subsidies, and have a time-bound exemption from other prohibited subsidies. For other developing countries, the export subsidy prohibition would take effect 8 years after the entry into force of the agreement establishing the WTO, and they have a time-bound (though fewer years than for poorer developing countries) exemption from the other prohibited subsidies. Countervailing investigation of a product originating from a developing-country member would be terminated if the overall level of subsidies does not exceed 2 per cent (and from certain developing countries 3 per cent) of the value of the product, or if the volume of the subsidized imports represents less than 4 per cent of the total imports for the like product in the importing signatory. For countries in the process of transformation from a centrally-planned into a market economy, prohibited subsidies shall be phased out within a period of seven years from the date of entry into force of the agreement.

General Agreement on Trade in Services (GATS)

The Services Agreement which forms part of the Final Act rests on three pillars. The first is a Framework Agreement containing basic obligations which apply to all member countries. The second concerns national schedules of commitments containing specific further national commitments which will be the subject of a continuing process of liberalization. The third is a number of annexes addressing the special situations of individual services sectors.

Part I of the basic agreement defines its scope – specifically, services supplied from the territory of one party to the territory of another; services supplied in the territory of one party to the consumers of any other (for example, tourism); services provided through the presence of service providing entities of one party in the territory of any

other (for example, banking); and services provided by nationals of one party in the territory of any other (for example, construction projects or consultancies).

Part II sets out general obligations and disciplines. A basic most-favoured-nation (MFN) obligation states that each party "shall accord immediately and unconditionally to services and service providers of any other Party, treatment no less favourable than that it accords to like services and service providers of any other country." However, it is recognized that MFN treatment may not be possible for every service activity and, therefore, it is envisaged that parties may indicate specific MFN exemptions. Conditions for such exemptions are included as an annex and provide for reviews after five years and a normal limitation of 10 years on their duration.

Transparency requirements include publication of all relevant laws and regulations. Provisions to facilitate the increased participation of developing countries in world services trade envisage negotiated commitments on access to technology, improvements in access to distribution channels and information networks and the liberalization of market access in sectors and modes of supply of export interest. The provisions covering economic integration are analogous to those in Article XXIV of GATT, requiring arrangements to have "substantial sectoral coverage" and to "provide for the absence or elimination of substantially all discrimination" between the parties.

Since domestic regulations, not border measures, provide the most significant influence on services trade, provisions spell out that all such measures of general application should be administered in a reasonable, objective and impartial manner. There would be a requirement that parties establish the means for prompt reviews of administrative decisions relating to the supply of services.

The agreement contains obligations with respect to recognition requirements (educational background, for instance) for the purpose of securing authorizations, licenses or certification in the services area. It encourages recognition requirements achieved through harmonization and internationally-agreed criteria. Further provisions state that parties are required to ensure that monopolies and exclusive service providers do not abuse their positions. Restrictive business practices should be subject to consultations between parties with a view to their elimination.

While parties are normally obliged not to restrict international transfers and payments for current transactions relating to commitments under the agreement, there are provisions allowing limited restrictions in the event of balance-of-payments difficulties. However, where such restrictions are imposed they would be subject to conditions; including that they are nondiscriminatory, that they avoid unnecessary commercial damage to other parties and that they are of a temporary nature.

The agreement contains both general exceptions and security exceptions provisions which are similar to Articles XX and XXI of the GATT. It also envisages negotiations with a view to the development of disciplines on trade distorting subsidies in the services area.

Part III contains provisions on market access and national treatment which would not be general obligations but would be commitments made in national schedules. Thus, in the case of market access, each party "shall accord services and service providers of other Parties treatment no less favourable than that provided for under the terms, limitations and conditions agreed and specified in its schedule." The intention of the market-access provision is to progressively eliminate the following types of measures: limitations on numbers of service providers, on the total value of service transactions or on the total number of service operations or people employed. Equally, restrictions on the kind of legal entity or joint venture through which a service is provided or any foreign capital limitations relating to maximum levels of foreign participation are to be progressively eliminated.

The national-treatment provision contains the obligation to treat foreign service suppliers and domestic service suppliers in the same manner. However, it does provide the possibility of different treatment being accorded the service providers of other parties to that accorded to domestic service providers. However, in such cases the conditions of competition should not, as a result, be modified in favour of the domestic service providers.

Part IV of the agreement establishes the basis for progressive liberalization in the services area through successive rounds of negotiations and the development of national schedules. It also permits, after a period of three years, parties to withdraw or modify commitments made in their schedules. Where commitments are modified or withdrawn, negotiations should be undertaken with interested parties to agree on compensatory adjustments. Where agreement cannot be reached, compensation would be decided by arbitration.

Part V of the agreement contains institutional provisions, including consultation and dispute settlement and the establishment of a Council on Services. The responsibilities of the Council are set out in a Ministerial Decision.

The first of the annexes to the agreement concerns the movement of labour. It permits parties to negotiate specific commitments applying to the movement of people providing services under the agreement. It requires that people covered by a specific commitment shall be allowed to provide the service in accordance with the terms of the commitment. Nevertheless, the agreement would not apply to measures affecting employment, citizenship, residence or employment on a permanent basis. The annex on financial services (largely banking and insurance) lays down the right of parties, notwithstanding other provisions, to take prudential measures, including for the protection of investors, deposit holders and policy holders, and to ensure the integrity and stability of the financial system. However, a further understanding on financial services would allow those participants who choose to do so to undertake commitments on financial services through a different method. With respect to market access, the understanding contains more detailed obligations on, among other things, monopoly rights, cross-border trade (certain insurance and reinsurance policy writing as well as financial data processing and transfer), the right to establish or expand a commercial presence, and the temporary entry of personnel. The provisions on national treatment refer explicitly to access to payments and clearing systems operated by public entities and to official funding and refinancing facilities. They also relate to membership of, or participation in, self-regulatory bodies, securities or futures exchanges and clearing agencies.

The annex on telecommunications relates to measures which affect access to and use of public telecommunications services and networks. In particular, it requires that such access be accorded to another party, on reasonable and non-discriminatory terms, to permit the supply of a service included in its schedule. Conditions attached to the use of public networks should be no more than is necessary to safeguard the public service responsibilities of their operators, to protect the technical integrity of the network and to ensure that foreign service suppliers do not supply services unless permitted to do so through a specific commitment. The annex also encourages technical cooperation to assist developing countries in the strengthening of their own domestic telecommunications sectors. The annex on air-transport services excludes from the agreement's coverage traffic rights (largely bilateral air-service agreements conferring landing rights) and directly related activities which might affect the negotiation of traffic rights. Nevertheless, the annex, in its current form, also states that the agreement should apply to aircraft repair and maintenance services, the marketing of air-transport services and computer-reservation services. The operation of the annex would be reviewed at least every five years.

In the final days of the services negotiations, three Decisions were taken – on Financial Services, Professional Services and the Movement of Natural Persons. The Decision on Financial Services confirmed that commitments in this sector would be implemented on an MFN basis, and permits Members to revise and finalize their schedules of commitments and their MFN exemptions six months after the entry into force of the Agreement. Contrary to some media reports, the audio-visual and maritime sectors have not been removed from the scope of the GATS.

*Agreement on Trade Related Aspects of Intellectual Property Rights (TRIPS),
Including Trade in Counterfeit Goods*

The agreement recognises that widely varying standards in the protection and enforcement of intellectual property rights and the lack of a multilateral framework of principles, rules and disciplines dealing with international trade in counterfeit goods have been a growing source of tension in international economic relations.

Rules and disciplines were needed to cope with these tensions. To that end, the agreement addresses the applicability of basic GATT principles and those of relevant international intellectual property agreements; the provision of adequate intellectual property rights; the provision of effective enforcement measures for those rights; multilateral dispute settlement; and transitional arrangements.

Part I of the agreement sets out general provisions and basic principles, notably a national-treatment commitment under which the nationals of other parties must be given treatment no less favourable than that accorded to a party's own nationals with regard to the protection of intellectual property. It also contains a most-favoured nation clause, a novelty in an international intellectual property agreement, under which any advantage a party gives to the nationals of another country must be extended immediately and unconditionally to the nationals of all other parties, even if such treatment is more favourable than that which it gives to its own nationals.

Part II addresses each intellectual property right in succession. With respect to copyright, parties are required to comply with the substantive provisions of the Berne Convention for the protection of literary and artistic works, in its latest version (Paris 1971), though they will not be obliged to protect moral rights as stipulated in Article 6bis of that Convention. It ensures that computer programs will be protected as literary works under the Berne Convention and lays down on what basis data bases should be protected by copyright. Important additions to existing international rules in the area of copyright and related rights are the provisions on rental rights. The draft requires authors of computer programmes and producers of sound recordings to be given the right to authorize or prohibit the commercial rental of their works to the public. A similar exclusive right applies to films where commercial rental has led to widespread copying which is materially impairing the right of reproduction. The draft also requires performers to be given protection from unauthorized recording and broadcast of live performances (bootlegging). The protection for performers and producers of sound recordings would be for no less than 50 years. Broadcasting organizations would have control over the use that can be made of broadcast signals without their authorization. This right would last for at least 20 years.

With respect to trademarks and service marks, the agreement defines what types of signs must be eligible for protection as a trademark or service mark and what the minimum rights conferred on their owners must be. Marks that have become well-known in a particular country shall enjoy additional protection. In addition, the agreement lays down a number of obligations with regard to the use of trademarks and service marks, their term of protection, and their licensing or assignment. For example, requirements that foreign marks be used in conjunction with local marks would, as a general rule, be prohibited.

In respect of geographical indications, the agreement lays down that all parties must provide means to prevent the use of any indication which misleads the consumer as to the origin of goods, and any use which would constitute an act of unfair competition. A higher level of protection is provided for geographical indications for wines and spirits, which are protected even where there is no danger of the public's being misled as to the true origin. Exceptions are allowed for names that have already become generic terms, but any country using such an exception must be willing to negotiate with a view to protecting the geographical indications in question. Furthermore, provision is made for further negotiations to establish a multilateral system of notification and registration of geographical indications for wines.

Industrial designs are also protected under the agreement for a period of 10 years. Owners of protected designs would be able to prevent the manufacture, sale or importation of articles bearing or embodying a design which is a copy of the protected design.

As regards patents, there is a general obligation to comply with the substantive provisions of the Paris Convention (1967). In addition, the agreement requires that 20-year patent protection be available for all inventions, whether of products or processes, in almost all fields of technology. Inventions may be excluded from patentability if their commercial exploitation is prohibited for reasons of public order or morality; otherwise, the permitted exclusions are for diagnostic, therapeutic and surgical methods, and for plants and (other than microorganisms) animals and essentially biological processes for the production of plants or animals (other than microbiological processes). Plant varieties, however, must be protectable either by patents or by a *sui generis* system (such as the breeder's rights provided in a UPOV [The Union for the Protection of New Varieties of Plants] Convention). Detailed conditions are laid down for compulsory licensing or governmental use of patents without the authorization of the patent owner. Rights conferred in respect of patents for processes must extend to the products directly obtained by the process; under certain conditions alleged infringers may be ordered by a court to prove that they have not used the patented process.

With respect to the protection of layout designs of integrated circuits, the agreement requires parties to provide protection on the basis of the Washington Treaty on Intellectual Property in Respect of Integrated Circuits which was opened for signature in May 1989, but with a number of additions: protection must be available for a minimum period of 10 years; the rights must extend to articles incorporating infringing layout designs; innocent infringers must be allowed to use or sell stock in hand or ordered before learning of the infringement against a suitable royalty; and compulsory licensing and government use is only allowed under a number of strict conditions.

Trade secrets and know-how which have commercial value must be protected against breach of confidence and other acts contrary to honest commercial practices. Test data submitted to governments in order to obtain marketing approval for pharmaceutical or agricultural chemicals must also be protected against unfair commercial use.

The final section in this part of the agreement concerns anti-competitive practices in contractual licenses. It provides for consultations between governments where there is reason to believe that licensing practices or conditions pertaining to intellectual property rights constitute an abuse of these rights and have an adverse effect on competition. Remedies against such abuses must be consistent with the other provisions of the agreement.

Part III of the agreement sets out the obligations of member governments to provide procedures and remedies under their domestic law to ensure that intellectual property rights can be effectively enforced, by foreign right holders as well as by their

own nationals. Procedures should permit effective action against infringement of intellectual property rights but should be fair and equitable, not unnecessarily complicated or costly, and should not entail unreasonable time-limits or unwarranted delays. They should allow for judicial review of final administrative decisions. There is no obligation to put in place a judicial system distinct from that for the enforcement of laws in general, nor to give priority to the enforcement of intellectual property rights in the allocation of resources or staff.

The civil and administrative procedures and remedies spelled out in the text include provisions on evidence of proof, injunctions, damages and other remedies which would include the right of judicial authorities to order the disposal or destruction of infringing goods. Judicial authorities must also have the authority to order prompt and effective provisional measures, in particular where any delay is likely to cause irreparable harm to the right holder, or where evidence is likely to be destroyed. Further provisions relate to measures to be taken at the border for the suspension by customs authorities of release, into domestic circulation, of counterfeit and pirated goods. Finally, parties should provide for criminal procedures and penalties at least in cases of willful trademark counterfeiting or copyright piracy on a commercial scale. Remedies should include imprisonment and fines sufficient to act as a deterrent.

The agreement would establish a Council for Trade Related Aspects of Intellectual Property Rights to monitor the operation of the agreement and governments' compliance with it. Dispute settlement would take place under the integrated GATT dispute-settlement procedures as revised in the Uruguay Round.

With respect to the implementation of the agreement, it envisages a one-year transition period for developed countries to bring their legislation and practices into conformity. Developing countries and countries in the process of transformation from a centrally-planned into a market economy would have a five-year transition period, and least-developed countries 11 years. Developing countries which do not at present provide product patent protection in an area of technology would have up to 10 years to introduce such protection. However, in the case of pharmaceutical and agricultural chemical products, they must accept the filing of patent applications from the beginning of the transitional period. Though the patent need not be granted until the end of this period, the novelty of the invention is preserved as of the date of filing the application. If authorization for the marketing of the relevant pharmaceutical or agricultural chemical is obtained during the transitional period, the developing country concerned must offer an exclusive marketing right for the product for five years, or until a product patent is granted, whichever is shorter.

Subject to certain exceptions, the general rule is that the obligations in the agreement would apply to existing intellectual property rights as well as to new ones.

Agreement on Technical Barriers to Trade (TBT)

This agreement will extend and clarify the Agreement on Technical Barriers to Trade reached in the Tokyo Round. It seeks to ensure that technical negotiations and standards, as well as testing and certification procedures, do not create unnecessary obstacles to trade. However, it recognizes that countries have the right to establish protection, at levels they consider appropriate, for example for human, animal or plant life or health or the environment, and should not be prevented from taking measures necessary to ensure those levels of protection are met. The agreement therefore encourages countries to use international standards where these are appropriate, but it does not require them to change their levels of protection as a result of standardization.

