

INTEGRATED DESIGN & CONSTRUCTION – SINGLE RESPONSIBILITY

A CHARTERED INSTITUTE OF BUILDING CODE OF PRACTICE



Integrated Design & Construction

– Single Responsibility

A Chartered Institute of Building Code of Practice

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A Chartered Institute of Building Code of Practice

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Foreword

The code of practice for Integrated Design and Construction-Single Responsibility (IDCsr) integrates within a single team all the key participants involved in the process of designing and constructing a successful project. The objective of the team is a focus on delivering the end product within pre-defined parameters. This marks the final extension of the paradigm shift initiated by Sir Michael Latham almost two decades ago and then further developed by Sir John Egan.

This document describes the next logical step by outlining a practical way of delivering a product through effective collaboration between the professionals involved. This is done by effectively merging the various stages of traditional design and project management. Resonance of many of the themes and concepts incorporated can be found in recent innovative procurement models being supported by the Cabinet Office. In the private sector, the practice of an integrated team approach, particularly where a single entity is responsible for design, delivery and operation, has already found its niche in a variety of sectors.

I congratulate the initiative and efforts of Colin Harding, PPCIOB and his team whose knowledge, experience and vision have been instrumental in creating this pioneering Code of Practice as the most comprehensive document formulating the practical application of a single responsibility team approach in the built environment.

I am pleased that the CIOB is continuing to lead from the front in the collective effort to drive the necessary culture changes in the industry, and this Code of Practice will stimulate significant improvements to the processes and practices of project design, delivery and management in the built environment.

James Wates CBE,FCIOB,FRICS,FICE,FCGI,FRSA
President (2010-2011) CIOB
Chairman, Wates Group
Chairman, CITB
Chairman, UKCG
Chairman, BRE Trust

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Much of this Code of Practice is based on my 50+ years of personal experience in construction management; however, it could not have been completed without the help, advice and contributions from the working group set up by the Chartered Institute of Building (CIOB). I am pleased to acknowledge the valuable contribution made by this group that comprised the following members (in the order of their involvement with the project):

Professor John Bale: for his encouragement, practical advice and suggestions regarding value management and the construction management process and for reviewing and correcting my final draft.

Dr Sarah Peace: who helped set up the structure of the Code of Practice and methodology of the working group and for freely sharing her valuable knowledge of partnering and collaborative working in the construction industry.

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Professor Farzad Khosrowshahi: gave freely of his considerable experience of academic authorship to help me set the right 'tone' and language for this Code of Practice, as well as the clarity of the charts and diagrams and also for his positive criticism and suggestions regarding the construction management process and management structure. Farzad contributed the comprehensive section on ICT, as well as reviewing and correcting the final draft of the Code of Practice.

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Asmau Nasir-Lawal: for sharing her experience of client needs and aspirations and originating the Client team roles, responsibilities and skills section.

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The IDCsr Project Insurance cover was developed from the Cabinet Office's work on Integrated Project Insurance by:

Steven Bamforth: Griffiths and Armour

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I accept full responsibility for originating the IDCsr Model Sale Agreement Terms and Conditions, but could not have completed the first draft without the sage advice of the doyen of construction law, Conrad Freedman.

The starting point for the agreement was a luxury yacht sale agreement provided by Jonathan Macklin: Sunseeker Yachts Poole.

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Trevor Drury: Morecraft Drury

Tony Shenton: Wates Construction North West

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Saleem Akram: CIOB

Conrad Freedman

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From the publishers Wiley Blackwell, Dr Paul Sayer and Hariett Konishi have been most helpful, patient and extremely tolerant of my failing memory.

Finally, I acknowledge the contribution of two people not directly involved with the preparation of this Code of Practice, but without whose earlier work, the publication of this book would not have been possible:

Sir Michael Latham: for 'Constructing the Team', which first raised awareness that the fragmented construction industry could at least collaborate, leading to a steady growth of Design & Build systems.

Sir John Egan: who in 'Rethinking Construction' introduced the notion of Lean Management practice to completely integrate the design and construction teams.

Glossary of terms and acronyms

Acronym	Full name	Summary role description
BIM	Building information modelling	An electronic design system and shared virtual workspace that enables everyone in the client and IDCC teams to fully and openly collaborate on the design and its build-ability
CAD	Computer aided design	The basic form of electronic design system
CDM	Construction design and management regulations 2007	Design safety regulations
CoP	Code of practice	This document
CPS	Client project sponsor	The overall leader of the client team
CTM	Client team manager	The client team project leader and advisor throughout the project
FM	Facilities management	The on going management of completed facilities and their services
GSL	Government soft landings	Planning system designed to ensure a smooth commissioning, handover and operational process
H&S	Health and safety	Health and safety generic
ICT	Information and communication technology	Electronic technology for the efficient administration of distributed, personal, team and project information
IDCC	IDCsr constructor	The legal entity that takes full responsibility for the design and construction of the project/product
IDCPI	IDCsr project insurance	Project insurance cover designed specifically for IDCsr projects
IDCsr	Integrated design and construction – single responsibility	The system and process
IDCPM	IDCC’s project manager	The leader of the IDCC team and the project
IPI	Integrated project insurance	The insurance cover developed for Government Construction Strategy collaborative projects

Acronym	Full name	Summary role description
IT	Information technology	The foundation of modern business
OGC	Office of government commerce	Government department
O&M	Operational and maintenance	Operation and maintenance of the completed facility
PBA	Project bank account	A form of Escrow Account that ring-fences client payments to ensure all suppliers are paid directly in accordance with the agreed payment terms
PD	Project definition	To provide the clearest and most detailed description of what the client really needs and wants from the project
PQP	Project quality plan	Detailed plan to implement the QMS
QMS	Quality management system	A project specific strategy to target the achievement of total 'right first time' quality assurance throughout the project
SPV	Special purpose vehicle	The project specific 'clean company' form that most IDCC legal entities will take
SWMP	Site waste management plan	An efficient resource management and recycling tool
VM	Value management	The structured analysis of the ways in which functionality can be achieved at minimum cost

Introduction

The construction industry's relative costs have steadily risen over the last 50 years or so, while profit margins of its contractors and sub-contractors have been eroded to the level that is no longer sufficient to justify significant external investment. Numerous reports have identified fragmentation of the industry's management structures and processes as the underlying cause of the waste and inefficiencies that keep costs so high and margins so low. Despite several well-meaning attempts, a system that genuinely reintegrates those structures and processes has never been made available until now.

Single Responsibility Integrated Design and Construction (IDCsr) is a totally integrated yet competitive form of procurement, design and project delivery for construction Clients and IDCsr Constructors (IDCCs). Every practitioner necessary for the effective and efficient design and construction of the project is employed or engaged by the IDCC Company. The leader of the IDCC team, and therefore the whole process, is the IDCsr Project Manager (IDCPM). Some of the key issues for which the IDCPM is responsible include dealing directly with the Client and Client Team Manager (CTM), welding all the IDCC's practitioners into a lean, wholly integrated production team and on behalf of the IDCC company accepting full responsibility for the design and delivery of the complete project, backed by the IDCsr Project Insurance policy cover.

With all designers securely embedded within this integrated structure, Client need, particularly cost certainty, will take precedence over design-centric aspirations. The IDCsr Sale Agreement Model Terms and Conditions are therefore based on the sale and purchase of a customised finished product at a pre-agreed fixed price. The IDCsr process is intended to make it as simple and satisfactory to buy a building as it is to purchase any other high-value, warranted manufactured product.