Innovative features of the revised agreement are that it covers processing and production methods related to the characteristics of the product itself. The coverage of conformity assessment procedures is enlarged and the disciplines made more precise. Notification provisions applying to local government and non-governmental bodies are elaborated in more detail than in the Tokyo Round agreement. A Code of Good Practice for the Preparation, Adoption and Application of Standards by standardizing bodies, which is open to acceptance by private sector bodies as well as the public sector, is included as an annex to the agreement.

Agreement on Sanitary and Phytosanitary Measures

This agreement concerns the application of sanitary and phytosanitary measures – in other words food safety and animal and plant health regulations. The agreement recognises that governments have the right to take sanitary and phytosanitary measures but that they should be applied only to the extent necessary to protect human, animal or plant life or health and should not arbitrarily or unjustifiably discriminate between Members where identical or similar conditions prevail.

In order to harmonize sanitary and phytosanitary measures on as wide a basis as possible, Members are encouraged to base their measures on international standards, guidelines and recommendations where they exist. However, Members may maintain or introduce measures which result in higher standards if there is scientific justification or as a consequence of consistent risk decisions based on an appropriate risk assessment. The Agreement spells out procedures and criteria for the assessment of risk and the determination of appropriate levels of sanitary or phytosanitary protection.

It is expected that Members would accept the sanitary and phytosanitary measures of others as equivalent if the exporting country demonstrates to the importing country that its measures achieve the importing country's appropriate level of health protection. The agreement includes provisions on control, inspection and approval procedures.

Source: WTO, *Overview: A Navigational Guide*, www.wto.org/english/thewto_e/whatis_e/tif_e/agrm1_e.htm (accessed May 18, 2010).

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12.1 Introduction

In the 2011 edition of this work, we did not devote a separate chapter to climate change and energy, but in light of (1) the Paris Agreement on Climate Change, (2) the increased acknowledgment that energy, not dollars, or euros, or renminbi, is the “real currency” of industrial nations (Morgan 2013), and (3) the realization that neither traditional national or international environmental law, nor traditional industrial policy, can be depended upon to bring about the needed changes, the subject is addressed here.

Other environmental and industrial challenges may lend themselves more easily to suggested reforms discussed earlier throughout this work or in the last chapter where generic recommendations to improve environmental, industrial, economic welfare, and employment prospects are found, but not the challenges posed by climate change and energy.

Why are climate change and energy different? First, reducing the adverse effects of climate change requires both continuous and long-term changes in greenhouse and toxic emissions. Second, industrial policy interventions must be designed for long-term effectiveness. Short-term solutions – involving technological changes in extraction, transmission, and utilization of electricity, as well as in agriculture, forestry, and land use – make the needed long-term solutions hard, unlikely, or impossible to achieve (Sachs et al. 2015). Third, limits in the availability of useful energy (defined as *exergy* – see Sections 3.2.3 and

3.5 in Chapter 3) is reducing the prospect of high long-term growth (Ayers 2006). Fourth, perhaps more than in other areas, both supply-side (production) and demand-side (consumption) policies must be devised and coordinated. Fifth, energy demands of some economic regions (e.g., Europe) and the profit-driven need for others to supply energy (e.g., Russia) renders geopolitical concerns important. Sixth, the energy content (and un-internalized social cost of carbon) of products and services involved in trade amongst nations challenges traditional trade regimes and requires changes in global accords. And finally, incumbent industrial actors, rather than the purveyors of better (i.e., more sustainable) technologies and policies, dominate the national and global political agendas.

Jeffrey Sachs et al. (2015) have raised the need for deep decarbonization involving changes that go beyond the commitments made in the Paris Agreement. Analyses of options and prospects can be found for both the United States (E3 2014, 2015; Gerrard and Dernbach 2018) and for the European Union (Ashford and Renda 2016). The E3 reports are part of a larger U.S.-focused project on deep decarbonization, the Deep Decarbonization Pathways Project (DDPP 2014, 2015a, 2015b). See also the 2017 Wuppertal report *Realising Long-Term Transitions Towards Low Carbon Societies* and the 2017 IDDRI report *Developing 2050 Decarbonization Strategies in the EU: Insights On Good Practice From National Experiences* (Sartor et al. 2017).

Resilience or adaptation strategies are also important (Magnan et al. 2015), but they are not a substitute for longer-term prevention approaches vis-à-vis climate change and other sustainability challenges.

There are a number of myths and misconceptions, which must be dispelled if effective action is to be undertaken towards deep decarbonization. In this chapter we address nine myths (Ashford and Renda 2016) and explore the strategies and combinations of public and private sector actions that could significantly address the looming climate change and energy challenges. See also a complementary compilation of myths by Aiginger (2016).

12.2 Myths on innovation, sustainable development, and the low-carbon economy that need to be dispelled to devise effective strategies

12.2.1 Myth #1: It is possible to realize mutual gains in industrial competitiveness, reduction of GHGs, and employment

In European policy circles there is an explicit belief in this myth represented by the industrial policy strategy called Europe 2020, although it is now being seriously questioned (ESPAS 2015). The myth also persists among some optimistic industrial policy strategists on the right. We believe it is wishful thinking. What may be possible are mutual gains in *economic welfare*, reduction of GHGs, and employment. However, significant gains in private-sector profit or even GDP may not necessarily be possible or desirable, and policies will increasingly create both winners and losers, with consequent distributional effects. The limitations of both GDP and productivity as adequate metrics for economic welfare and predictors of employment are by now well recognized (see Ashford and Hall 2011a; and Section 1.1.1 in Chapter 1).*

* There is good GDP and bad GDP. All GDP measures reflect expenditures related to transactions which are as different as selling cars and treating lung disease caused by air pollution from those cars. See, inter alia, Philipsen, D. (2015), *The Little Big Number: How GDP Came to Rule the World and What to Do about It*, Princeton University Press.

The distinction between policies directed toward increasing traditionally defined competitiveness and those directed towards enhancing economic welfare is that the former is profit-driven and best informed by GDP, while the latter is human-needs (or end-use functions) driven – including employment – and described by other and broader metrics – see i24c (2016a). The term “competitiveness” is now commonly used in policy discussions. However, an alternative use of the term is that it is not restricted to profit, increases in GDP, or market share derived from the usual private-sector-dominated metrics, but rather also includes societal measures of economic and social welfare, including employment. See especially Aiginger et al. (2013), who argue for a more comprehensive definition of competitiveness.

12.2.2 Myth #2: Technological innovation in products and services is essential to achieving deep decarbonization in industrial nations. It is argued that there is a serious “innovation deficit”

In order to sensibly discuss the diffusion/innovation debate, it is useful to recount the sources of greenhouse gas emissions. Transportation/mobility, housing/shelter, and food/nutrition not only account for ~ 80 percent of Europe’s resource use and ~ 60 percent of its household expenditures (i24c 2016a), they are also the areas of economic activity that consume energy and materials, and provide services that lead to significant greenhouse gas (GHG) emissions and environmental contamination. The United States is not very different (Houser 2013). The energy/electricity industry extracts, refines, produces, and transmits energy that powers the industrial system, and the industrial system supplies the materials and physical capital that are essential for the economic system to function successfully.

By design, the world is driven by what Daly (2008) calls a “throughput mentality,” where externalities that accompany the production and consumption of goods and services are rarely or insufficiently internalized. Both production and consumption are encouraged and subsidized, creating a pseudo-equilibrium, which occasionally collapses as a result of a financial bubble (Ayres 2015; Stiglitz 2010). The rules under which industrial economics operate do not favor conservation, energy efficiency, or the essential determinants of growth.* Not only is there a serious absence of rules dealing with the various compromises to sustainability, there is a deficit of monitoring, enforcement, and compliance of the rules that do exist.

Beyond improvements addressing the externalities contributing to GHGs emissions and pollution (what comprises an overarching environmental policy approach), the policies are not directed towards transformation of the industrial system involving (1) a very low carbon system, (2) low-waste value chains associated with the economic activities mentioned above, and (3) a circular economy related to enhancing dematerialization and de-energizing the production of goods and services (see Ekins et al. 2015). These could comprise a re-designed industrial policy approach. Together they constitute an integrated sustainable industrial policy for the environment, a kind of industrial ecosystem, as some have called it. While both innovation and diffusion might be important for improving both the environment and economic welfare, they are not magic bullets, nor is the optimal balance among them likely to be the same for addressing the different sources of GHG emissions. Both supply-side and demand-side policies are in need of reexamination and re-design.

* For a provocative report addressing the necessity of a new approach, see Stiglitz (2015) “Rewriting the Rules for the American Economy: An Agenda for Growth and Shared Prosperity.” See also Dernbach (2011) “Creating the Law of Environmentally Sustainable Development.”

There are a number of reports and studies addressing the goal of decarbonization, but Ahman and Nilsson's (2015) stands out for its conciseness and focus on manufacturing.

Despite considerable evidence that a diffusion deficit rather than an innovation deficit characterizes the need to deploy existing technological approaches, articles and reports continue to reinforce the latter. Especially revealing is the article in *Foreign Affairs* by Sivaram and Norris (2016) entitled "The Clean Energy Revolution: Fighting Climate Change with Innovation." The emphasis is to support R&D on the power grid, citing the importance of the Breakthrough Energy Coalition, involving twenty-eight investors from ten countries, unveiled by Bill Gates and President Obama's announcement of the formation of Mission Innovation involving a twenty-country commitment focusing on power generation and transmission, and arguing for future public-private partnerships to advance the needed innovation.

Romm (2016) offers a convincing debunking of this perspective, arguing that "the truth is that we have dawdled so long on serious climate action that we must rapidly slash CO₂ emissions, which requires over 100 times more money spent on deployment [diffusion] than R&D." Further, based on the history of successful innovation, Romm argues that we should not expect that breakthrough technologies can be developed in time. Looking a little deeper at the debate, when the term R&D is used, sometimes advocates are arguing for basic R&D, and sometimes moving technologies from bench or lab up to practical scale are intended by that term, such as what is reflected in the U.S. ARPA-E endeavor. The difference is important. It is crucial that semantics do not obscure important differences in what is being advocated or planned. A focus and clarity on the details of specific projects, and what is being specifically recommended, would help the policy planning process. In this regard, the reader is referred to a recent report by i24c (2016b, p. 32) in which it is stated that in "the energy sector, Europe has no ideas deficit, but in many instances, a deployment [diffusion] deficit."

As explored in Chapter 6, the technology innovation *process* consists of invention, innovation, and diffusion. There are a number of analysts – e.g., Amory Lovins (2011) and Robert Ayres (2016) – who argue that many technologies already exist that could be defused into use. However, they suffer from inadequacies in appropriate market and regulatory signals, insufficient market demand, and/or lock-in due to inappropriate policies and agency capture by incumbent technology providers.* Further, more than *technological* innovation is needed. Institutional, organizational, and societal/social innovation are also essential and should be always kept in mind by policymakers in order to avoid missing the bigger picture of what innovation can do for long-term societal well-being.†

12.2.3 Myth #3: Innovation per se fuels the industrial state and creates jobs

Much innovation in products and processes simply employs more material (natural and physical capital) and energy, while fostering increases in GDP. Yet, as the labor content of production decreases, jobs are displaced, contributing to un- or underemployment in both blue- and white-collar professions (Brynjolfsson and McAfee 2014; Autor 2014; Autor et al. 2017; Acemoglu et al. 2014). As discussed under Myth #2, the United States, like Europe, may be suffering from a "diffusion deficit." A more nuanced innovation policy taking into account effects on employment of invention, innovation, and diffusion needs

* See Bhattacharjee and McCoy (2012) for an extensive incentives analysis influencing the diffusion of energy technologies. For earlier work focusing on options for achieving reductions in GHGs, see Pacala and Socolow (2004) and Blok et al. (2012). See also Erickson et al. (2015) and Marchant (2018).

† For example, Sachs et al. (2015) examine DDPPs without modeling new technologies, only looking at the ones commercially available or currently being tested.

to be adopted so that interventions in the appropriate part of the innovation cycle, e.g., deployment rather than basic R&D, can be used to achieve positive consequences for employment (Dechezleprêtre et al. 2016; Goldman Sachs 2016).

12.2.4 Myth #4: Governments cannot pick winners. Winners pick governments

The U.S. experience with aircraft, computers, the internet, space technology, and pharmaceuticals (to name just a few examples) clearly demonstrates the power of government funding of research, e.g., see the U.S. examples of DARPA and ARPA (Mazzucato 2014; Bonvillian and Van Atta 2011). In a recent contribution, Mariana Mazzucato convincingly argued that state-funded research (e.g., the ARPA-E in the U.S.) is achieving major breakthroughs in at least one of the key technologies that will provide a contribution to decarbonization, i.e., batteries for energy storage. In addition, while private sector efforts such as Elon Musk's Tesla have made important steps towards the production of "an existing, pretty powerful battery technology," ARPA-E has been pursuing technological innovation in the purest sense by "creating new ways of doing" things, which "have the potential to be significantly better" (Mazzucato 2016). Bill Gates himself acknowledged that only the state, in the form of public institutions like ARPA-E, can lead the way to an energy breakthrough (Gates 2012).

12.2.5 Myth #5: Industrial policy is synonymous with innovation policy

An industrial policy not only encompasses invention, innovation, and diffusion, it also envisions, *inter alia*, the training – and re-education – of scientists, engineers, data and ICT specialists, service and health care providers, etc., in addition to well-conceived employment and social policy options (Ashford and Hall 2011a and b). Trickle-down theory – often accompanied by the mantra "a rising tide raises all boats" – embodies the belief that economic advance in the private sector benefits the society and workers have been basically discredited. The economic crisis of 2008 stands out as a stark reminder of what a deregulated financial market results in. In a recent commentary on the relationship between industrial policy and innovation policy, with an aim to establish an "industrial compact" focusing on system changes envisioning techno-economic and sociotechnical transformations, Steward (2015, p. 17) argues that the industrial compact should be "broad [in] scope, have purposive directionality, deliver system transformation and rely on network capabilities"* and not expect that enhancing industry profit alone will benefit others in the society.

12.2.6 Myth #6: Regulation inhibits beneficial innovation

There is overwhelming empirical evidence that regulation – especially stringent regulation and standards – properly designed, has stimulated new products, processes, and work practices that would not otherwise have occurred (Ashford et al. 1985; Ashford and Hall 2011b; Porter and van der Linde 1995; Pelkmans and Renda 2014; also see OECD 2016 for a recent comparison of regulatory stringency among OECD nations). However, often transformative, disruptive innovation comes from outside the incumbent producers or providers, which implies that care must be taken in order to prevent incumbents and

* Steward, F. (2015). "Policies and Practices to Promote Work Enhancing Pathways in the Transition to a Low Carbon Economy." See also: Vivideconomics (2015) "Understanding European Industrial Competitiveness and Drivers of Innovation in the New Global Economy," prepared for i24c.

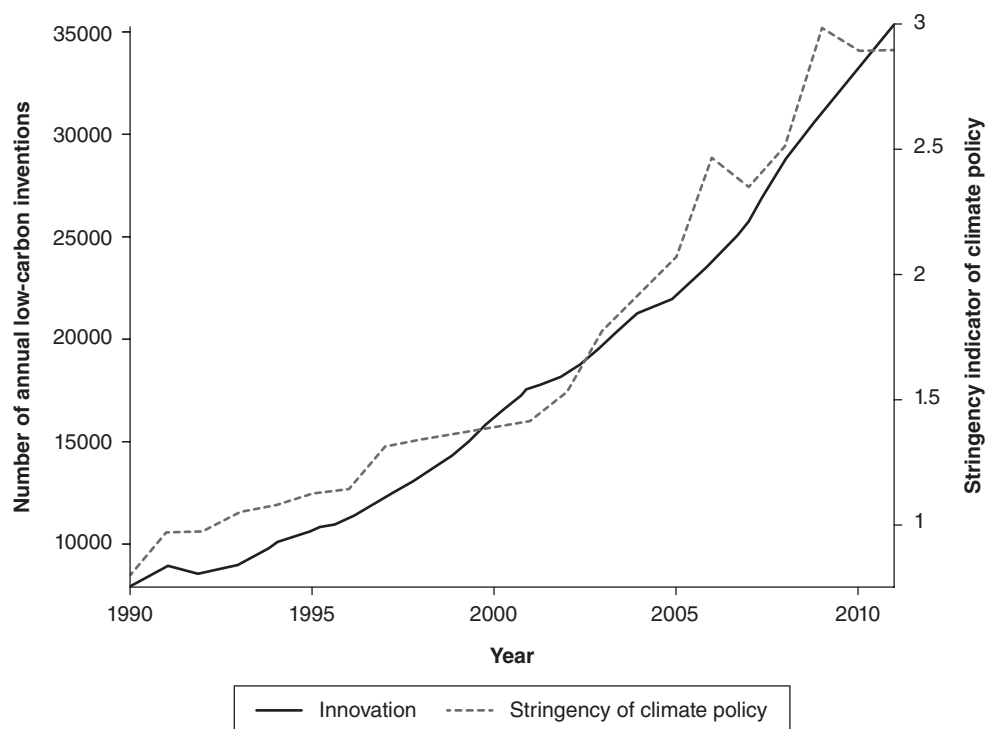


Figure 12.1 Innovation and stringency of climate change policies

Source: Dechezleprêtre et al. (2016, p. 7). Data from the PATSTAT database and OECD Climate policy stringency indicator (2014). Individual countries are weighted by their GDP in order to calculate the average policy stringency across the OECD.

special interests from unduly influencing both the industrial and the regulatory policy process – see the extensive discussion in Section 8.3 in Chapter 8 and Wilson and Tyfield (2018). Negotiated agreements and self-regulation need to be viewed with appropriate scrutiny (Ashford and Caldart 1999; Coglianese 2015). In relation to decarbonization, Dechezleprêtre et al. (2016) map the correlation between the number of low-carbon inventions for which patent protection has been sought by inventors located in OECD countries between 1990 and 2012, with an indicator of the stringency of climate change policy developed by the OECD (Botta and Kozluk 2014). Figure 12.1 presents the graph and shows how innovation efforts and the stringency of policy follow a similar trajectory.

12.2.7 Myth #7: Carbon leakage presents a practical disincentive and limits to what regulation can achieve in terms of decarbonization

“Emissions leakage” is generally defined as the increase in foreign emissions that results as a consequence of domestic actions to reduce emissions that encourages the export of manufacturing abroad (Fischer 2015, p. 298). Not only may foreign producers use cheaper (and dirtier) energy sources, they may also be generally less efficient than first-world domestic firms in their manufacturing operations. The consequence is usually that the global prices for energy go down as other [exporting] countries consume more fossil fuels. The competitiveness implications can be significant, as can the impacts on world

trade activities (Carbon Trust 2009; Fischer 2015; Mavroidis and de Mello 2015; Wu and Salzman 2014; Trujillo 2018). “China’s exports are eight times as carbon-intensive as those of the EU and three times as those of the US” (Atkinson et al. 2011, as quoted in Fischer 2015, p. 305).

In fact, the export of manufacturing (e.g., from the EU and the U.S. to China) and services (e.g., to India) has been accelerated and intensified by the absence of enforceable or enforced regulations in those locations, allowing domestic importers in developed countries to “trade on the externalities” and thereby increase their profits, with negligible reduction of prices to consumers – as well as a reduction of jobs at home. Trade rules should allow discrimination between products and services that are attended by undesirable side effects like adverse health, safety, environmental, or climate change effects (see the WTO asbestos decision in 2000), as well as adverse employment effects (see Copaldo (2014) on the development on the Trans-Atlantic Trade and Investment Partnership (TTIP)). In a recent publication, the World Economic Forum (WEF 2015) also acknowledged that sustainable and effective trade policy, including most notably a prominent role of decarbonization in regional and bilateral trade agreements, is one of the enabling factors of long-term decarbonization (WEF 2015).

If enough major economies could agree on a coordinated approach to carbon pricing or a uniform global price on carbon that spreads coverage broadly enough – which is not the case with nations acting independently – carbon leakage would become a less important issue (Fischer 2015, p. 298).

Barring the adoption of a global price for carbon in the near future, the concerns of especially developed countries wanting to curtail global GHG emissions may very well turn to international trade to address their concerns for adverse effects on their international competitiveness, namely (1) subsidies for the development and deployment of cleaner technologies, so-called green subsidies (Charnovitz 2014), and (2) border carbon adjustments (BCAs) (Condon and Ignaciuk 2013; Andersen 2017). While countervailing duties may well be allowed under Section XX of the GATT to prevent the import of goods produced with inappropriately high energy (disadvantaging developing countries), subsidies for environmental improvements are no longer exempt from “actionable subsidies” prohibited by the WTO. Trade scholars have uniformly called for a revision to the WTO trade rules, specifically the Subsidies Code (Charnovitz 2014; Condon and Ignaciuk 2013; Fischer 2015; Mavroidis and de Mello 2015; Wu and Salzman 2014; WTO n.d.). See the discussion on trade options in Chapter 11.

12.2.8 Myth #8: Trade in non-energy-related goods and services is a win-win proposition for all parties

The experience with both NAFTA and the WTO have clearly demonstrated not only a loss of health, safety, and environmental protection, but also a worsening of wages, working conditions, and human and working rights in one or both trading partners (Greider 1998; Scott et al. 2017). Money flows from the developing world to the developed world where returns on investment are the highest. Trade does indeed primarily benefit the private-sector exporters and importers, contributing to wealth and income inequality, but not always with benefit to consumers and workers. EU trade initiatives (TTIP and other policies) need to be carefully assessed – and changed if necessary – for their potential to contribute to mitigating global climate change, as well as their adverse impact on employment.*

* See Autor et al.’s (2016) important study on “The China Shock: Learning from Labor Market Adjustment to Large Changes in Trade.”

12.2.9 Myth #9: Nations can “go it alone”

It is clear that a multilateral effort is needed for significant, high-risk industrial development, combining skills, insight, and financial capital and joint risk taking – such as has been suggested for a “Global Apollo Programme to Combat Climate Change” (King et al. 2015). With real and uncertain costs in transitioning to different energy futures, collaborative efforts should be pursued wherever possible in order that long-term goals not be undercut by short-term competitive advantage and free-riding (see Gallagher 2014). In illustrating the global nature of clean energy technology and the importance of technology transfer (diffusion), Gallagher (2014) argues that (1) clean energy technology innovation has globalized – it is no longer a national process, (2) the most important barriers are cost, lack of policy, and insufficient access to finance, and (3) the best incentives are market-formation policies and the provision of affordable finance.

12.3 Recommended interventions

The dispelling of these nine myths suggests a way forward towards a constructive global climate change mitigation and prevention strategy, as well as geopolitical solution. Elements of that strategy include specific interventions such as fuel efficiency or emission standards for vehicles. Others include the support of basic and applied research in industry or by government. Still others attempt to influence the consumption or conservation of energy. What has been obvious is that while some pathways are useful to pursue, fundamental problems that do not lend themselves to technical or technological interventions remain. These include: (1) political influence and technical dominance of incumbents; (2) trade conflicts traceable to “carbon leakage”; and (3) geopolitical accords.

For more than a decade, using the concept of “wedges” of different interventions, not including nuclear energy, scholars have argued that technologies then currently available were more than sufficient to reduce greenhouse gas emissions (Pacala and Socolow 2004; Blok et al. 2012). With very little having been done to apply those technologies in the interim, the task has become increasingly difficult. In a book edited by Gerrard and Dernbach (2018),* Marchant (2018) has focused on identifying a catalogue of legal interventions addressing:

- Standards for carbon reduction
 - minimum efficiency standards for appliances
 - emission standards for transport
- Expedited approval for superior technologies
- Carbon taxes
- Tradeable permits
 - permits
 - cap-and-trade
- Technology mandates
 - ZEV
 - bans on incandescent lighting
 - renewable portfolio standards (RPS)

* See also an earlier paper by Dernbach (2007) for interventions addressing transit, transportation, fuel taxation, electricity pricing, residential/commercial building efficiency, and freight regulation affecting mostly energy efficiency/conservation and demand-side consumption. See also Dernbach (2016).

- Government procurement
- R&D funding
- Subsidies
- Incentive programs (beyond subsidies, e.g., customer/consumer rebates)
- IP (patent policy interventions)
- Competition/prizes
- Land use
- Soft law (certification, labeling, private standards, building codes)

With the possibly undeserved optimism about cap-and-trade over carbon taxes and undeserved pessimism about government being effective at picking winners, it is a valuable listing. Surprisingly, market dominance by incumbents as a major impediment to progress and the need for anti-trust law is not featured, although Ashford and Renda (2016) have given the need to address these barriers a major emphasis. Options for interventions that use trade rules are provided by Trujillo (2018).

Finally, very little attention by many energy policy commentators – with the important and prominent exceptions of Ayers (2006, 2015), Hoffmann (2011), and Morgan (2013) – is given to the important issue of what effects policies that reduce fossil fuel dependence and use will have on economic growth. See Section 3.2.3 in Chapter 3 for a fuller discussion of how exergy, the useful part of available energy that can be harnessed for economic activity, is diminishing (Ayers 2015).

Ulrich Hoffmann (2011, p. 1) provides a valuable summary of *The Fallacies of Green Growth*.*

Many economists and policy makers advocate a fundamental shift towards “green growth” as the new, qualitatively-different growth paradigm, based on enhanced material/resource/energy efficiency and drastic changes in the energy mix. “Green growth” may work well in creating new growth impulses with reduced environmental load and facilitating related technological and structural change. But can it also mitigate climate change at the required scale (i.e. significant, absolute and permanent decline of GHG emissions at global level) and pace? The UNCTAD Discussion Paper argues that growth, technological, population-expansion and governance constraints as well as some key systemic issues cast a very long shadow on the “green growth” hopes. One should not deceive oneself into believing that such evolutionary (and often reductionist) approach will be sufficient to cope with the complexities of climate change. It may rather give much false hope and excuses to do nothing really fundamental that can bring about a U-turn of global GHG emissions. The proponents of a resource efficiency revolution and a drastic change in the energy mix need to scrutinize the historical evidence, in particular the arithmetic of economic and population growth. Furthermore, they need to realize that the required transformation goes beyond innovation and structural changes to include democratization of the economy and cultural change. Climate change calls into question the global equality of opportunity for prosperity (i.e. ecological justice and development space) and is thus a huge developmental challenge for the South and a question of life and death for some developing countries.

* Hoffmann’s (2011) paper reviews the fallacies of green growth in coping with climate change and the implications for development space. Drawing on ample empirical data and examples, the paper analyses the environmental effectiveness, economic efficiency, and social-political acceptability of the main elements in the green growth toolbox.

Alfredsson et al. (2018, p. 1) remind us that “affluence is a primary driver of GHG emissions” and that “improving the standard of living of the world’s poor will consume a major portion of the two-degree carbon budget.” Paradoxically, much of the world needs to increase their energy use and consumption, and simply transferring wealth from the advanced societies to the neediest can actually increase GHG emissions since income levels are the primary determinants of energy consumption and GHG emissions (Alfredsson et al. 2018, paraphrasing Hubacek et al. 2017). Thus, the energy challenge has become the poster child of a “wicked problem.”

In the next chapter, we address more generic suggestions for achieving sustainable development problems that include but go beyond energy and climate disruption. They also include concerns for economic welfare and employment.

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Part VI

Strategic policy design for sustainable transformations

In this last part of this book, we discuss the necessary and sufficient components of strategic policy design and implementation for sustainable transformations of the industrial state. Our major focus is on the developed nations, although many aspects of the special challenges faced by nations in less advanced stages of development (industrializing states) are also addressed. Our conviction is that developed economies must display leadership and take dramatic action to serve as a model and empirical basis for policies that might be fashioned for the developing world. Of course, history shows that importing policies from developed nations to developing nations without serious scrutiny and appropriate changes is fraught with mistakes and missteps. At a time when a new leadership on sustainable development is urgently needed, those nations that are willing to disrupt the status quo and make serious inroads towards sustainability are likely to reap the benefits that will accompany the first movers. Such benefits include a society where inequality is falling and well-being is increasing, where citizens have the ability to engage in democracy (through an open participatory and political space that encourages new voices to contribute to integrated thinking and solutions), and where the living and working environments are flourishing, since the pressure from the release of toxic chemicals is drastically reduced.



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13 Pathways to sustainability

Co-optimizing economic development, the environment, and employment and earning capacity

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13.1 Transformation challenges for the industrial state

In addressing pathways to sustainability that co-optimize *competitiveness*, *employment*, and *the environment*, it is clear that more than an economic recovery is needed to respond to the underlying problems of the 2008 financial crises, the causes of which began much earlier (Varoufakis 2011).

In this work, we argue that what is needed instead of economic recovery is a *transformation of the industrial state*. The problem with language and words, like the terms competitiveness and recovery, is that they carry with them assumptions that hide a multitude of ideas and socio-economic behaviors that may no longer be true.

Because the term “competitiveness” is so often used in policy discussions, it is important to be clear that the term should not be restricted to profit, increases in GDP, or market share – derived from the usual neoclassical economic and private-sector-dominated metrics – but rather must also include societal measures of both aggregate and distributional measures of economic and social welfare, including purchasing power. See especially Aiginger et al. (2013), who argues for a more comprehensive definition of competitiveness.

An economic recovery implies returning to the economic and social system that predated collapse or crisis, but with additional checks, balances, and stopgap measures that can prevent a return to chaos. In a sense, in the United States this approach was represented by the New Deal to correct the economic excesses of the Depression and in Europe by the Marshall Plan to rebuild war-torn economies. While we recognize the value of approaching sustainable development from the grassroots/bottom up, having studied the evidence presented throughout this work, we are convinced of the need to utilize top-down interventions to change the structures that guide investment and development. In fact, such changes – outlined in Tables 13.1 to 13.4 and discussed in Sections 13.3 and 13.4 – may enable grassroot initiatives to flourish by expanding the scope of their impact/influence.