To assist Clients in getting the best results from the IDCsr system, they need to appoint an experienced CTM to advise and assist the Client Project Sponsor and Client team. The CTM's key role is to guide the Client team in establishing their fundamental needs, developing and testing the business case to support them and from that preparing the Project Definition. The Project Definition must describe precisely and comprehensively what the Client really needs and wants from the project, together with a realistic and fundable budget. The CTM then goes on to become the Client's interface with the IDCC during the concept, design and delivery stages of the project.

IDCsr is designed to be used by experienced construction professionals, familiar and proficient with traditional design and construction system best practice, who wish to work with their clients in a totally positive, integrated business environment.

By embracing complete, unambiguous integration of the entire process and management structure, IDCsr teams working constructively with their Client teams will be able to create well-designed, well-constructed and fully warranted products, delivered by the agreed handover date, without fuss and without fail. This Code of Practice is intended to assist like-minded clients and construction professionals to do just that, replicating the times when builders were architects and architects were builders – now working together again as constructors.

Colin Harding

Background

The late Victorian and Edwardian era preceding the First World War was undoubtedly the golden age of traditional Design and Build. Then, architects provided total single point responsibility, while representing the client, by accepting full responsibility for their design, as well as for the quality and workmanship of the finished product.

The professional master builders of the time, their general foremen and highly skilled craftsmen, like architects, had a total understanding of good design and traditional best practice building construction methods. They trained and directly employed craftsmen in all trades, including, at the end of the 19th century, those in the emerging technologies of electrical and heating engineering.

There were no formal partnering contracts or middlemen, just a basic fixed price order or, in the case of private dwellings, a sale contract with the reputation of the builder, as well as the architect at stake. Design liability and defects were not a serious issue because designs were based on well-tested empirical principles. More importantly, the design and construction team, who invariably worked together regularly, guarded their reputations jealously. If a problem was reported, it was investigated and attended to promptly without fuss or rancour. The whole system relied on mutual trust and respect between clients, architects and builders working together, underpinned by simple, straightforward legal agreements.

The industry that re-grouped after the First World War in the 1920s would be fundamentally changed as the process and then the industry gradually started to fragment. The post-war emergence of the steel frame and *in situ* reinforced concrete as 'the modern' standard construction systems meant that architects could now design buildings of any shape or size without the restrictions imposed by the traditional structural materials with their old empirical rules. This led to the growth of 'structural engineering' practices that took over responsibility for an important part of the building's design from the architects. It also began to erode the role of the general foreman (site manager) who had traditionally contributed technical expertise across the entire range of craft skills.

Independent quantity surveying practices started to emerge, transferring effective control of a project's cost to an independent third party. As the number of independent consultants involved in the design and supervision of construction continued to grow, so did the number of misunderstandings, errors and consequent conflicts.

By the end of the Second World War, the problems created by the fragmentation of the construction industry were recognised by Government. The Banwell Report (1964) on 'The Placing and Management of Contracts in the Building and Civil Engineering Industry' first made the now familiar recommendations on collaboration between designers and contractors, but in practice, it had little impact. The steady fragmentation of the design process continued through the 20th century with the gradual growth of independent design

consultancies such as fire engineering, acoustics, interior design, landscaping, planning, building control and the whole range of sustainability, 'eco' and other environment-related consultants. Architects passed down much of their design responsibility to these consultants. More seriously, as design management developed, responsibility for more and more sections of a project's design was being transferred by architects to principal contractors through nominated and named sub-contractors and suppliers.

Consequently, conflict and litigation, particularly over design liability versus workmanship and 'fitness for purpose', were steadily increasing. Construction law emerged as a separate recognised discipline in 1983, with the establishment of the Society of Construction Law.

Following the United Kingdom's 1991/1992 recession, Sir Michael Latham was appointed to carry out a joint 'Government/Industry Review of Procurement and Contractual Arrangements in the UK Construction Industry', leading to the publication in 1994 of 'Constructing the Team'. Its principal recommendation of 'partnering' between client, designer and contractor was soon forgotten and in hindsight, somewhat idealistic. Nevertheless, the Latham review raised awareness that alternatives to the traditional fragmented procurement and management systems were available, so that the use of Design and Build forms started to increase and continued to grow in the private sector through the 1990s and 2000s. During the same period, the amendment and customisation of the old standard contract forms became commonplace, and a growing range of alternative procurement systems with their own contracts emerged.

During the Channel Tunnel construction project in 1988–1994, the analysis by the DETR of the construction of two identical office buildings at each side of the Channel designed by the same UK architects demonstrated that the fragmentation of design and construction of the UK contractual system contributed significantly towards excessive waste and low profitability of the system in the United Kingdom, in particular that the UK side employed twice the number of management personnel on their project than the French. (Ref 1)

In 1997, Sir John Egan was appointed to carry out yet another review of the construction industry's management systems. From his earlier experience of modernising the failing British car industry, Egan's principle recommendations set out in his report 'Rethinking Construction' (1998) were to apply Lean Management techniques to the construction process, which would streamline the management structure of the industry. Sir John envisaged that the consequently lean, totally integrated design, production and supply chain management structure would improve efficiency, quality and reliability, thereby reducing overall cost to the client, while improving margins for the supply chain. From his experience, he recognised that higher profit margins created investment, training and innovation, leading to lower costs and improved quality.

However, Lean Management techniques were not applied effectively, and 'integration' was softened to 'partnering', which was specifically restricted to the consultants and largest contractors of Virtual Construction. Risk avoidance led to basic risk dumping to the trade contractors and sub-contractors, rather than lean thinking leading to system improvement, and so improved productivity. In some cases, responsibility for the design of most structural elements, including foundations, structural frame, floors, roofs and cladding started to be transferred at tender stage to the trade contractors by designating them as 'contractor designed'.

The most significant result from 'Rethinking Construction' was the creation of separate frameworks for larger contractors, architects, cost consultants, engineers and specialist service providers, effectively creating an oligopoly for the most attractive public sector work, pushing risk down to the smaller contractors, specialists and sub-contractors and subjecting them to (the Treasury's description) 'rigorous competition', reminiscent of former adversarial malpractices of previous decades.

The establishment of these public sector frameworks marked the final division of the construction industry into two distinct, highly fragmented parts as the following:

1. Virtual Construction, consisting of the fee-generating design and supervisory consultants with the largest contractors and service providers.
2. The much larger yet subservient Real Construction, the contractors, sub-contractors and specialists who actually do the real building work on site.

The Virtual versus Real Construction dichotomy exacerbated the fundamental flaw of the ageing multi-responsibility design and construction management systems – the contractual separation of design from pre- and on-site construction. This is the division that has created the construction industry's 'Management Equation from Hell,' where the principal contractors who sign the contract with the client have no authority over the design, specification or value of their own products, yet bear total responsibility for those product's quality and performance.

That same fragmentation spurred a parallel proliferation of increasingly complex contract forms, habitually amended by clients and funders' lawyers. Ironically, some of the most complex and confusing contracts are those designed to promote partnering and collaboration, including the legal protocol that comes with the otherwise essential modern design tool of BIM. Adversarial drafting leads to adversarial management practices (Ref 2).

A leading UK construction barrister wrote in April 2013 – "Half the business of buildings is about building the blessed thing. The other half is about the bumf that I make a living from and half our industry loves too – it's the contractual playground" (Ref 3). This 'contractual playground', together with the over-manning and consequent duplication of roles, creates the inefficiencies and conflicts that make the United Kingdom one of the most expensive countries in which to build.