The utilitarian *assumption* that a profitable economic system that maximizes collective or total wealth can be best for everyone through distribution and redistribution is manifestly not true. The work on inequality of wealth and income by Piketty (2014), Atkinson

(2015), Stiglitz (2015), Kallis (2011), Bivens (2017), and Alperovitz et al. (2015) paints a clear picture of the growing wealth and income gaps, despite people working just as hard or harder and longer today than in the past to make a living. The belief expressed by the European Commission in its Lisbon Strategy and its successor, the Europe 2020 strategy – intended to create “smart, sustainable and inclusive growth” that results in the most competitive, environmentally sound, and job-creating economic system in the world – is now regarded as both unrealistic and unachievable (Ashford and Renda 2016).

Questions have been raised as to whether capitalism and equality are compatible (Atkinson 2015; Piketty 2014; Stiglitz 2016), whether capitalism requires endless growth (Saunders 2016), whether exponential growth is still possible (Ayres 2006), whether a sustainable environment can be achieved in a market economy (Sanders 2006), whether “going green” will suffice to achieve sustainability (Borel-Saladin and Turok 2013; Hoffmann 2011; Lorek and Spangenberg 2013), whether instituting community and societal ownership can replace both capitalism and socialism (Alperovitz et al. 2015), whether individual earning capacity can be significantly increased through expanding opportunities for individual ownership of productive capital (R. Ashford et al. 2012), whether a deliberate policy of degrowth is needed and can be achieved (D’Alisa et al. 2014; Kallis 2011), and indeed whether macroeconomics is so basically flawed that it needs to be abandoned (Keen 2016; 2017; Stiglitz 2016).

Two issues that have enormous and immediate policy implications are the relative contributions of technological displacement (Brynjolfsson and McAfee 2014) and trade (Bivens 2017; Autor et al. 2017) to unemployment and wages. These different perspectives have been discussed and the views of their protagonists (promoters) and antagonists (detractors) noted and analyzed in this work (see Section 1.2.3 in Chapter 1, Sections 3.3.1 and 3.5.2 in Chapter 3, and Section 5.2.1 in Chapter 5 for a discussion of technological displacement; see Section 5.2.5 in Chapter 5 for the effects of globalization and trade on employment and wages).

What emerges here is not definitive answers to the questions that have been raised but rather the identification of an extensive range of deliberate strategies at multiple levels that could, if carefully integrated, lay the foundation for a transformation of the industrial state. Leaving the needed transformation to the markets by themselves is unlikely to manifest in meaningful change towards a more sustainable – and fair – society.

In the final chapter of the original 2011 edition of this work, we generated detailed recommendations for going forward. In revised form, these are represented in the tables found in Section 13.2. However, changes have been made in three significant ways: (1) there is more of a focus on global climate change and energy; (2) the last 6–7 years have provided evidence that not only are sustainability challenges worsening – in achieving equitable economic welfare, meaningful and well-paid employment, and earning capacity, and the needed environmental and climate change improvements – but policies are wrong-headed and more drastic medicine is needed; and (3) world conflict is worsening, creating economic, political, and environmental migrants in the context of failing national and international governance.

Fortunately, we are now aided by the work and thinking of some renowned scholars of sustainability who have entered into the debate. Joseph Stiglitz (2015) has addressed these questions head-on in his *Rewriting the Rules of the American Economy: An Agenda for Shared Prosperity*. See also Alperovitz et al.’s (2015) *The Next System Project: New Political Possibilities for the 21st Century*; John C. Dernbach’s law review article “Creating the Law of Environmentally Sustainable Economic Development”; and the report from the Economic Policy Institute by Bivens (2017) entitled *Adding Insult to Injury: How Bad Policy Decisions Have Amplified Globalization’s Costs for American Workers*.

In preparing a revised version of the 2011 work, we decided to retain the ambitious objective of crafting a comprehensive framework that tries to tie together theories across

multiple disciplines – from economic development, innovation, and employment, to environmental, occupational, and public health and safety regulation, to trade and international multilateral environmental agreements. While it can be challenging to bring such a range of subjects together, this integration is critical to ensuring that strategies intended to advance economic development and environmental protection, for example, do not undermine employment (or income) or run afoul of international agreements. Scholars have argued that our inability to integrate solutions is the major barrier to sustainable development (Dernbach 2011). We hope this work and this chapter in particular make important steps towards connecting the critical dimensions that need to be considered when transforming how we live and work on this planet.

The approach taken by Stiglitz (2015) in *Rewriting the Rules* focuses on correcting the economic system with specific recommendations for serious changes to the economic system with regards to transparency; the treatment of income and salaries, profit, private and public investment, intellectual property rights, and credit; the financial sector; labor markets; health care; social security; capital transfers; and penalties for wrong-doing (see Box 13.1). Although these recommendations go a long way in correcting major concerns, Stiglitz does not directly address the environment or the democratization of ownership, and appears to assume, rather than discuss, whether capitalism is compatible with democracy or equality.

Box 13.1 Stiglitz, J. (2013) *rewriting the rules* (excerpts from the executive summary, pp. 8–9)

Taming the top

Fix the financial sector

- End “too big to fail” by imposing additional capital surcharges on systemically risky financial institutions and breaking up firms that cannot produce credible living wills.
- Better regulate the shadow banking sector.
- Bring greater transparency to all financial markets by requiring all alternative asset managers to publicly disclose holdings, returns, and fee structures.
- Reduce credit and debit card fees through improved regulation of card providers and enhanced competition.
- Enforce existing rules with stricter penalties for companies and corporate officials that break the law.
- Reform Federal Reserve governance to reduce conflicts of interest and institute more open and accountable elections.

Incentivize long-term business growth

- Restructure CEO pay by closing the performance-pay tax loophole and increasing transparency on the size of compensation packages relative to performance and median worker pay and on the dilution as a result of grants of stock options.
- Enact a financial transaction tax to reduce short-term trading and encourage more productive long-term investment.
- Empower long-term stakeholders through the tax code, the use of so-called “loyalty shares,” and greater accountability for managers of retirement funds.

Make markets competitive

- Restore balance to intellectual property rights to encourage innovation and entrepreneurship.
- Restore balance to global trade agreements by ensuring investor protections are not prioritized above protections on the environment and labor, and increasing transparency in the negotiation process.
- Provide health care cost controls by allowing government bargaining.
- Expand a variant of chapter 11 bankruptcy to homeowners and student borrowers.

Rebalance the tax and transfer system

- Raise the top marginal rate by converting all reductions to tax credits and limiting the use of credits.
- Raise taxes on capital gains and dividends.
- Encourage U.S. investment by taxing corporations on global income.
- Tax undesirable behavior such as short-term trading or polluting and eliminate corporate welfare and other tax expenditures that foster inefficiency and inequality.

Growing the middle***Make full employment the goal***

- Reform monetary policy to give higher priority to full employment.
- Reinvigorate public investment to lay the foundation for long-term economic performance and job growth, including by investing in large-scale infrastructure renovation: a 10-year campaign to make the U.S. a world leader in innovation, manufacturing, and jobs.
- Invest in large-scale infrastructure renovation with a 10-year campaign to make the U.S. a world infrastructure innovation, manufacturing, and jobs leader.
- Expand public transportation to promote equal access to jobs and opportunity.

Empower workers

- Strengthen the right to bargain by easing legal barriers to unionization, imposing stricter penalties on illegal anti-union intimidation tactics, and amending laws to reflect the changing workplace.
- Have government set the standards by attaching strong pro-worker stipulations to its contracts and development subsidies.
- Increase funding for enforcement and raise penalties for violating labor standards.
- Raise the nationwide minimum wage and increase the salary threshold for overtime pay.

Expand access to labor markets and opportunities for advancement

- Reform the criminal justice system to reduce incarceration rates and related financial burdens for the poor.

- Reform immigration law to provide a pathway to citizenship for undocumented workers.
- Legislate universal paid sick and family leave.
- Subsidize child care to benefit children and improve women's workforce participation.
- Promote pay equity and eliminate legal obstacles that prevent employees from sharing salary information.
- Protect women's access to reproductive health services.

Expand economic security and opportunity

- Invest in young children through child benefits, early education, and universal pre-K.
- Increase access to higher education by reforming tuition financing, restoring protections to student loans, and adopting universal income-based repayment.
- Make health care affordable and universal by opening Medicare to all.
- Expand access to banking services through a postal savings bank.
- Create a public option for the supply of mortgages.
- Expand Social Security with a supplemental public investment program modeled on private Individual Retirement Accounts, and raise the payroll cap to increase revenue.

In contrast, Spangenberg (2007), Bivens (2017), Bivens and Blair (2016), and Dernbach (2011) address the options to correct the growing inequality, employment challenges, and environmental problems of the capitalist state.

Alperovitz et al. (2015), Kelly (2012), and Jackson and Victor (2013) concern themselves with enhancing community and societal ownership, while Robert Ashford (2015) focuses on increasing individual ownership through expanding access to capital ownership through the future earnings of capital. Jackson and Victor (2013) emphasize the critical need to transition to a shorter workweek, as do Ashford and Kallis (2013). Such a transition may be more acceptable and likely when combined with R. Ashford's vision of expanding access to capital ownership.

Finally, the financial crisis also created an opportunity to seriously question the viability of the *growth* agenda, fueling the *degrowth* movement that continues to advance a broad range of ideas and paradigms (D'Alisa et al. 2014; Kallis 2011).

As the title of this work indicates, our work focuses primarily on the urgent need for industrialized economies to transform the way goods and services are provided to their people (Ashford and Hall 2011a). While poverty, environmental and disease devastation, and abuses of human rights are major challenges that need attention in the developing world, we believe that technology, financing, and political leadership for sustainable development may first need to find their expression in the developed world before being adapted to the developing world. Put differently, the industrialized nations need to get their own house in order and explore and experiment with different models for development that might then be emulated or modified in emerging regions. Ultimately, developing countries will need appropriate technical, institutional, and financial assistance to make the changes that are needed so desperately, but such changes must place them on a sustainable development trajectory.

Sustainable development decries a simplistic definition and rather is a multidimensional concept characterizing development that seeks to:

- meet human needs and avoid adverse effects of industrialization within and among nations and on subsequent generations;
- provide an adequate and fair distribution of essential goods and services;
- provide for good health, safety, and an environment without environmental injustices;
- provide for fair working conditions and ensure occupational health and safety;
- provide for fair, stable, and meaningful employment and earning capacity;
- meet and expand the potential for a nation's self-reliance, capacity for innovation, and participation in the global economy; and
- engage individuals in society to realize their human potential (that is, social inclusion).

In the next section of this chapter, we present in four tables a number of policies and approaches that industry, governments, non-government organizations, and stakeholders can take to advance the above development agenda. These policies and approaches – which pull together the ideas/recommendations discussed throughout this work – emphasize the need for technological, organizational, institutional, and social innovation that can disrupt existing forms of industrial development, ideally replacing them with inherently sustainable models of production and service delivery.

In this regard, our work is grounded firmly within the Schumpeterian notion of creative destruction, whereby innovation (or new ideas) replace existing and perhaps open up new markets in the process. What we urgently need are systems that provide incentives for disruptive change that results in inherently sustainable goods and services. While we have spoken extensively about the failure or limitations of environmental, economic, and employment policies and regulations, we should also reflect on the failure of our educational systems to provide students, practitioners, and scholars with new ways of thinking about and envisioning the future. Specifically, the dominance of neoclassical economic thinking is perhaps one of the most pervasive challenges facing sustainable development. The interventions listed in the tables reflect the assumption that accepted economic theory and growth are likely to remain central components and features of national development agendas. What we have attempted to do is reveal to students, practitioners, and scholars how they can refashion existing approaches and develop new laws, policies, and strategies to create a transformational framework. To do this, we needed to explore our existing systems in some detail to highlight where changes are needed. Thus, this work is written for individuals who are or will be working within the systems we already have in place, and who are driven to change these systems. While it is tempting to focus on new visions of the future, we believe these will simply remain an illusion if those who have the ability to shape our governance systems do not have the tools or knowledge to do so.

What should be evident from this work is that we believe an *evolutionary* rate of change – where innovation is more sustaining than disrupting in its nature (Christensen 1997) – is likely to be insufficient to make major inroads into the development challenge ahead.* What is needed is *revolutionary* change – of both a technical and strategic nature and a political and social nature. At Rio+20, the international community missed a critical opportunity to establish an agenda of radical change/innovation to promote sustainable development. In Section 13.3, we explore approaches that could help address the likelihood of slower, or even negative growth, or increases in inequality, and negative influences on employment, wages, and earning capacity – as a consequence of limits to growth or by design (through degrowth).

* See Sections 6.2.2 in Chapter 6 and 7.6.5 in Chapter 7 for a discussion of evolutionary versus revolutionary change.

While the green economy could lead to more sustainable forms of development, the lack of any universally agreed-upon green-economy targets to guide progress means that nations may have no option but to adopt a business as usual approach to development, especially given the current global financial crisis and concern for jobs. Rather than viewing mechanisms to promote sustainable development as an economic burden (or job destroyer), governments could adopt an agenda that welcomes creative destruction and deliberately targets the destruction of old approaches and conventional ways of developing.

With regards to guiding progress towards sustainable development, the 2015 Paris Agreement on climate change and the 2015 Sustainable Development Goals (SDGs) do provide a unifying set of commitments that can shape development (see Section 2.4.4 in Chapter 2). While the Paris Agreement commitments are voluntary, the requirement to report progress every five years keeps attention on those commitments. In contrast, the SDGs and the emerging network of supporting targets and indicators have the potential to broaden the scope of developing efforts so that multiple goals can be addressed at once (Hall et al. 2017). Thus, expanding the “problem space” to include a broader range of issues – such as environmental concerns, worker health and safety, meaningful and rewarding employment, and economic welfare – also expands the scope of innovation and the dimensions of the “design space.” The design space refers to the dimensions along which the designers of technical/social systems concern themselves. Expanding the available sociotechnical design space includes simultaneous consideration of the determinants of competitiveness/economic welfare, the environment, and employment. The interconnectedness of SDGs provides governments, industry, NGOs, and international institutions with an opportunity expand their problem and design spaces in an effort to promote more sustainable solutions – i.e., solutions that address multiple interconnected goals.

Further, technological innovation and trade drive national economies in different ways (Charles and Lehner 1998). The former exploits a nation’s innovative potential, the latter its excess production capacity. A sector or national economy that increases its competitiveness through innovation-based performance does present some opportunities for skill enhancement and higher-paying jobs, whereas pursuing competitiveness through cost-reduction strategies focuses on leaner production (with worker displacement), flexible labor markets, and knowledge increasingly embodied in hardware and software rather than in human capital.