The only way to prevent even further growth of this debilitating 'great legal game' is to re-integrate the two sides of the industry – Real and Virtual Construction – so that IDCsr-integrated single legal entities become solely responsible direct to the client for the complete process, from concept and design through delivery and after care, as set out in this Code of Practice.

References: Integrate to Innovate: Colin Harding: Construction Research and Innovation (CRI) Vol 1 Issue 2: 2010: Single Responsibility Integrated Design and Construction: A New Model for Improved Client Value: Colin Harding,; CRI Sept 2011: Ref 1 Biologically Better: Colin Harding: Building 28.3 02: Ref 2: Time to abandon the contractual status quo : Colin Harding, Building 16.7.93: Ref 3: Handy tips on DIY: Tony Bingham: Building 12.4.13

1

IDCsr principles and process

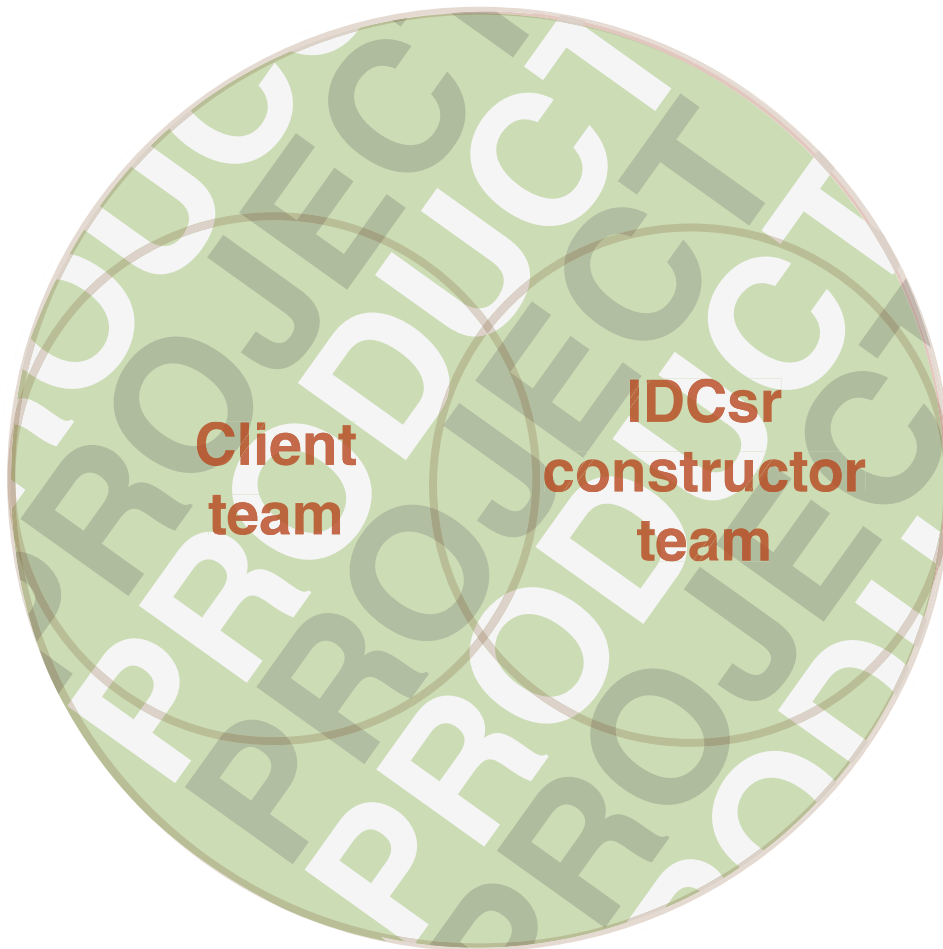


Figure 1 Integrated Design and Construction – single responsibility.

1.1 The principles and process of integrated design and construction – single responsibility

1. The over-riding principle of the IDCsr process is that of purchasing a customised product at a fixed price, rather than the traditional commissioning of a contracting service to build to an independent design and a third party's budget.

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2. This can only be achieved by fully integrating design and construction management as well as the complete process itself through a single legal entity, the IDCsr Constructor (IDCC), as in any other product manufacturing sector.
3. The IDCsr process is built around the IDCC, which is made up of like-minded construction professionals, specialists and trade suppliers, led by the IDCC's project manager (IDCPM) to provide a fully integrated design and construction package direct to the client. The success of the IDCsr process is reliant on the total integration of disciplines within the IDCC, so that it can accept complete responsibility for the overall design, construction and commissioning of the project, backed by the IDCsr Project Insurance Policy. (see figure 1)
4. The success of the process is equally reliant on the commitment of the leader of the Client Team, the Client Project Sponsor (CPS) to IDCsr principles and practice, including the appointment of an experienced IDCsr Client Team Manager (CTM) to lead, assist and guide the CPS and Client Team throughout the process, particularly during Stage 1.
5. The IDCsr process is divided into three stages – see Figure 2.
6. Stage 1 Inception
 - Investigating and preparing a formal statement of need
 - Developing the business case
 - Testing the feasibility of the business case
 - Developing the project definition
 - Establishing a realistic budget from the above mentioned
 - Agreeing funding in principle
 - Deciding whether to negotiate or go to competition
 - Identifying appropriate IDCCs to invite to bid
 - Establishing competition criteria and bid evaluation process
 - Preparing the Client Brief/bid documentation
7. The achievement of the best possible design that satisfies the client's aspirations and purpose relates directly to the range and quality of the information included in the Client Requirements/Project Definition (PD) and therefore the skills of the CTM, in guiding and encouraging the project sponsor and team to commit sufficient time and effort to the PD's detailed development.
8. Stage 2 Selection
 - Transfer of Project Definition and Client Requirements to IDCCs
 - IDCCs develop competitive bids (or negotiate)
 - Client evaluation of bids and selection of preferred IDCC
 - Client signs IDCsr sale agreement
 - Client and IDCC activate IDCsr project bank account
9. In Stage 2, the IDCC teams work up their concept bids from the same Project Definition and Brief, either to the Client's budget or by quoting

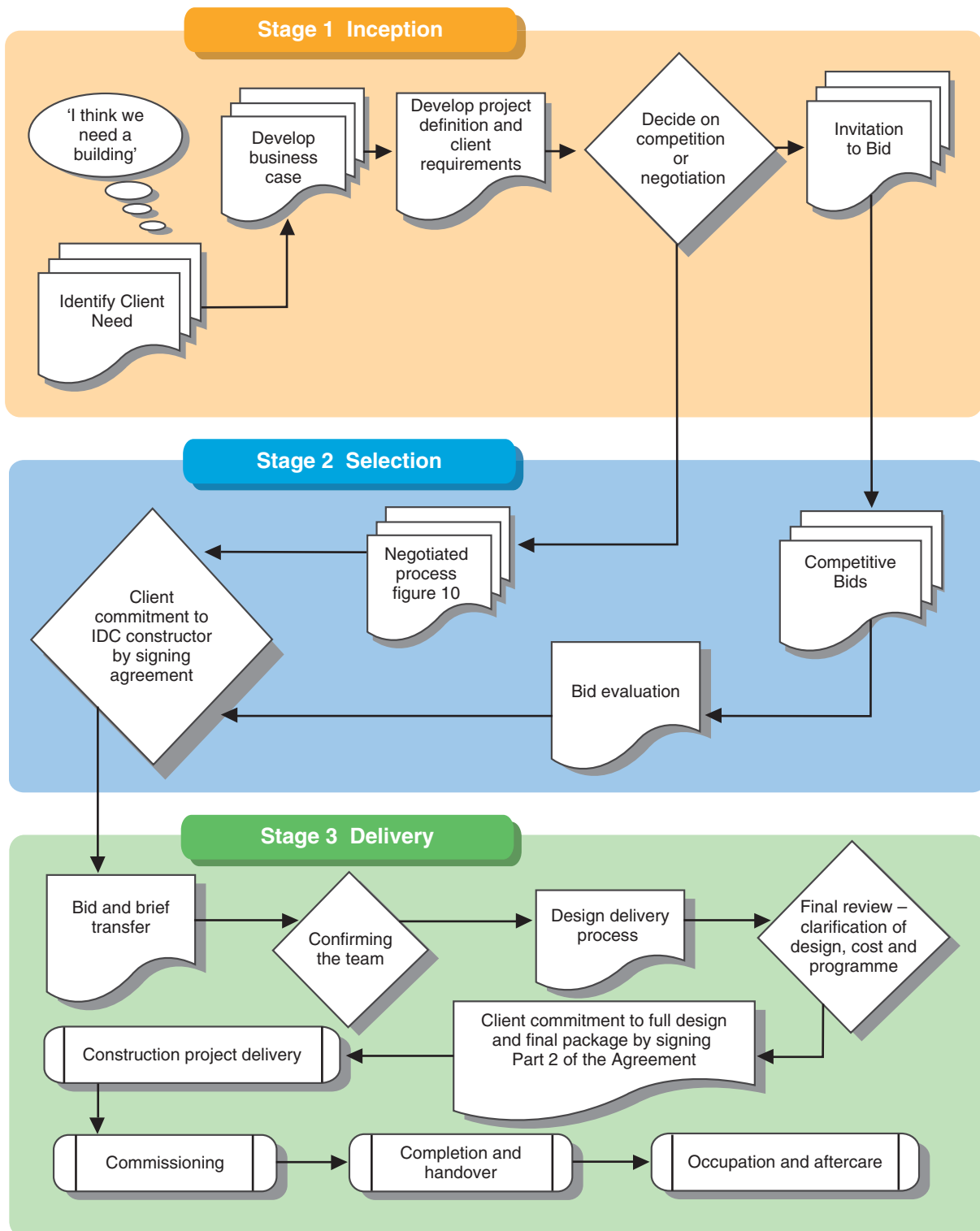


Figure 2 The IDCsr process.

above or below that budget as necessary. The Client selects one IDCC and commits to them by signing the IDCsr Sale Agreement.

10. Stage 3 Delivery

- IDCsr handover of bid and Brief to design and construction team
- Empowerment of Design Teams and instruction to proceed with the designs

- Detailed design
 - Design freeze
 - Construction and bid Management to co-ordinate overall final package
 - Client Team Leaders and IDCC Team Leaders review complete deal and settle all outstanding issues
 - Client confirms the agreed designs, cost and programme and gives authorisation to proceed with construction by signing Part 2 of the Sale Agreement-Construction Project Delivery
11. The successful IDCPM and team, working together with the client team, then jointly work up the full design from that Project Definition and Brief in the most effective way to the agreed budget. Once the resulting project design, specifications and method statements have been agreed with the client (on signing Part 2 of the Sale Agreement), responsibility for the quality of that design, workmanship, materials, components and service, rests solely with the IDCC team, led by the IDCPM. Provided the IDCPM and team deliver the project in accordance with those designs and specifications, the project will be deemed to be suitable for its intended purpose.
 12. Working in a truly integrated IDCsr environment, all participants will be 'on the same side' so that information can be freely shared between everyone in both client and IDCC teams without the fear of contractual retribution. All communications can be open and accessible through project intranets. The IDCsr process provides the ideal platform for BIM technology or other e-design systems without any additional contracts or protocols. Most participants to the project will be involved from the start of the process, creating added value through the collaborative challenging of designs, costs and methodology, so avoiding duplication of effort, clashes and errors. A total focus on process and end product will reduce waste in design, construction and operation.
 13. IDCsr embraces all the well-established technical practices of design and construction management – developing concepts and feasibility studies, design management, value engineering, project management, cost control, risk management, sustainability, health and safety management, quality management/assurance and facilities management.
 14. To successfully maintain a constructive integrated environment, a culture of mutual respect must prevail between all participants, including the specialists and trade suppliers engaged in the work on site, as well as the designers, construction managers and client. 'Respect' in this context also includes securing safe and healthy working conditions and regular, prompt and secure payments through pre-agreed stage payments for all, without retentions.
 15. In most other industries, improvement occurs through learning processes, team building and successive refinement and simplification. The inherent collaboration created by the integration of the IDCsr process fosters long-term relationships between IDCCs, designers, specialists and trade suppliers, leading to continuous improvement of designs, specifications and results. In the case of negotiated repeat business for regular clients, innovations and economies devised on one project can be incorporated in the next, so progressively improving the standard of service and product.

16. The success of the IDCsr process is reliant on the design being completed before site construction work commences to allow construction to proceed in accordance with the pre-planned method statement that forms part of the Agreement. Variations are therefore not covered by the Agreement but, if absolutely unavoidable and by mutual agreement, will be subject to separate, independent IDCsr Sale Agreements. This puts huge emphasis on research, value engineering, visualisation/BIM and so on before the design freeze. However, minor modifications to the design that have no financial or programming consequences can be made by the client or constructor, by mutual agreement.
17. The IDCsr system can be used by most Clients on most sizes and types of projects (including refurbishments), who wish to work directly and constructively with their IDCCs, to benefit from IDCsr's comprehensive one-stop service/sale.
18. IDCsr projects can be constructed by specialist IDCsr Constructors or traditional Design and Build contractors who in return for complete authority over the design and construction process are prepared through the IDCsr system to accept complete responsibility for the co-ordination and quality of the design, as well as the finished product, delivering it by the agreed completion date(s) without question. The IDCsr system can be utilised by such experienced companies:
 - with established teams led by directly employed experienced professional management and administration staff as team leaders, as set out later in this Code of Practice
 - who are prepared to accept the totality of responsibility for quality and reliability and are committed to the Model Terms and Conditions of the IDCsr Sale Agreement that goes with the system – without amendment
 - who have a tried and tested specific IDCsr quality management and control system in place
 - who have established relationships with appropriately (depending on the type of project) experienced and qualified architects and engineers who are comfortable with the IDCsr ethos and process
 - with a comprehensive register of regular tried and trusted specialists and trade suppliers who understand the benefits, as well as the responsibilities of IDCsr
 - who are financially stable
 - who have an IDCsr Project Insurance Policy facility in place.

Special Note 1

It is very important for Clients, potential IDCsr Constructors and their teams to appreciate that the IDCsr system comes as a complete, carefully balanced system together with the IDCsr Sale Agreement, neither of which should be amended and where all parties follow the best practice principles set out in this code of practice. The basic principles cannot be 'mixed and matched' with traditional procurement forms or 'cherry picked' in the hope of selecting the best out of old and new systems. It is a choice of one or the other. If clients, constructors or their suppliers are uncomfortable with any of the Agreement terms or the principles of IDCsr, then they should use one of the many alternative traditional contract forms that are readily available

2

The IDCsr constructor legal entity – structures, responsibilities and skills

2.1 IDCsr constructor team structure

The single responsibility integrated design and construction process can succeed only if there is a fully integrated legal entity (the IDCC) in place that is technically competent, willing and capable of taking complete responsibility for the design and construction of the project in the manner described in this Code of Practice.