The innovation-based performance strategy rewards and encourages skill acquisition for some, with appropriate financial benefits for those workers. In contrast, a cost-reduction strategy creates a division between workers: some are necessarily upskilled, but the skill content of many is reduced. This contrast in the effects on employment may no longer hold (see the discussion in Section 13.3 and the work of Autor and Acemoglu in Sections 3.3.1 and 3.5.2 in Chapter 3). Different national strategies might be pursued in either case, reflecting different domestic preferences and cultures, but there are further implications, depending on the extent to which trade drives the economy.

13.2 Selected interventions from the perspective of the developed nation–state

Given the powerful role of technology and globalization as drivers of change, **we argue that the operationally important dimensions of sustainability consist of competitiveness (equitable economic development and welfare), the environment, and employment and earning capacity** (Figure 13.1). These three dimensions together drive sustainable development along different pathways and go to different places than environmentally driven concerns alone, which may otherwise require trade-offs, for example, between environmental improvements and jobs.

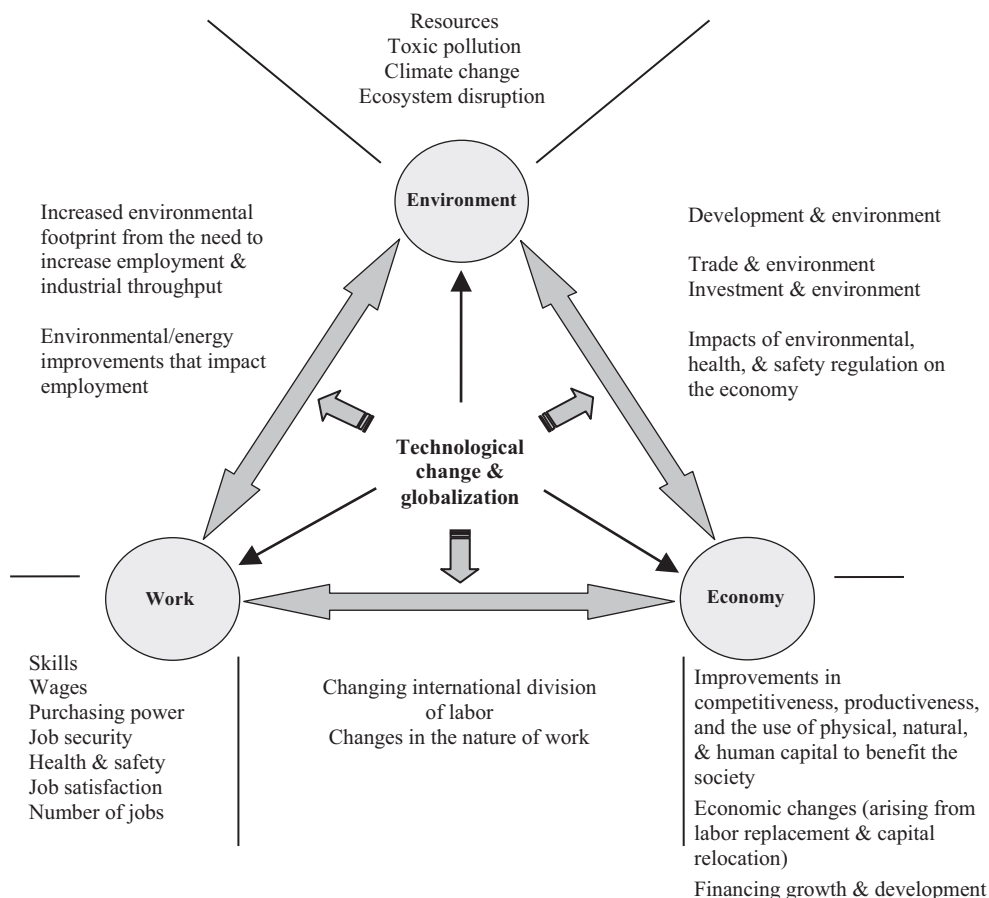


Figure 13.1 Technological change and globalization as drivers of change within and between three operationally important dimensions of sustainability

From the above perspective on sustainable development, we have developed a series of specific national and international governance initiatives that, if adopted, could promote progress towards sustainability. These initiatives advocate the need to:

- Promote more sustainable industrial production and consumption (Table 13.1);
- Improve health, safety, and the environment (Table 13.2);
- Enhance meaningful, rewarding, and safer employment and adequate earning capacity (Table 13.3); and
- Promote more sustainable industrial trade (Table 13.4).

For each of the four strategic areas listed above, the recommendations are grouped in one of five categories – industry initiatives, government intervention and regulation, education and human resource development, stakeholder involvement, or the international community. We believe the initiatives captured in Tables 13.1 to 13.4 provide a useful set of ideas for advancing many of the SDGs.

Table 13.1 Strategies to promote more sustainable industrial production and consumption

Industry initiatives	Government intervention and regulation	Education and human resource development	Stakeholder involvement	International community
• Use more natural capital. • Dematerialize products and processes. • Devote more attention to durable goods and remanufacturing. • Shift to cleaner and inherently safer technology, products, processes, product-services, and services. • Use less energy in production and in the provision of products and services that themselves require less energy in their operation and use. • Shift from selling products to selling product-services wherever possible. • Hire scientists, environmental and public health professionals, engineers, material scientists, and energy specialists to design and work together to devise energy-saving, cleaner, and inherently safer products, processes, product-services, and services. • Transform, if possible, or replace incumbent industry with innovative and sustainable producers and providers of services.	• Provide the physical infrastructure (for example, high-speed rail, ports, and telecommunications) and legal infrastructure (patent protection, R&D tax credits) for industrial development. • Create and disseminate knowledge and innovative technology through experimentation and demonstration projects. • Design legislation and regulations that create producer and consumer incentives that favor innovation in products, processes, product-services, and system changes that are energy-saving, environmentally sounder, inherently safer, and employment enhancing. • Create nascent markets for new technology through government purchasing. • Provide favorable tax treatment for investment and for human resource development and use. • Regulate commercial advertising and provide countering government messaging.	• Educate scientists, environmental and public health professionals, engineers, material scientists, and energy specialists to design and work together to devise cleaner and inherently safer products and production processes and the provision of services. • Educate consumers and citizens to favor energy-saving, cleaner, and inherently safer products, product-services, and services wherever possible. • Educate managers, entrepreneurs, business leaders, and workers to understand the need for more sustainable practices. • Educate lawyers to develop laws to guide a transition toward sustainable development. • Educate children to meet their needs with nonmaterial goods and activities wherever possible and to recognize and want sustainable products and activities.	• Through education and communication, encourage consumers and citizens to favor energy-saving, cleaner, and inherently safer products, product-services, and services and to meet their needs (for example, for leisure or recreational activities) with nonmaterial goods and activities wherever possible. • Three main types of consumer need to be considered: 1 the individual <i>consumer</i>, who typically purchases items available in the market; 2 the <i>commercial</i> consumer, who purchases products made by industry as inputs to its manufacturing processes; and 3 the <i>government</i>, which purchases military hardware and materials and equipment for infrastructure and public services. There are opportunities within each of these consumer groups to promote sustainable or green purchasing practices.	• Ensure that UNIDO has sufficient resources to promote sustainable industrial development that supports competitiveness, protects the environment, and creates meaningful and well-paid employment.

Source: Adapted from Ashford and Hall (2011b).

Table 13.2 Strategies to improve health, safety, and the environment

<i>Industry initiatives</i>	<i>Government intervention and regulation</i>	<i>Education and human resource development</i>	<i>Stakeholder involvement</i>	<i>International community</i>
• Hire specialists in health, safety, environmental impact assessment, and energy. • Integrate marketing, product development, production, environmental affairs, and human resource efforts by eliminating or transcending the unnecessary divisional divides in the firm.	• Design legislation, regulations, and tax incentives that favor products, processes, product-services, and system changes that are energy-saving, environmentally sound, inherently safer, and employment enhancing. • Remove regulations and tax treatment that create perverse incentives. • Tax unsustainable products and processes.	• Educate scientists, environmental, and public health professionals, engineers, material scientists, and energy specialists on the importance of creating a healthy <i>work</i> and <i>natural</i> environment through sustainable industrial production and consumption.	• Promote NGO activity to press for energy-saving, environmentally sound, and inherently safer products and production. • Devise means to motivate consumers and citizens to press for the regulatory and educational initiatives needed to promote more sustainable industrial production and consumption.	• Press for the signing, ratification, implementation, and enforcement of MEAs. • Open up the negotiation process to include NGOs and labor organizations. • Empower the UNEP as the central institution to coordinate the various MEA secretariats. • Ensure UNEP receives the funding it was promised at Rio+20.

Source: Adapted from Ashford and Hall (2011b).

Table 13.3 Strategies to enhance meaningful, rewarding, and safer employment and adequate earning capacity

<i>Industry initiatives</i>	<i>Government intervention and regulation</i>	<i>Education and human resource development</i>	<i>Stakeholder involvement</i>	<i>International community</i>
• Invest in new products, processes, product-services, and services that enhance employment. • Seek productivity improvements by processes that increase the <i>productiveness</i> of workers. • Invest in increasing the capacity of the firm's human resources rather than replace labor with capital. • Engage in revenue-enhancing activities and commerce through innovation and performance enhancement rather than through cost-reduction strategies involving the reduction of jobs or wages. • Pay attention to the human-technology interface, that is, optimize matching human behavior with technological artifacts. • Foster healthy industrial relations. • Make changes to the social and hierarchical environment in the enterprise.	• Reject the liberalization of labor markets. • Remove disincentives to hire labor (e.g., remove policies that tax labor). • Promote incentives to use labor. • Support research on mechanisms for job creation (including job design) that go beyond the usual fiscal and tax incentives. • Deliberately enhance the desirable aspects of employment and job creation through labor standards and protections (for example, for health and safety), continuing education and upskilling, tax incentives to employers, and unemployment adjustment policies, including reeducation and unemployment and income guarantees. • Expand the opportunities for capital ownership by workers and ordinary citizens.	• Rethink educational pedagogy, focusing on the acquisition of both technical skills that engender systems and critical thinking and interpersonal skills involving the ability to communicate. • Improve the means to enhance lifelong training and learning.	• Encourage workers to press both for more stable, more meaningful, safer, and more rewarding employment and for opportunities to acquire capital ownership. • Educate and train workers to contribute to the adoption of more sustainable practices.	• Secure the funding and aggressively pursue the nonpayment of dues by some nations to fully empower the ILO to carry out its mission. • Begin a serious dialogue with the WTO regarding the adoption of core labor rights into the WTO agreements and machinery.

Source: Adapted from Ashford and Hall (2011b).

Table 13.4 Strategies to promote more sustainable industrial trade

<i>Industry initiatives</i>	<i>Government intervention and regulation</i>	<i>Education and human resource development</i>	<i>Stakeholder involvement</i>	<i>International community</i>
• Support or join sustainable trade initiatives/coalitions. • Obtain investment capital from banks that advocate for sustainable trade.	• Encourage national firms to trade from the “bottom of the pyramid.” • Think beyond increasing revenues to the private sector, or the balance of payments, when planning trade strategies such that disadvantaged workers, citizens, and groups in need of special protection are benefited. • Implement the commitment made by developed nations at the Rio Conference to provide financial and technical assistance to developing nations. • More aggressively pursue the adoption and enforcement of codes of conduct in the financing of projects in developing countries. • Increase the transparency and accountability of the activities of export credit agencies and sovereign wealth funds.	• Educate business and finance graduates and public administrators on strategies to promote sustainable trade.	• Press for transparency and accountability on the part of the nation’s trade representative. • Press for consultations of adversely affected and disadvantaged firms, workers, consumers, and citizens with the office of the trade representative. • Press for the inclusion of both core labor standards and environmental protection in trade negotiations and agreements. • Expand multipartite governance used in the ILO to negotiations on both multilateral environmental agreements and trade agreements.	• Develop a consistent, coherent trade policy that removes the conflicts among the different trade treaties by revising the GATT, TBT, and SPS agreements. • Develop a more open-minded approach to respecting the right of individual nations to establish their own degree of health, safety, and environmental protection beyond minimum standards <i>on a precautionary basis</i>, reflecting their cultural preferences. • Recognize the importance of securing the protection of labor and human rights in all trade agreements. • Open up the panel process to inputs from NGOs and environmental and labor organizations. • Consider adopting a multipartite governance structure. • Resolve conflicts in requirements and philosophies among MEAs, TRIPS, WTO and other trade regimes, and national environmental and public health protection laws.

Source: Adapted from Ashford and Hall (2011b).

In presenting these recommendations, we recognize that there are likely to be significant barriers to their implementation. Who is likely to win and who is likely to lose in the transformation of the industrial state towards sustainability is a question that has to be addressed. Persons, firms, and governments who benefit from maintaining the status quo or continuing its trends may drive us deeper into unsustainability. They can create a major source of lock-in and path dependence. Further, they can stand in the way of different actors who may provide better pathways. (See the discussion in Chapter 12 of a technology diffusion deficit, rather than an innovation deficit, in energy technology.)

To address these concerns, legal interventions and policies should focus on “opening up the problem space,” rather than just trying to enhance the *capacity** of existing actors to change. Policies are also needed to “open up the participatory and political space.” These include using the power of legal compulsion through law and legal institutions, antitrust law, the limiting of unjustified profiteering, the cessation of rewarding excessive consumption of both materials and energy, subsidizing the wrong kind of production and provision of services, countering and punishing financial corruption and fraud, and fair employment and wage policies.† Sustainable development requires stimulating revolutionary technological innovation through environmental, health, safety, economic, and labor market regulation. Greater support for such regulation is likely to be found if new voices are able to contribute to integrated thinking and solutions.

In summary, a sustainable development approach must be fashioned to create a competitive and green economy that creates safe, meaningful, and well-paid employment and sufficient earning capacity within the context of rapid technological change and changes in globalization.

13.3 Inequality, employment, wages, and earning capacity within the nation–state

While it is possible that the next (fifth) industrial revolution (see Section 3.3.1.1 in Chapter 3) will be driven by innovation in artificial intelligence and advances in information and communication technologies (Brynjolfsson and McAfee 2014; Bivens 2017), it is not yet clear to what extent such innovation-driven growth may “hollow out the middle class.” Carlota Perez (2016) draws a more optimistic picture providing economies “go green” in response to clear socio-political choices (see Section 3.3.1.1 in Chapter 3). See also the contrasting discussion by Hoffmann (2011) of why going green is not enough.

As should be evident from the previous section, a major argument of our work is the need to place employment, wages, and earning capacity considerations on par with environmental and economic considerations as one strategy to reduce inequality and increase access to essential goods and services. Just as thinking about the environment before industrial development is planned and implemented is necessary to optimize environmental quality, consideration of labor and income concerns also require deliberate and intelligent actions before embarking on (re)industrialization efforts in guiding industrial transformations. In this section, we explore ten options that have been presented as ways to reduce inequality and/or improve wages/earning capacity.