The management structures of most experienced IDCCs have evolved from those of traditional design and build contractors to create a totally integrated team as shown in Figure 3. Figure 4 illustrates the formal project management responsibility and e-design communications structure of a typical IDCC.

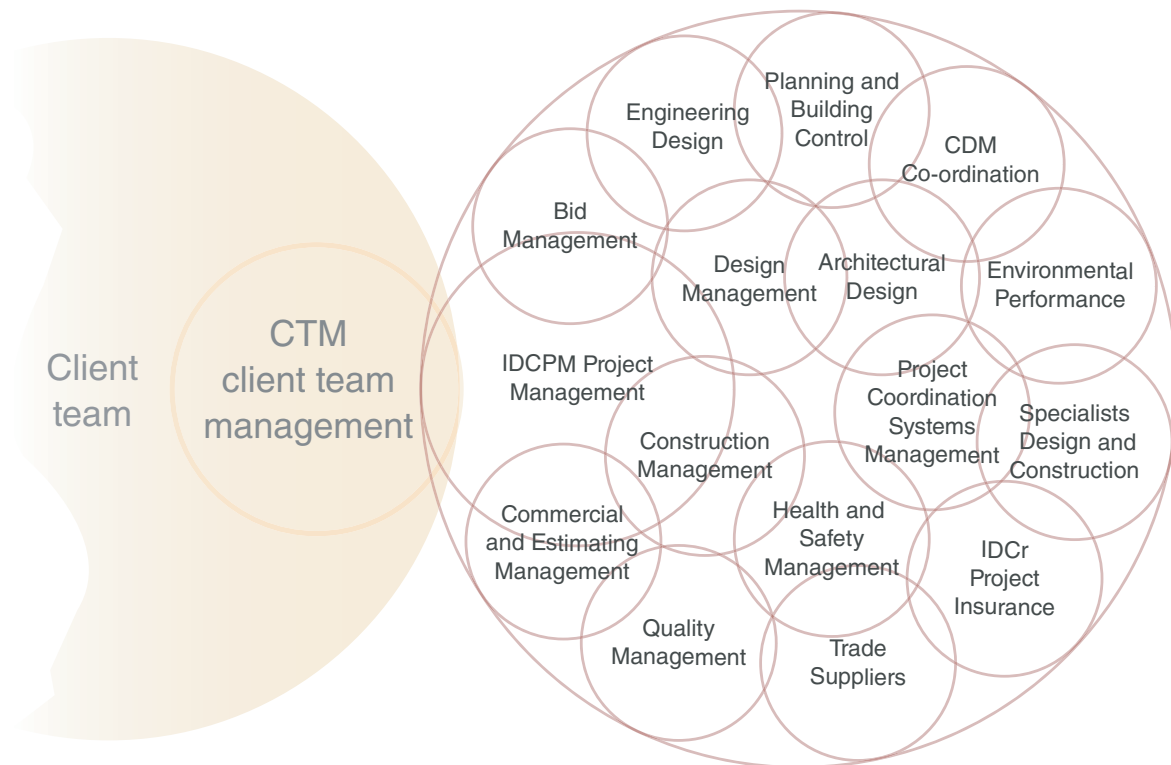


Figure 3 The IDCsr constructor legal entity project management team.

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For clarity, the standard company governance, accounting, employment, sales and administration functions have been omitted from both charts. Figure 5 shows how ownership of the IDCC special purpose vehicle (SPV) company can be broadened to include a consortia of designers, consultants and trade suppliers.

Appropriately qualified, directly employed personnel are essential to fulfil the roles of IDCsr Project Manager (IDCPM), Design Management, Commercial Management, Project Co-Ordination, Construction and Site Management and their support teams. Architectural and engineering design can be in-house or outsourced to appropriately experienced, like-minded consultants.

The site construction work can be carried out by specialists and trade suppliers who work regularly and collaboratively with the IDCC, backed up by the IDCC's directly employed personnel. The success of the IDCsr process is just as dependent on trust and collaboration between designers, construction managers, specialists and trade suppliers, as it is between IDCCs and their clients.

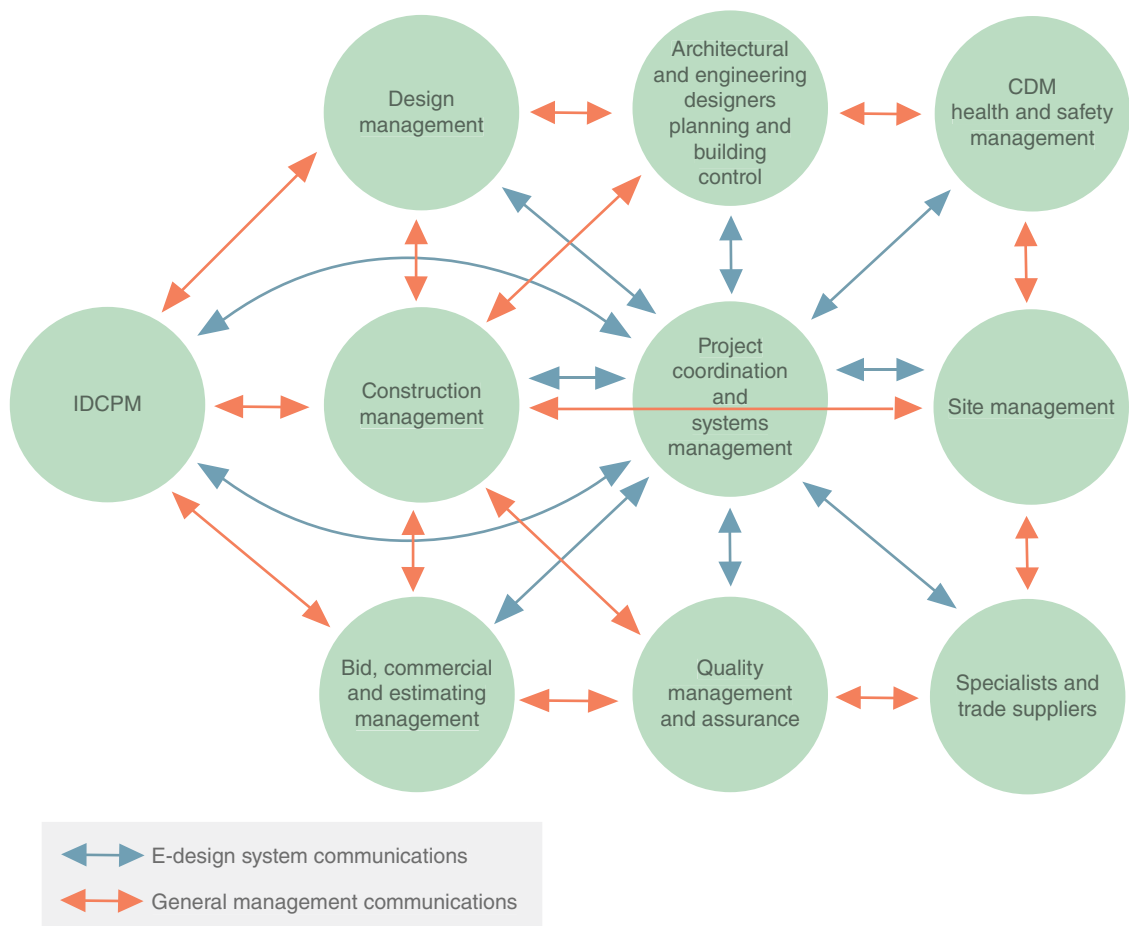
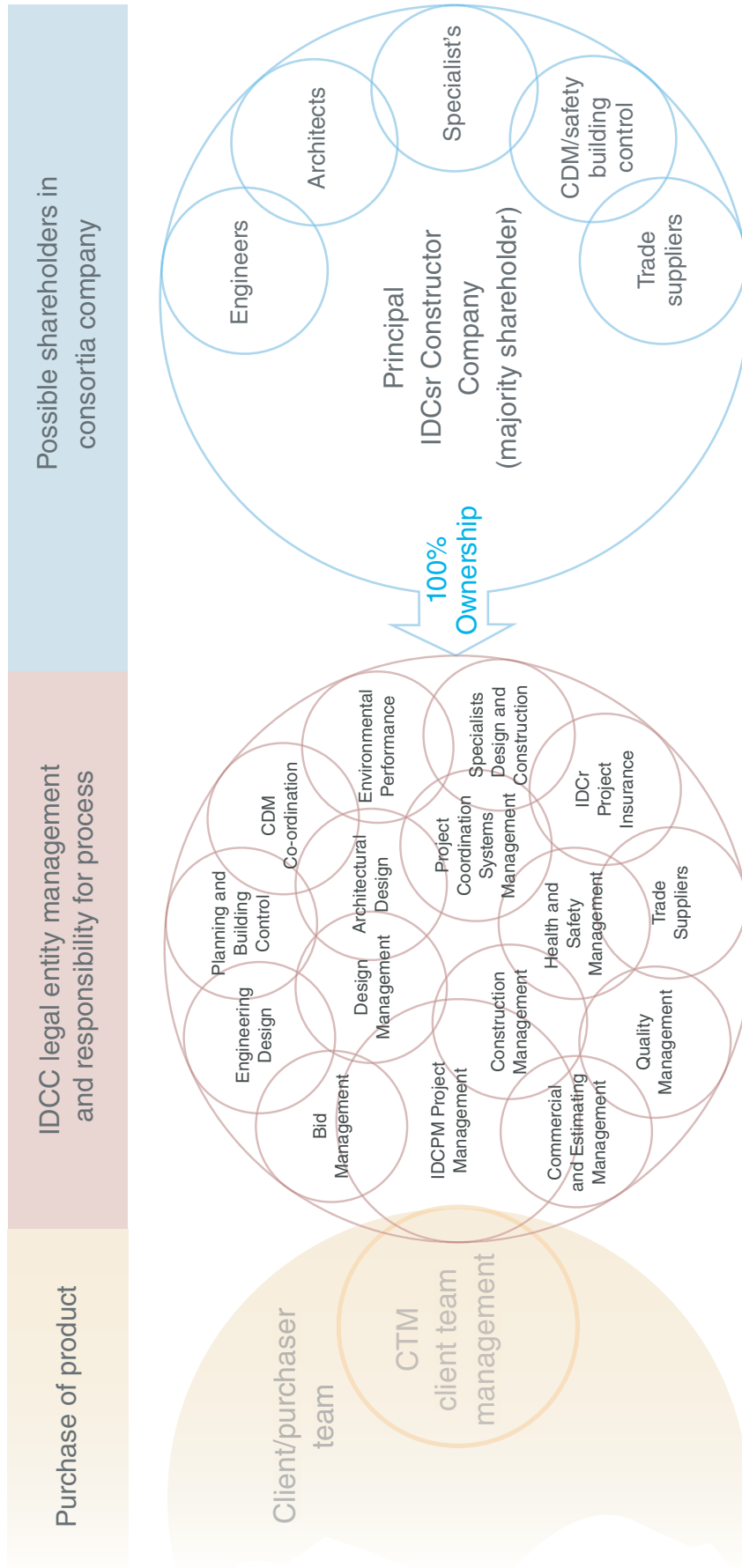


Figure 4 IDCsr constructor formal management responsibility and design communications chart.



2 The IDCsr constructor legal entity

Figure 5 IDCC consortia structure.

2.2 The IDCsr constructor project management team

IDCPM Project Management
Construction Management
Design Management
Commercial and Estimating Management
Bid Management
Architectural Design
Engineering Design
Planning and Building Control
CDM Co-Ordination
Environmental Performance
Project Co-Ordination and Systems Management
Specialists Design and Construction
Trade Suppliers
Health and Safety Management
Quality Management + IDCsr Project Insurance

2.3 IDCC consortia approach

As the IDCsr system becomes established, some consultants, specialists and trade suppliers may wish to join in consortia with IDCsr constructor companies, to share ownership of the process. In order to protect the over-riding principle of integrated single responsibility, the make up of the IDCC selling the project to the client must remain as in Figure 3. However, regular team members could invest in a consortia joint venture company, which in turn owns 100% of the IDCsr SPV legal entity and guarantees its performance – see Figure 5. The principal IDCC company should own a majority of shares in the consortia company to maintain clear, decisive management and governance of the IDCsr operational legal entity, without discouraging the further integration of long-term IDCC team members within the consortia.

2.4 IDCsr constructor team roles responsibilities and skills

2.4.1 IDCsr project manager

The IDCPM's role is pivotal to the success of the IDCsr project, and the IDCPM will be named personally in the Agreement. The role includes being the principal contact with the client and leading the bidding, design and construction process, including linking with facilities management during the handover/after care stage, in other words, the whole project. In exchange for total authority over the design and construction of the project, the IDCPM, on behalf of the IDCC, must accept full responsibility for the entire project's success.

The Responsibilities of the IDCPM include the following:

- Interpretation of the client requirements and project definition
- Overall co-ordination and supervision of the design and design management process
- Leading and driving reviews of design evaluation, value engineering/value management, build-ability and so forth.
- Best practice construction management
- Compliance with specification
- Environmental performance
- Health and safety management and performance, accepting ultimate responsibility for all health and safety matters throughout the design and construction process.
- Cost control and payments
- Ensuring that payments to suppliers are made in accordance with the Agreement conditions
- After-sales services
- The over-riding responsibility on behalf of the IDCsr entity, to work closely with the Client Team Manager (CTM) to maintain continuous transparent communication with the client throughout the process
- Ensuring that effective quality management systems are in place throughout the process and rigorously applied and monitored, in collaboration with the CTM. It has been known for decades that design errors and defects occur mainly from lack of care rather than from lack of skills. With a team of experienced committed professionals without any adversarial distractions, following the same well-thought-out Quality Assurance system from concept to completion, the IDCPM is responsible for achieving all the project targets, delivering defect-free projects that more than adequately fulfil the requirements of the client's project definition and brief.
- Ensuring that environmental performance ratings specified in the Client Brief are achieved by the design and construction teams.

The Skills expected of the IDCPM include the following:

- Outstanding natural leadership ability
- Complete grasp of the management of the overall design, construction and handover processes
- Broad understanding of best practice modern design and building construction techniques and procedures: in other words, a thoroughly professional constructor
- Proven ability to be a leader of people, teams and processes, sometimes simultaneously and often in a dynamic, complex and challenging environment
- Comprehensive knowledge and understanding of most, if not all, of the key activities undertaken within any IDCsr project, from appreciation of architectural design and design management through to construction management, project delivery, commissioning and after-care.

- Contractually and commercially aware and highly skilled at both IT and project programming
- Ability to demonstrate respect for individuals and trade suppliers by being amenable, approachable and equitable to all those working within the IDCsr team.