* In addition to capacity, initiatives need to create opportunities for, and willingness to engage in, change/innovation. See Sections 7.6.1 to 7.6.3 in Chapter 7 for a discussion of willingness, opportunity/motivation, and capacity/capability for change, respectively. All three elements are necessary for firms to adopt new innovations and generate their own innovations.

† See Speth (2008, 2010a) for policies to foster more democratic institutions, to minimize corruption of the social contract, and to limit the influence of corporations. These policies address campaign-finance reform; changes in the laws affecting corporations, mergers, and bankruptcy; and electoral process changes, among other issues.

The recent downturn of the extraordinarily long economic boom combined with the 2008 global financial crisis has revealed fundamental structural employment problems in industrialized economies.* Piketty's (2014) work on *Capital in the Twenty-First Century* further shows that wealth inequality is increasing and heading back to the levels seen before World War I.† Thus, industrialized nations face a challenging future in terms of being able to provide citizens with meaningful employment and adequate earning capacity that can begin to close the inequality gap between the rich and middle class/poor. In fact, without specific interventions that can redistribute (or distribute) wealth, well-paid employment may not be sufficient to reduce inequality.

Decoupling strategies deployed to promote a green economy may only have a marginal result in creating jobs. Thus, while economic growth may be decoupled from environmental impacts, the process may not adequately impact inequality because of important structural changes in technology and global finance.

We agree with Smith et al. (2010) that *overall* wealth and consumption are unlikely to decline in the medium term, but see a critical need to focus on employment and earning capacity alongside the emphasis they place on innovation. We also see the need to broaden the focus on technological innovation to include organizational, institutional, and social innovation.

A key question, then, is what options exist to promote employment and earning capacity in the face of the technology-based displacement of jobs by the very process of creative destruction we advocate? In fact, a revolutionary (as opposed to evolutionary) pace of change that disrupts existing industrial processes could have dramatic impacts on employment, where dirty industries are replaced by green enterprises or cooperatives that require a workforce with an entirely new skill set and organizational structure. The form and size of these green enterprises or cooperatives is likely to vary significantly by sector and geographic area, so it is difficult to know if they would create more or less jobs. While such dilemmas present challenges to advancing a sustainable development agenda, there are several specific options (discussed below) that are worth exploring.

In general, earning capacity can be enhanced by some combination of two contributions – wages earned through employment and money earned through the ownership of productive capital. The former requires the restructuring of work to enhance the contributions and *productiveness* of labor – as opposed to increasing labor productivity by enhancing the productiveness of physical capital (N.A. Ashford et al. 2012a, 2012b).‡ The latter includes

* The 2009 Nobel Prize in economics was given to three economists who demonstrated that some unemployment is inevitable, even in economies that are in equilibrium because of “search friction” – also known as “structural unemployment” or “equilibrium unemployment” – because of the mismatch between the skills of the current workforce and the needs of employers (Cho 2010, p. 330). Unemployment exists alongside vacancies in jobs. In the United States, while structural unemployment was considered to be 2–3 percent, equilibrium unemployment seems to have now approached a number that is two or three times that historical measure. For a contrary view, see Romer 2011 who argues that most of U.S. unemployment is the consequence of low demand for goods and services by consumers, which in turn is fueled by high unemployment among them, as well as by the collapse of the housing market and unprecedented indebtedness. Neither view emphasizes technological displacement or trade as major factors.

† While such trends have been well documented for specific countries and regions – for example, see Krugman's (2007) analysis of the U.S. economy – Piketty's analysis of data from twenty countries provides a unique perspective on how wealth and inequality have changed over the past century across the globe. For an informative critique of Piketty's work, see Galbraith (2014).

‡ We distinguish *productiveness*, which refers to the inherent contributions of labor or capital to output, from *productivity*, which is an artificial ratio of output per unit of labor or capital. A more productive machine that is capable of faster output provides an example of capital productiveness, whereas a more productive worker (due to enhanced skills/knowledge) who is more creative, can work faster, and/or

ordinary investment from wage savings that people might make through the purchasing of stocks, bonds, and property; changes in ownership structures of businesses through mechanisms such as employee stock ownership plans (ESOPs); and enabling people to acquire capital with the future earnings of capital through borrowing – based on binary economics (R. Ashford et al. 2012; R. Ashford 2013).

In Box 13.2, we list interventions that include not only structural and technological changes, many of which are discussed in greater detail below, but also changes in the purchasing power of workers, consumers, and citizens that are essentially income and wealth transfers that could be implemented independent of technological and structural changes of the economy. They require a dramatic shift in political leadership and social commitment. They are increasingly discussed more seriously in Europe than in the U.S.

A point worth re-emphasizing is that from a Schumpeterian perspective, liberalizing the labor market with greater employer freedom to lower wages, shed labor, and utilize temporary or contingent employment rewards those who do not effectively utilize human skills and talents (Kleinknecht 1998, 2015). This again underscores the failure of neo-classical economics to take the dynamics of both economic and social innovation into account.

Box 13.2 Interventions to address inequality, wages, and purchasing power

- Redistribute income and wealth
 - Change the taxation of income and wealth (see the discussion of Option 1)
 - Increase the minimum wage
 - Provide a guaranteed minimum income
 - Pay those doing unpaid work, such as child-rearing/care of the elderly
- Change the effective taxing of labor and pollution/energy by taxing pollution/energy and reducing the tax on labor
- Engage in Keynesian spending (see the discussion of Option 2)
- Shorten the workweek with or without a reduction in wages (see the discussion of Options 3 and 4)
- Supplement the shortfall in paid wages during economic downturns (see the discussion of Option 5)
- Increase the contribution of employment to productivity improvements by designing work back into the production process and the delivery of services (see the discussion of Option 6)
- Redesign products, production processes, services, and systems (see the discussion of Option 7)
- Change the nature of consumer and human-centered demand (see the discussion of Option 8)

produce higher-quality outputs provides an example of labor productiveness. As a statistical artifact, either form of productiveness can increase labor productivity. Thus, it is important to know the productiveness of labor, capital, and the labor–capital interface because this provides a more accurate measure of where a company's/nation's competitiveness lies – i.e., in its capital, its labor, the interface between the two, or a mixture of two or more of these elements. Energy also has to be accounted for as an independent source of economic growth (Ayres and Warr 2009).

- Adopt the recommendations of Marjorie Kelly in *The Ownership Society* in creating “B-corporations” to invest in public services (see the discussion of Option 9)
- Increase the participation of workers in employee stock ownership plans (ESOPs) in their places of work (see the footnote on ESOPs in the discussion of Option 10)
- Institutionalize the central tenets of binary economics allowing people to gain income from collectivizing their financial capital currently restricted to banks and investment cartels (see the discussion of Option 10)

As discussed in Section 3.5.2 in Chapter 3, Halina S. Brown (2016) poses the relevant question of how to address income inequality while also promoting sustainable consumption. Her key finding is that household income is a strong predictor of that household’s carbon footprint. Specifically, as shown in Figure 3.4 (in Chapter 3), among the U.S. households the correlation is linear for the bottom 80 percent of income categories (up to approximately \$120,000 for a family of four) and accelerates above it (Ummel 2014). In other words, the more we earn, the greater our greenhouse gas (GHG) footprint is. As a consequence, if we were to decrease income inequality by reducing the number of households with the extremes of income (at the top and at the bottom) and increase the number of households in the central categories, total consumption-based GHG emissions would remain more or less the same. However, if we reduced the proportion of households in the lowest income bracket by moving them into the middle-income category, without touching the households in the top category, the total emissions would increase. **The conclusion of this analysis in terms of inequality and sustainable consumption is that raising the income of those who most need it will result in greater total greenhouse gas emissions unless we simultaneously reduce the income at the top.** Of course, there are other complementary policies that can reduce GHG emissions related to embracing the idea of the circular economy, de-materializing and de-energizing products and services, and reducing consumption across the board. Interventions discussed throughout this chapter address all these complementary initiatives in greater detail.

In the text below, we discuss a range of options that could reduce inequality and promote employment and earning capacity.

- 1 *Transfer wealth or income from capital owners and highly paid workers to those underemployed or unemployed – a redistribution of wealth or income.*

The idea that redistribution measures can be effectively used to close the inequality gap is not without historical precedent. By looking at over a century of tax data, Piketty (2014) makes a convincing case that progressive taxation following World War II – which reached 90 percent or higher on the highest incomes in the U.S., Britain, and Germany during the 1940s – is associated with declining inequality during the same period. Also, the rapid decline in taxes on the highest incomes that began during the Reagan and Thatcher era in the 1980s mirrors the growth in inequality that occurred over the same time period. In a smaller study, Prasad (2008) assessed the redistribution of income through taxes, social transfers (social insurance, pensions, and unemployment insurance), and social expenditures (education, health, water, and other social services). By reviewing over fifteen years of data in a large number of developed and developing countries, he found that the redistributive impact of taxes and social transfers, which became increasingly regressive over time, have not been able to reverse income inequality. On the other hand, as experience

in Mauritius, Malaysia, the Nordic countries, and for low-income people in Brazil has shown, social policy can be used more aggressively to address inequality without adversely affecting growth or employment objectives. Both tax (fiscal) and social policy are needed to support employment objectives. Bivens and Blair (2016) make a strong case that progressive taxation is just what we need today. See also Goodwin (2014a; 2014b; 2017).

A challenge now facing efforts to promote redistribution policies is the ease at which capital can move around the world in search of tax havens. There is certainly a fear that executive talent and wealth will flee any country that significantly raises taxes to the detriment of the economy. However, it is far more likely that any changes that occurred would have a limited impact on economic productivity (Piketty 2014). Perhaps, the more challenging problem is the influence of the wealthy on policy formulation (Gilens and Page 2014).^{*} Given the likely extent and duration of taxation required to close the inequality gap, it is unlikely that a progressive and significant redistribution agenda could be established and maintained in the current political climate. Further, a redistribution agenda by itself does not directly address environmental concerns. Thus, at least for the near term, we are convinced of the need for other financial mechanisms that can *distribute* (as opposed to *redistribute*) wealth based on market principles (see Option 10).

2 *Engage in Keynesian spending for labor-intensive projects improving infrastructure, with government and taxpayers footing the bill.*

Following the 2008 financial crisis, the U.S. engaged in a modest Keynesian approach to job creation in the face of insufficient current demand for public services. In 2009, Congress enacted the American Recovery and Reinvestment Act (ARRA). The act increased funds to state and local governments by increasing federal matching funds on items such as Medicaid and education; extending and expanding unemployment benefits; purchasing goods and services, for example, by funding multi-year infrastructure projects; and providing temporary tax relief for individuals and businesses (CBO 2013). The stimulus package was funded through deficit spending, with the final budget deficit estimated to be \$830 billion between fiscal years 2009 and 2019 (CBO 2014).

While the impact of such stimulus programs is likely to be effective over the short term – for example, it was estimated that ARRA created 76,000 new jobs during 2013 – the long-run impacts could result in a reduction of economic output (CBO 2014). Thus, as a strategic policy option, it presents only a temporary solution and may only promote sustainable development if the program is specifically targeted at green investments.[†]

3 *Spread existing work out over a larger population by shortening the workweek, but without maintaining wage parity.*

* An important empirical study of 1,779 policy issues in the U.S. provides compelling evidence that economic elites and organized groups representing business interests have a significant impact on U.S. government policy (Gilens and Page 2014). In contrast, the average citizen and mass-based interest groups were found to have little or no independent influence.

† A study by Pollin et al. (2008) calculated how many jobs would be created in the U.S. by a \$100-billion green stimulus program. According to their model, a \$100-billion green stimulus is projected to create two million jobs, while a “traditional” stimulus in house hold consumption would create 1.7 million jobs. Notably, spending \$100 billion within the U.S. oil industry would create only around 542,000 jobs (ibid.). Apart from the elevated performance of a green stimulus in job creation, it also entails a series of long-term benefits, including increased consumer savings through the reduction of energy bills; the stabilization of oil, gas, and coal prices through reduced demand and increased energy diversity; and, obviously, a cleaner, low-carbon environment (ibid.). See Section 5.3.2 in Chapter 5 for additional commentary on the effects of a greener economy on employment.

One potential strategy to increase employment is to spread available work among a greater number of people by reducing the number of hours worked each week. If no adjustment is made to hourly pay, such an action would represent a redistribution of wage income from existing workers to a larger pool of potential workers. Many commentators advocate spreading out the work without addressing the question of the level of overall wages paid (Jackson 2009; Schor 2010, 2010b, 2010c; Speth 2010a). By itself, increasing the number of workers employed does nothing or little to redistribute the share of profits of industrial production or the provision of services from capital or business owners to workers. Asking wage income to be shared by more workers under the euphemism of enticing some workers to either enjoy more leisure time or to spend more time taking care of their children and their elderly parents* seems to ignore the fact that the majority of those working in a depressed economy want to work more, not less. And, of course, these two activities – leisure and home care – are not the same. Workers are also likely to demand higher hourly wages for a shorter workweek to maintain wage parity or seek a second job, leading to higher job turnover and net unemployment for some groups. For these reasons, the French adoption of a thirty-five hour workweek was for a while at best a temporary moderate financial success for most workers, but not successful for some, and it had mixed results on conditions of work and gender (Hayden 2006).† The overall level of employment was essentially unaffected (Estevão and Sá 2008).

Those who advocate for a reduced workweek, tend to associate the strategy with objectives such as enhancing “work–life” balance, reducing unemployment during economic downturns (see Option 5), or reducing environment impacts through reduced consumption and less energy-intensive living patterns (Coote and Franklin 2013). Thus, if adopted, the strategy should be considered alongside broader efforts to restructure physical and social structures to advance sustainable development. For example, it is possible that a reduced income via a shorter workweek would not present a problem if basic goods and services, such as health care, were made affordable or provided for free. Under such a scenario, the provision or financing of these goods and services could be achieved through cooperative models of service provision (see Option 9) or a binary economic system of corporate finance (see Option 10), respectively.

4 *Spread out existing work over a larger population by shortening the workweek, but with the maintenance of wage parity.*

One way that a shorter work policy could succeed without making any radical changes in physical and social structures, would be to ensure that worker pay remains unchanged through the transition. Thus, workers would effectively be paid more per hour to maintain their income. Such a strategy would require a *redistribution* of income from either profits or the tax base (see Option 1) or a *distribution* of income earned by giving workers market opportunities to acquire capital with the future earnings of capital, based on

* Ironically, giving high-wage workers more leisure time to care for their children or parents is likely to displace low-wage care-givers and reduce their consumption, which is already low from an equity perspective.