2.4.2 IDCsr project team leaders

2.4.2.1 IDCsr bid manager

The role of the Bid Manager is to lead and co-ordinate the preparation, presentation and delivery of the bid.

The responsibilities of the IDCsr Bid Manager include the following:

- Co-ordinating and submitting the completed bid within agreed timescales to the client team, to give the IDCC the best possible chance of succeeding.
- Collaborating with the IDCPM, Construction Manager, Design Manager, Commercial Manager and all in the organisation, who can contribute to the bid's success.

The skills expected of the IDCsr Bid Manager include the following:

- Ability to evaluate and understand the client's organisation, product and needs, as well as how best to articulate and respond to how the IDCC organisation can fulfil those needs.
- Ability to work closely with the client's and constructor's core teams while liaising with everyone in the organisation who can contribute to the bid's success.
- Exceptional presentational knowledge and skills.

2.4.2.2 IDCsr construction manager

The role of the IDCsr Construction Manager is to support the IDCPM, whilst collaborating with the IDCC Design Team throughout the design stage, bringing best practice construction techniques and programming knowledge and then to lead, co-ordinate and supervise the construction delivery process.

The Responsibilities of the IDCsr Construction Manager include the following:

- Accepting full responsibility for the delivery of the construction stage
- Contributing to the design development particularly regarding buildability
- Collaborating with the IDCPM and CTM and the IDCC team
- Managing the overall construction process
- Working closely with and supervising all design and construction team leaders
- Identifying, evaluating and resolving issues related to cost, progress and quality
- With support from the Quality Manager and liaising with the CTM, continually monitoring Quality Assurance systems to ensure that they are working effectively to achieve the 'zero-defects' target

- Co-ordinating all labour resources, specialists and trade suppliers.
- With the support of the Health and Safety Manager and Site Management, ensuring that health and safety is prioritised by all on-site personnel including that of neighbours and the general public.

The Skills expected of the IDCsr Construction Manager include the following:

- Exceptional management and organisational skills
- Extensive construction industry experience
- Comprehensive knowledge and understanding of the industry
- Exceptional negotiating abilities
- Broad range of industry networks
- Complete understanding of project management
- Determination to always achieve project targets and deadlines
- Commitment to apply traditional construction management best practice to the IDCsr process
- A natural leadership ability to inspire, influence and advise, whilst remaining open and approachable
- Ability to focus on key details whilst appreciating the bigger picture.

2.4.2.3 IDCsr design manager

The IDCsr Design Manager is responsible for managing all project-related design activities, people, processes and resources.

The Responsibilities of the IDCsr Design Manager include the following:

- Advising on appointment of designers and specialist package designers
- Leading and managing the design team including specialist package/element designers to create a culture of openness, collaboration and economy to drive out excessive or unnecessary costs, so providing clients with maximum value for money from the design
- Being the lead contact with the client on all design related matters in association with the IDCPM
- Enabling and controlling the effective flow and production of design information
- Delivering value through integration, collaboration, planning, co-ordination, reduction of risk and innovation
- Contributing to the successful delivery of the overall completed project
- Leading the development and agreement of the BIM execution plan, responsibilities matrix and model progression specification for BIM project implementation, or alternative e-design systems.

The Skills expected of the IDCsr Design Manager include the following:

- Exceptional understanding of briefing and design processes
- Comprehensive leadership and organisational skills

- Appreciation of procurement, construction and commercial issues
- Understanding and application of Health and Safety, CDM 2015, environment and sustainability
- Management of specialist package designers
- Design programming
- Facilitation of team working, collaboration and communication
- Background in a design or construction-related discipline with several years' experience in pre-construction and delivery design management roles.

2.4.2.4 IDCsr site manager

The role of the Site Manager is to lead, co-ordinate, motivate and supervise all activities on site.

The Responsibilities of the IDCsr Site Manager include the following:

- Accepting full responsibility for the safe and efficient management of all personnel and activities on site
- Assisting the IDCPM, Construction and Commercial Managers
- Resolving procedural, technical and co-ordination issues on site
- Managing and supervising the effective operation of the Quality Management system.
- Leading, enthusing and co-ordinating all labour resources and trade suppliers on site towards a shared goal
- Liaising and working with the client's operational management throughout the commissioning, completion and occupation phase of the project
- Site Waste Management Plan/Liaising with other parties (Public/Local Authorities, etc.)/Fire strategies/plans/programming/H&S Plan
- Working closely with Health and Safety Manager to motivate all personnel on site to prioritise Health and Safety matters

The Skills expected of the IDCsr Site Manager include the following:

- Exceptional leadership, management and organisational skills
- Extensive understanding of the site management process
- Determination to meet all of the project's deadlines and targets
- Broad technical understanding of the construction process
- Good communicator at all levels

2.4.2.5 IDCsr commercial manager

The role of the Commercial Manager includes the selection and eventual appointment of appropriate trade suppliers (in conjunction with construction management), cost supervision, liaison with construction management

and quality management generally, supplier stage payments and financial reporting and forecasting.

The Responsibilities of the IDCsr Commercial Manager include the following:

- Advising the IDCPM, identifying, investigating and resolving procedural and commercial issues
- Supervising the efficient organisation of stage payments strictly in accordance with the Agreement supplier payment conditions
- Working in conjunction with the Construction Manager and other team members to ensure the smooth operational progress of the project
- Working closely with estimating department
- Identifying areas that are not in keeping with regulatory practice
- Offering direction and instruction
- Reviewing, scrutinising and developing operational process flows
- Ensuring that the financial aspects and impact of the contractual commitments are clear to all parties
- Ensuring that all support staff including administration, operations and finance, understand and adhere to contractual obligations; applying them correctly
- Managing daily commercial operations
- Supervising cash flow management, reporting and forecasting.

The Skills expected of the IDCsr Commercial Manager include the following:

- Extensive management and organisational skills
- Expert negotiating skills
- Extensive industry experience
- Comprehensive knowledge about the industry
- Efficient presentation and communication skills
- Professionalism and cordiality
- Solid industry networks
- Outstanding project management experience
- Capacity to handle work stress
- Commitment to meeting project deadlines
- Decisiveness and mercantile shrewdness
- Solid problem-solving, decision-making and analytical capabilities.

2.4.2.6 IDCsr health and safety manager

The role of the Health and Safety Manager is to advise and supervise the provision of a safe and healthy working environment for all site personnel and those affected by the construction process throughout the duration of the project and also to ensure that all activities comply with the current CDM Regulations.

The Responsibilities of the IDCsr Health and Safety Manager include the following:

- To advise the IDCPM, Construction Manager and Site Manager on good safety management practice and legislation
- To prepare the CDM, Health and Safety Reviews and residual risks, if any, leading to the completion of the Health and Safety Files and O&M files for use by site management and the Client following completion and occupation
- To ensure that the health and safety Plan is compliant with the standard format set out in BS OHAS 18001
- To regularly check that the Health and Safety Plan is being implemented throughout the project

The Skills expected of the IDCsr Health and Safety Manager include the following:

- Extensive knowledge and experience of the development and management of Health and Safety systems, plans and reviews
- Comprehensive understanding of all current safety legislation and good practice
- The ability to lead, supervise and advise all practitioners working on the project

2.4.2.7 IDCsr project co-ordinator

The role of the Project Co-ordinator is to install, maintain and manage the various project ICT systems, to advise and assist all staff to use and benefit from the project's design and management systems, including installing secure filing and archiving technology.