† Hayden (2006) provides a detailed analysis of the implementation of the shorter workweek with some wage retention that was accomplished by reducing the payroll taxes levied on employers. Thus, rather than wage parity maintained by transferring wealth from employers to workers, it was actually accomplished indirectly by transfers from the taxpayers to the workers. Even so, because of concessions in work-time flexibility of hours (including evening and weekend work) that could be demanded – on short notice – by employers of their workers in any particular week, the advantages of extra leisure time were compromised by uncertainty in time demands on workers, especially those that were lower-paid and less-skilled, as well as reductions in overtime pay.

binary economics (see Option 10). See Ashford and Kallis (2013) and Kallis et al. (2013) for a deep discussion of the benefits and difficulties associated with a shorter workweek.

- 5 *Limit the elimination of jobs during economic downturns; supplement the shortfall in paid wages for workers on furlough or working shorter weeks from a government-administered, employer-financed fund.*

It is common practice in the U.S. to lay off workers during economic downturns. However, such action could leave firms without a skilled workforce when the economy recovers if the workers have found employment elsewhere. To address such problems, Germany, Austria, and several other European countries have established “Kurzarbeit” (short work) policies that encourage employers to retain workers – for six to eighteen months – during periods of economic decline. For example, in Germany, employees could either be on furlough or a shorter work schedule with the wage shortfall made up by a government fund to which employers had contributed in better times (Kulish 2010). Incentives can also be offered to encourage workers to obtain additional training and skills during their period of Kurzarbeit (see Option 6). When compared with the U.S. economy, the Kurzarbeit policy in Germany enabled firms to realize impressive growth as the economy began to recover in 2010 (ibid.).

The success of internal flexibility mechanisms such as the Kurzarbeit policy indicates that the direct protection of jobs, rather than indirect monetary and fiscal policies, may be a policy direction worth serious attention.

- 6 *Increase labor’s contribution and therefore its claim on the profits from production and services by upskilling and redesigning work back into production and services.*

The achievement of this objective would require a redesign of labor’s role in commercial activities that would reverse the decades-old trend in replacing labor with capital. Knowledge applied in an iterative way (knowledge injected periodically or continuously over time) can have a cumulative effect, with new knowledge building on past knowledge acquisition and investment. This is akin to adding financial flows to previous investments that have accumulated and appreciated in value and is unlike investments in physical capital that depreciate in value over time because functionality decreases due to regular utilization. Knowledge capital, even if it sometimes becomes less valuable over time, may nonetheless grow (accumulate) from using it and adding to it over time (Foray 2006). This observation has direct relevance for the choices that are made as to which factor endowments to invest in to produce a product or provide a service. Hardware deteriorates, but knowledge held by a skilled person who continues to learn can appreciate in value for many years.

Given the labor-displacing potential of technological innovation, Brynjolfsson and McAfee (2014) call for a significant research and development effort to target innovation at augmenting human ability rather than substituting for it. Similarly, we have argued for the need for radical improvements in the human–technology interface that creates new relationships between human capital and technology (Ashford and Hall 2011b). Rather than educating students and professionals in how to remove labor from the production process – using techniques such as lean manufacturing – a far more challenging and worthwhile endeavor would be to find ways to reintegrate meaningful work back into the industrial economy. To this end, the 2018 MIT Inclusive Innovation Challenge may have the potential to advance new ideas on how to create meaningful and well-paid employment in a digital economy.* The current economic growth strategy that essentially replaces

* See <http://www.mitinclusiveinnovation.com/the-challenge/> (accessed February 11, 2018).

labor with physical capital and energy under the guise of promoting efficiency and productivity is unsustainable. Redesigning the nature of work by searching for symbiotic relationships between humans and technology is one way to promote the earning capacity of workers. The alternative is to accept that capital will continue to displace jobs and search for other mechanisms to distribute wealth (see Options 1 and 10).

- 7 *Meet essential human needs in a less-expensive and less resource-intensive way by redesigning products, production, services, and systems.*

Innovation will play a central role in the delivery of sustainable goods and services. In this work, we have expressed the need to pay attention to technological, organizational, institutional, and social innovation, each of which could fundamentally change the supply and/or demand for goods and services, with equally significant changes on employment and income.

Innovation can be considered from four different perspectives:*

- 1 *Product changes* (for example, the creation of a new product/technology/service);
- 2 *Process changes* (for example, improvements or efficiency gains in the process of manufacturing a product or delivering a service);
- 3 Shifts from products to *product-services* (for example, purchasing a photocopying service rather than a photocopying machine); and
- 4 More far-reaching *system changes* (for example, a dramatic realignment of producers, service providers, and other actors to create entirely new ways of delivering a product or service – perhaps through a cooperative; see Option 9).

The first two categories have received the most attention in the literature on job displacement and wage inequality (Vivarelli and Pianta 2000). In particular, process changes – productivity gains that occur because of the improved productiveness of capital (such as the use of more efficient technology) – are often cited as the main cause of job displacement (see the several works of Autor and Acemoglu discussed in Section 5.2.1 in Chapter 5). In Europe, the concern that process innovation was displacing jobs led to a growing interest in product-service innovation/systems (Mont and Tukker 2006; Tukker and Tischner 2006). These types of innovation are targeted on ways to sell “need fulfillment” rather than products that the customer must then use to satisfy his or her own needs. For example, the decision of Xerox to sell a photocopying service rather than photocopying machines means that customers no longer need to worry about owning and operating equipment. This new form of business model also means that Xerox must rethink the design of its machines for ease of recyclability and longevity – two factors that are critical to reduce the ecological footprint of products. It will be interesting to see how this type of product-service model will take shape in the emerging autonomous vehicle market. For example, will automobile manufacturers completely rethink the design, durability, and recyclability of their vehicles if they will ultimately be responsible for their entire lifecycle?

A critical aspect of product-service innovation is that labor can be essential to integrate technology (a product) and its associated service(s). Thus, a fruitful avenue of research would be to consider how product-services can contribute to competitiveness, more sustainable production and consumption patterns, and create meaningful and well-paid employment. Further, it is worth stressing that all four types of technological change – technological, organizational, institutional, and social – are necessary to achieve sustainable development.

* See Section 6.2.1 in Chapter 6 for a discussion of the different types of technological innovation.

Rigid industries whose processes have remained stagnant face considerable difficulties in becoming significantly more sustainable. Shifts from products to product-services rely on changes in the use, location, and ownership of products in which mature product manufacturers may participate, but this requires significant changes involving managerial, institutional, organizational, and social (i.e., customer; see Option 8) innovations. Changes in sociotechnical systems, such as transportation or agriculture, are even more difficult. This suggests that the creative use of government intervention – through a sustainability-focused national industrial policy – is a more promising strategic approach for achieving sustainable industrial transformations than relying on more neoliberal policies.*

- 8 *Change the nature of consumer and human-centered demand by encouraging cultural change more focused on using disposable income on services with significantly less capital and energy intensiveness and much more labor-intensiveness.*

Changing the nature of demand is fundamental to the sustainable consumption movement. It requires not only a decrease in material- and energy-intensive products and services, but also anticipates a shift of demand from “stuff” to human services – see Jackson and Victor (2011), Cohen et al. (2010), and Bengtsson et al. (2018).

One strategy that could influence consumer purchasing to support labor would be to create a “made by humans” label (Brynjolfsson and McAfee 2014). Similarly, a label could be developed to indicate whether a product or service is “inherently sustainable.” Such a label could take the full lifecycle into account and only be granted to a product or service if it has a negligible negative impact on the environment and society. Ideally, the certified product or service would enable the environment and society to flourish.

- 9 *Promote the creation of cooperative economy to broaden ownership.*

The cooperative economy involves the replacement of capital ownership in its present corporate form by private investment of individuals promoting sustainable development in so-called “benefit corporations” (Kelly 2012).† Business models that support a cooperative economy include cooperatives, employee-owned firms, credit unions, community land trusts, foundation-owned companies, and any form of organization that is owned and controlled by its workers or community. The notion of a cooperative workplace has a long history that reaches back to the 1844 Rochdale Principles,‡ which provide the foundation for the Cooperative Principles (or values) – including democracy, equity, and common ownership of property – that underlie modern day cooperatives.§ Cooperative ownership structures can be found in many sectors

* See Chapter 8 for a discussion of government policies to foster innovation, economic growth, and employment.

† See also Quarter et al. (2009) for an informative discussion of the “social economy” in Canada. The social economy is an umbrella term that relates to a wide range of organizations focused on meeting social needs and which have economic aspects such as the payment of wages and benefits to employees. The social economy is perhaps a broader notion than the cooperative economy, but they have much in common. For a discussion of the emerging social economy in Europe, see Borzaga et al. (2014).

‡ See the Co-operative Heritage Trust, *The Rochdale Principles*, <http://www.rochdalepioneersmuseum.coop/about-us/the-rochdale-principles> (accessed December 19, 2017).

§ For more information on existing cooperatives, see the International Co-operative Alliance (ICA), which was established in 1895 “to unite, represent and serve co-operatives worldwide” (source: ICA, The Alliance, <https://ica.coop/en/whats-co-op/co-operative-identity-values-principles>, accessed December 19, 2017). See also the National Cooperative Business Association (founded in 1916 as the Cooperative League of the United States of America), that supports cooperatives that are jointly owned and democratically controlled (source: NCBA, <http://www.ncba.coop/>, accessed December 19, 2017).

of the economy, especially in healthcare provision, retail, food stores, agriculture, art, and restaurants. Cooperatives are less likely to be found in large-scale manufacturing or pharmaceutical firms that engage in significant research and development. These larger organizations are the primary targets for Option 10, which focuses on a new approach to corporate finance/investment.

If Brynjolfsson and McAfee (2014) are correct and technological innovation (specifically, “digitization”) is set to displace vast numbers of workers with “ordinary” skills and abilities, the question is how will these people engage in the economy? The cooperative economy presents one strategy for creating employment that can deliver essential goods and services to communities and regions. The democratic nature of cooperative organizations* means that the owners decide what work they wish to engage in and what remunerative rewards they should receive. Thus, there is potential for greater wealth, should the owners decide to pay themselves higher incomes (Hoffman 2012). Further, the place-based nature of cooperatives means they are directly concerned with issues such as the vitality of the local community and environment.† The emphasis cooperatives place on equity provides an avenue to address gender-based inequalities in the workplace (Rothschild and Tomchin 2005) and similar issues related to workforce diversity (Meyers 2005). The modern cooperative movement has also been linked with the social conditions that can promote greater happiness (Kaswan 2014). All of these benefits result in what is called the “cooperative advantage” of jointly owned and democratically controlled organizations over investor-owned firms (Birchall 2003; Novkovic 2008). The democratic nature of cooperatives also asks (or perhaps challenges) its members to reconcile their own personal interest in democratic citizenry with the capitalist demands that come with business ownership. Schoening (2005, p. 293) argues that by reconciling these two perspectives, “cooperatives develop a spirit of Cooperative Entrepreneurialism that allows them to engage in free enterprise, while also adhering to the cooperative values of equality and democracy.” Such an alignment of interests may be essential to create truly sustainable goods and services. Put differently, it may be more challenging to transform investor-owned firms where the interests and incentives for employees and owners are not naturally aligned.

While the ecological, employment, and democratic benefits from a cooperative economy are promising, a critical question is whether the broader capital ownership through cooperatives would be sufficient to close the inequality gap. As long as for-profit corporations exist and continue to advance an “extractive ownership” model (Kelly 2012), the financial wealth being created (i.e., profits, retained earnings, and increases in share prices) and concentrated is likely to be far greater than that generated from cooperatives,‡ which also intentionally distribute their wealth among a great number of people. Thus, additional mechanisms may also be needed to broaden the wealth being created by capital, as opposed to labor, productiveness (see Option 10).

Finally, as the number of benefit corporations continues to increase in the cooperative economy (Surowiecki 2014), specific mechanisms may be needed to enable these organizations to remain viable during economic downturns. Whereas for-profit organizations

* An important work by Rothschild and Whitt (1986) demonstrated the centrality of building organizational processes that enabled members’ voices to be heard and considered, namely substantive workplace democracy, for cooperative organizations to remain intact and vigorous.

† In many ways, cooperatives could be described as advancing the notion of *eco-development*, which promotes ecologically sound regional development (see Section 2.3 in Chapter 2).

‡ More favorable tax treatment of dividends and profits associated with cooperatives, as compared with conventional corporations, could be justified since cooperatives also create public benefits for their intended societal beneficiaries that may not be captured or appropriated by the cooperative investors. Thus, wealth creation in cooperatives includes both private benefits and public goods. Traditional investors are usually indifferent to the creation of public goods that they cannot directly profit from.

can shed labor or curtail their social programs/mission without being sued by their shareholders, benefit corporations (especially those certified as a “B Corp”)* must adhere to both their social and fiduciary responsibilities. Thus, enabling benefit corporations to take advantage of, for example, the Kurzarbeit (short work) policy (see Option 5) may provide an important lifeline for these corporations during periods of economic turmoil. Similar policies may be needed to enable benefit corporations to remain competitive with for-profit corporations, or at a minimum create a more even playing field if needed.

- 10 *Better enable poor and middle-class people to become owners by extending to them competitive market opportunities to acquire capital with the future earnings of capital, based on binary economics.*[†]

The mechanism by which competitive market opportunities for poor and middle-class people to acquire capital with the future earnings of capital, based on binary economics, is described in Section 3.6.1 in Chapter 3. It should be stressed, however, that the approach presented here is one of a number of potential ways in which a binary income could be earned.[‡]

Binary economists’ fundamentally different view of economic growth has important implications for how they think about how economic growth can be more effectively promoted and how people can participate in this growth. Conventional economists assume that the gains for most people must come in the form of more jobs and higher wages, lower prices for goods and services, and welfare redistribution – all functions of productivity improvements. Binary economists, on the other hand, see far greater potential gains for most people by enabling them to expand their participation in the economy by acquiring capital. According to binary economics, a broader distribution of capital acquisition provides the rational expectation of more broadly distributed capital income in future years to people with a higher marginal consumption spending rate, and therefore more incentive to employ capital and labor in earlier years. This principle is called the principle of binary growth (R. Ashford 2013).

If the effect of technological innovation is to displace, reduce, and supplement the contribution of labor to production while increasing the contribution of other kinds of capital, binary economists argue that we need to employ the existing mechanisms (that presently enable well-capitalized people to acquire that capital with the future earnings of capital) more broadly to enable *all people* to acquire a share of this growing capital productivity (R. Ashford 1998). More specifically, like people who are already well capitalized, every individual needs to be enabled to acquire capital, not merely with the earnings of

* See “The B Corp Declaration,” available at <https://www.bcorporation.net/> (accessed December 19, 2017).

† We would like to thank Robert Ashford for his contribution to the description of binary economics in this section and throughout this work.

‡ Many people are unaware that the rationale for the ESOP (employee stock ownership plan) stems from the theory of binary economics (R. Ashford 2006). In its current form, the ESOP provides a limited mechanism for workers to acquire capital through a combination of de-ferred labor compensation, future company revenues, and corporate tax deductions. Thus, significantly revising the structure of the ESOP and expanding who can receive a binary income from the scheme would be one way in which the theory discussed in this section could be applied. Further, extensive research on firms with ESOPs has found that organizations with a participatory culture *and* profit sharing – i.e., they have a cooperative structure (see Option 9) – tend to outperform those that do not have both of these elements (Blasi et al. 2013). Thus, the ESOP could be a valuable performance-enhancing mechanism in a cooperative economy.

labor, but also increasingly with the earnings of capital. R. Ashford (2006, p. 12) provides the following arguments for broadening (or democratizing) the acquisition of capital.

Compared to well-capitalized people, poor and working people are severely disadvantaged when it comes to acquiring capital. In general, mainstream economic policy requires them to acquire capital by using their current labor earnings while those who already own substantial capital can acquire additional capital either with their capital earnings or with borrowed money that is repaid with the earnings of the capital acquired. Because most employees need their current labor earnings to provide for their families' current living expenses, [Louis] Kelso proposed an approach to capital acquisition that does not require workers to use their current labor income either but rather enables them to acquire capital using the future income of the capital acquired just as wealthy people are presently able to do.

Binary economists maintain that (1) using labor earnings is *not* the best way for poor and working people to acquire capital and (2) limiting capital acquisition with the earnings of capital primarily to wealthy people is *not* the best way to promote economic growth and prosperity. According to government statistics, almost all non-residential capital in the United States is acquired with the earnings of capital; and very little non-residential capital is acquired with the earnings of labor. Most poor and working people do not have enough labor earnings to support themselves and their families and consequently find themselves increasingly in consumer debt. If most poor and working people are ever to acquire viable capital estates and eliminate their consumer debt, they will need to acquire capital with the earnings of capital just as wealthy people do.

Allowing people to use binary income as they desire is the simplest application of the theory (as suggested in Options 3, 4, and 9), and aligns with the principle of binary growth, but there are other ways in which the income could be used. For example, the binary income could be limited to spending on products and services that are certified as "inherently sustainable" and/or "made by humans" (see Option 8).^{*} Such action could be a useful way to create new markets for the next generation of sustainable products and services. Alternatively, the binary income could be used to subsidize (or provide) services such as health care for the poor or welfare payments.

One critical difference between the binary economic solution and that presented in Option 1 is that binary economics is concerned with broadening the voluntary process of *distribution*, whereas Option 1 focuses on *redistribution*.[†] In the binary analysis, the consequences of concentrated ownership – which in conventional economics are either ignored, treated as at best a secondary matter, or touted as a beneficent source for the creation of jobs or the payment of welfare redistribution – are viewed instead as a significant impediment to fuller employment and a monopolistic suppression of greater growth potential. The binary economics solution focuses on enabling people to increase their earning capacity by acquiring capital via voluntary transactions with the *future* earnings of capital. In contrast, redistribution mechanisms seek to tax current income and wealth.

^{*} The task of classifying whether a product or service was "made by humans" is likely to face significant definitional and theoretical challenges. For example, if a worker controls a complex machine to manufacture a product, can this product be classified as human made? Binary economists maintain that the cost of employing capital and labor is the most objective measure of the value of the work each productive input contributes to production.

[†] For an explanation of how the binary approach does not involve any redistribution, see R. Ashford (2013) and R. Ashford et al. (2012b).

Thus, while the binary solution would not address the *existing* levels of inequality described by Piketty (2014) and others (Krugman 2007),* it would provide low and middle-income groups with a mechanism to substantially enhance their future earning capacity by supplementing any labor income and transfer payments they receive with capital income, which could help close the inequality gap or prevent it from growing.

One sustainability concern with the binary economic solution is that it predicts that substantially more economic growth would result from broadening capital acquisition with the future earnings of capital than would result if the same capital acquisition were more narrowly acquired.† The prospect of this substantial incremental growth could have severe implications for the environment.‡ In response to such concern, R. Ashford and Shakespeare (1999, pp. 379) argue that

the promise of binary growth is a promise of green growth. It includes the promise not only of a population better able to afford more food, clothing, shelter, health care, transportation and communication around the world but also the promise of greener products, greener processes, greener activities and tastes as well as a consumer population with stronger property interests in the environment and better able to afford the greener choice.

We believe that without a social innovation in consumer demand, it may be necessary to channel the use of binary income as described above.

Finally, whereas Kelly's (2012) "generative" (or cooperative) economy advances an alternative corporate structure that would hopefully spread ownership and operate in a more socially responsible manner (see Option 9), binary economics offers a way for major national and multinational corporations to reform their approach to corporate finance by operating in a more ethical and profitable way. Given that both types of organization will coexist for the foreseeable future, it is important to think about how they might both advance the sustainable development agenda. If adopted by major national and multinational corporations, a binary economics approach could enable corporations to (1) spread ownership among their employees, customers, "neighbors" (e.g., people living near corporate facilities in poor neighborhoods and company towns), and other targeted groups (without requiring personal payroll deductions or other investments on their part); (2) enhance the earning capacity of those receiving the binary income; and (3) spawn an economy in which sustainable production is more affordable, politically favored, and more conducive to sustainable and environmentally friendly growth. Given the potential ways in which a binary solution could help advance a sustainable development agenda, we believe the approach deserves some serious attention.

* See the ongoing analysis of the "State of Working America," by the Economics Policy Institute (EPI), for a useful review of wealth, incomes, wages, and employment in the U.S. (Source: EPI, <http://www.stateofworkingamerica.org/> (accessed December 19, 2017)).

† We believe that the potential for binary growth should also be assessed in the context of Robert Ayres's observation that past economic growth owes much of its success to cheap sources of energy that he maintains will not continue in the future (Ayres and Warr 2009).

‡ The same sustainability concern could be levied on any economic strategy designed to promote growth. However, growth strategies that do not have an explicit mechanism to distribute wealth more broadly may distribute any increase in costs related to a green transition disproportionately (and unfairly) on the poor and leave them comparatively less financially able to bear them.

Deliberately focusing on the above options, rather than attempting to return to a traditional growth-based, export-led economy, allows for creative experimentation with what is likely to become the major social concern of government – i.e., to address inequality, unemployment, and poor earning capacity – without subordinating the interests of poor and middle-class people to the more affluent. Such subordination causes redistributions that exacerbate the disparity among economic winners and losers, with many people ending up as the losers.

Some of the options have the potential to limit wasteful growth (7, 8, and 9) and underutilize human capital (4, 5, and 6). Some options (1, 2, 3, 4, 5, 6, and 10) require other complementary policies to limit wasteful consumption. What should be evident is that there is no simple solution and that a portfolio of initiatives that target specific problems and reinforce one another is needed.

While some options (2 and 5) may be relatively straightforward to implement, others (1 and 10) may face significant political barriers and may only be viable following a social awakening or global event. What is troubling is that the global financial crisis seems to have been unable to open the door for new, transformative ideas. The pre-crisis financial systems and national approaches to development remain largely intact.

Finally, the actors responsible for implementing each option vary. Governments (1, 2, 3, 4, 5, and 10), national and multinational corporations (3, 4, 5, 6, 7, 10), education/academia (6, 7), and workers (3, 4, 5, and 9) would each need to take lead or supportive roles in realizing a number of the options. Thus, while national governments have the legitimate voice in the international arena, they will need the support of industry, educators, workers, communities, and other entities to advance the full complement of options.

13.4 Changes in globalization, trade, and the global financial system

The interventions discussed in the previous sections will offer some relief from slowing economic growth, destruction of the environment, wage stagnation, and increasing inequality within nations in the developed world, but much more is needed. Changes in globalization, trade, and the global financial system make those interventions difficult.

Furthermore, however daunting the challenges are for developed nations, the large and increasing global problems of economic and political migrants, the disintegration of shared prosperity and contraction in the European Union, belligerence in the Asia-Pacific region and Eastern Europe, resurgence of the global nuclear threat, and the expansion of cultural and religious geopolitical wars in the Middle East form a backdrop of the enormous complexity facing humanity.

Scholars have weighed in on the relative contributions of technological displacement and globalization/trade to employment, wages, and purchasing power. These were addressed in the discussion of “the perfect storm” in Section 0.4 of the Overview. We are persuaded that technological displacement has been the major negative driver since the 1970s and that a resurgence should be expected with the advent of innovation in computer-related technologies and artificial intelligence (captured in the work of Brynjolfsson and McAfee, Autor, and Acemoglu). With the significant reduction of purchasing power among a sizable part of the population, one should not expect developed economies to attain their historical rates of economic growth, and they need to recognize that only a small part of the population will benefit from that growth.

More recently, trade, currency manipulation, and the fault-lines of the global financial system and the Eurozone have been recognized as a major and increasing distortion of future prospects for improvement (see the work of Bivens, Stiglitz, and Varoufakis). Trade practices, in particular, whereby some nations have benefited by not internalizing the real costs of using suboptimal energy and physical and human capital, and through sheer inefficiency in the use of those endowments, have distorted global trading regimes through

both underpricing and through carbon (and environmental) leakage (see Chapter 12). In addition to undervalued currencies and currency manipulation, border tax adjustments in products and services are recognized as long overdue, although importers in developed countries – as well as exporters in emerging economies – would vehemently oppose these measures.

Opposition in both developed and emerging economies is to be found in authoritarian regimes and the economic elites – see Gilens and Page (2014), Piketty (2014), Atkinson (2015), and Stiglitz (2010) – who exercise overwhelming control over political agendas that would otherwise benefit the vast majority of people.

In this work, we have also emphasized the need to “open up the problem and design space” as well as the “political space” to encourage democratic, comprehensive, and integrative solutions to problems. While working at the margins within nations is also important – e.g., reform of the tax treatment of investment, income, and profit; democratic expansion of the ownership of productive capital; environmental initiatives; and labor market reforms – the distortions of globalization, trade, national expenditures for military activities, and the movement of migrants all require that achieving sustainability is much more than a technical, economic, and environmental challenge. It is a political and geopolitical challenge that requires nations to engage fully in reducing global distortions and conflict.

In this work, we have endured to bring together the full complement of factors that need to be considered and addressed to transform the industrial state. The complexity of such a transformation will require a systemic and integrated approach to change. We hope this work provides a transdisciplinary framework that indicates where change is needed and how expanding the design *and* political space for integrated solutions can result in revolutionary change towards sustainable development.

13.5 Conclusion and reflections on economic growth, credit, environment, employment, trade, and a binary economy

Since the 1970s, productivity and GDP have grown steadily, but this growth has not been accompanied by growth in income for much of the society, meaning that the wealth created has not accrued to ordinary people. Since the early 2000s, wages as a percentage of GDP have declined, while corporate profits as a percentage of GDP have increased. The usual policy solutions offered to address these trends include (1) more investment in technology and innovation through increased spending, (2) more access to financial credit on the part of both producers and consumers, (3) redistribution of income through more progressive taxation, (4) raising the minimum wage, (5) a shorter workweek with retained income levels to spread out the work and increase labor’s share of profits, (6) designing work back into the production of goods and services, (7) a guaranteed annual income, paying for unpaid work usually performed by women and low-wage workers, and (8) the reform of international trade. See Bivens (2018) for recommendations for creating jobs and economic security in the U.S. addressing some of these policy solutions.

These options are essentially a variant of the current economic–industrial model of “free-market” economies. This model is based on a conventional approach to economic analysis found in various schools of classical, neoclassical, and Keynesian economics. What is missing from this analysis is explicit consideration of the economic consequences of **the distribution of the acquisition (and thereby the ownership) of productive capital** (natural and physical capital, energy, and ICT – what is known as real capital). Although there are major differences among the various economic schools that underlie conventional economic policy, these schools share in common one questionable, unstated assumption: namely, that the distribution of capital acquisition has no substantial market relationship to the distribution of individual earning capacity and economic growth. If this assumption

is false, then the distribution of productivity improvements and profits, and the rate and sustainability of their growth, cannot be adequately addressed without addressing the market distribution of capital acquisition.

Binary economics rests on the observation that (1) real capital and labor are two independent sources of production and earning capacity, (2) although advancing technology may be seen to make labor more productive, it also makes capital more productive than labor in task after task, and (3) the distribution of its acquisition has a substantial impact on the distribution of individual earning capacity and growth.

Contrary to the assumption of the various economic models that view the primary role of real capital as making labor more productive, increased technological replacement of labor by capital means that capital is doing more and more of the work and is responsible for more of the economic growth. Further, in replacing labor, capital is not simply undertaking the *same* amount of work; rather, it is *vastly increasing* the amount of work that can be done. When understood in this way, it becomes clear that those individuals who continually acquire (and thereby own) the growing productive capacity of the economy embodied in the real capital will also enjoy an increasing share of economic growth. Providing poor and middle-class people with a competitive means to acquire capital and thereby earn income from capital would increase their effective demand, which would in turn stimulate future economic growth through their increasing ability to purchase goods and services. This mechanism – known as the principle of binary growth – could encourage firms to increase their productive capacity in the expectation of greater consumer demand, which would further enhance employment opportunities (for both labor and capital).

It is now becoming increasingly clear that the yields of economic activity through industrial investment and innovation are not only benefiting a smaller and smaller group of people, but plateaus are being reached in the productiveness/efficiency of new innovations (see, e.g., the work of Robert Ayres, which has explored the decreasing amount of useful energy – called exergy – that can be harnessed from energy sources).

The historical approach to these problems was to provide more credit to producers to enable them to realize riskier gains and more consumer credit to citizens so they can keep up with a previous growth level – a situation which led to the 2008 financial crisis. Degrowth as an intentional strategy is now being discussed in some circles, and it is largely motivated by a concern for environmental impacts and global climate change that are exacerbated by more industrial growth. Responding to the reality of shrinking resources, a popular and growing, if still small, movement towards sustainable production and consumption has also emerged. Of course, both degrowth and reduced consumption challenge the standard economic labor productivity growth model.

Other options that are focused on the redistribution of income, while socially justifiable to many people, are likely to be met with resistance by those who are advantaged by the present arrangements and who have a disproportionate and large impact on the political, industrial, economic, energy, tax, trade, and environmental systems.

Designing work back into the production of goods and services is a technical option that would increase labor intensiveness and share of economic growth, but this runs counter to the wave of enhancing computer applications and artificial intelligence in those activities. It would also require universities to completely transform how they are educating engineering, science, and business graduates, who are challenged to always do more with less, which typically means less labor.

This brings us to the option of broadly distributing the *ownership of productive (real) capital* by leveraging existing corporate finance mechanisms that enable capital to pay for itself with its *future* earnings. The subsequent increase in the effective demand of citizens (as explained above) could stimulate significant future economic growth. Thus, in order not to run into planetary boundaries, growth from those investments financed using the principles of binary economics, like all other growth, will either have to be focused on

much more sustainable (and less) production and consumption, or technical changes have to be made to what is produced and consumed – or both.

Finally, the reform of trade practices, which characteristically do not price the cost of social and environmental externalities, needs serious discussion, no matter what pathway is taken to increase broad-based economic welfare.

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