The Responsibilities of the IDCsr Project Co-ordinator include the following:

- The implementation and maintenance of systems related to project design and construction and information management through the Systems Manager
- Managing the project's design and management systems, to ensure the smooth flow and storage of all project information and documentation and generally assisting the IDCPM, other team leaders and staff in how to use it
- Working closely with or fulfilling the role of BIM Manager
- The updating and maintenance of project management information and files (software and other media)
- The taking of records of project meetings to update project tasks and outcomes into the management system
- Develop standard and ad hoc reports for IDCC management and client's use
- In conjunction with the Construction and Commercial Managers, assist in the preparation of payment runs from the Project Bank Account based on

the project stage payment schedules in accordance with the Agreement conditions

- Managing and maintaining accurate project files to include all documentation to sustain internal and external regulatory compliance, including audits
- Assist project staff with research and compilation of data necessary to complete progress reports to agreed timetable, the Maintenance Manual, Post Contract Reviews and Post Occupancy Evaluation Check List
- Set-up and maintain a secure long-term filing and archiving record system with back-up systems

The Skills expected of the IDCsr Project Co-ordinator include the following:

- Extensive knowledge and experience of current information and document management technology including evolving systems
- Attention to detail, with strategic, methodical and systemised approach
- Comprehensive IT literacy, including BIM management or similar
- Being amenable, approachable and supportive to all team members at all levels
- Capability of managing large amounts of information and data across varying subjects and areas simultaneously

2.4.2.8 IDCsr quality manager

The role of the Quality Manager is to encourage and assist the IDCC Team in the application of a specific Quality Management System to target the achievement of total 'right first time' quality assurance throughout the project.

The Responsibilities of the IDCsr Quality Manager include the following:

- The design, co-ordination and creation (in conjunction with senior construction and site management) of a project quality plan (PQP) in accordance with a quality management system (QMS), compliant with BS:EN 9001 covering the whole IDCsr design, construction, commissioning and handover process
- Leading the education and training of the IDCsr team in the use of the PQP and QMS, enthusing them to accept total responsibility for the quality of both their own and their team's work
- Working with the IDCPM and IDCC team managers and the project insurers to ensure appropriate supervision and checking of personnel and processes is installed and continually monitored
- Developing a total commitment from the IDCsr team to getting it right first time and to targeting zero defects
- Assisting the CTM to become pro-actively involved in all aspects of the PQP/QMS
- Agreeing with the IDCPM and the CTM appropriate stage completion, handover and signing off procedures

The Skills expected of the IDCsr Quality Manager include the following:

- Extensive knowledge and experience of the development and management of quality assurance and quality management systems in the construction industry
- The ability to lead, explain and enthuse about the importance of utilising the PQP/QMS within a self-regulated environment
- Comprehensive understanding of British Standards and Codes of Practice applicable to each project
- Being amenable, approachable and supportive to all team members at all levels.

Special Note 2

As the IDCC accepts total single responsibility for the project, the pro-active role of the IDCsr Quality Manager is critical to the project's success and the IDCC's long-term reputation. This is achieved by integrating the traditionally separate functions of risk management and quality management. Instead of passing it down the supply chain, risk is managed by the whole IDCC's integrated team working with the Quality Manager: educating, encouraging and, where necessary, advising team members on how to achieve consistently high-quality results.

3

IDCsr client team – structures, responsibilities and skills

3.1 Structure

To achieve the best possible results from the IDCsr process, there must be a well-structured, integrated Client Team in place, all committed to integrative working with the IDCC Team and following the guidelines and processes set out in this Code of Practice.

Overall leadership of the Client Team will come from the Client Project Sponsor (CPS), who will chair the Client Team, supported by the Client Team Manager (CTM), who will advise the CPS and lead the team on a day-to-day basis. The CTM, depending on qualifications and expertise, can be an internal appointment or an external specialist CTM engaged (and named personally in the contract) for the project.

The Client Team should bring together those within the client organisation who will have an involvement in the project, not only at the development stage, but also throughout its lifecycle. It is important that key personnel who will be marketing, managing and/or working in the proposed facility are appointed to the team and contribute to the preparation of the Project Definition and Client Requirements. Experienced senior managers/directors who have authority to influence decisions and heading up different sections of the organisation should also be available to provide advice, should their input be required.

Different parts or sections of a client organisation will often have different drivers and requirements. Those commissioning the development process are concerned with delivering a project to time, cost and quality. Asset managers will be interested in project lifecycles that affect the on-going cost of maintenance and will want to specify components accordingly, whilst sales departments will want a product that is easy to market and promote to customers.

In preparing the project definition, the leadership within the client team must have the skills and ability not only to involve the relevant departments, but also to arrive at decisions having balanced the needs and requirements of each against the overall objective of the project (Figure 6).

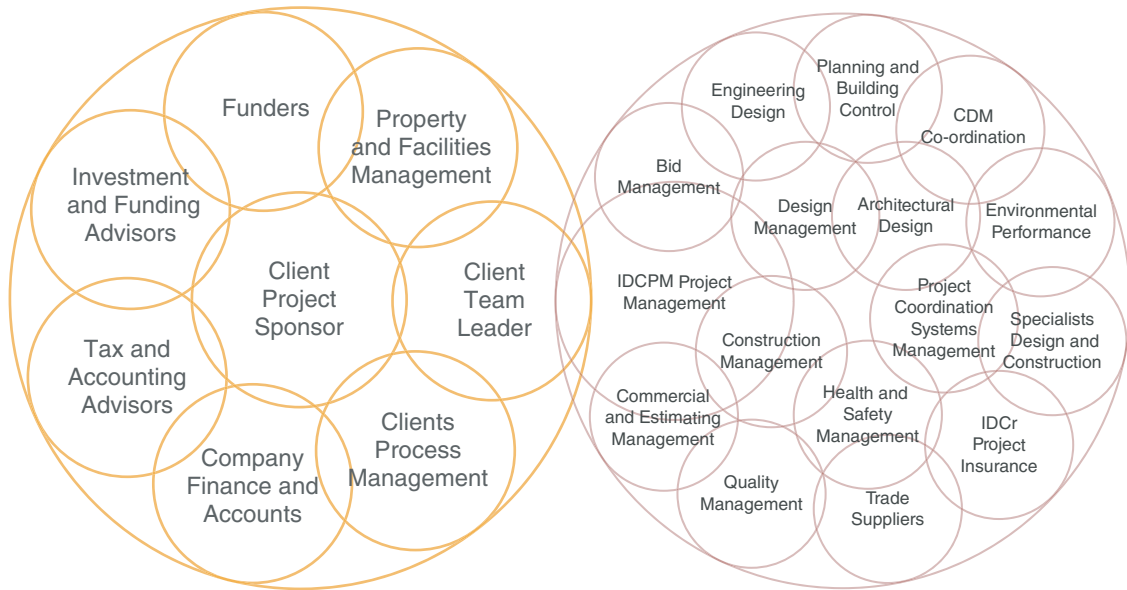


Figure 6 Client team.

Special Note 3

It cannot be emphasised enough that the more direct involvement the whole Client Team have in the design and planning of projects and the more effort and resources everyone puts into clearly defining their needs and specific requirements, the better the project definition and therefore the better the end result they will receive on completion.

Client Team could include the following:

- Client Project Sponsor
- Client Team Manager
- Client Process Management
- Property and Facilities Management
- Client Finance and Accounts Management
- Investment and Funding Advisors
- Funders
- Tax and Accounting Advisors

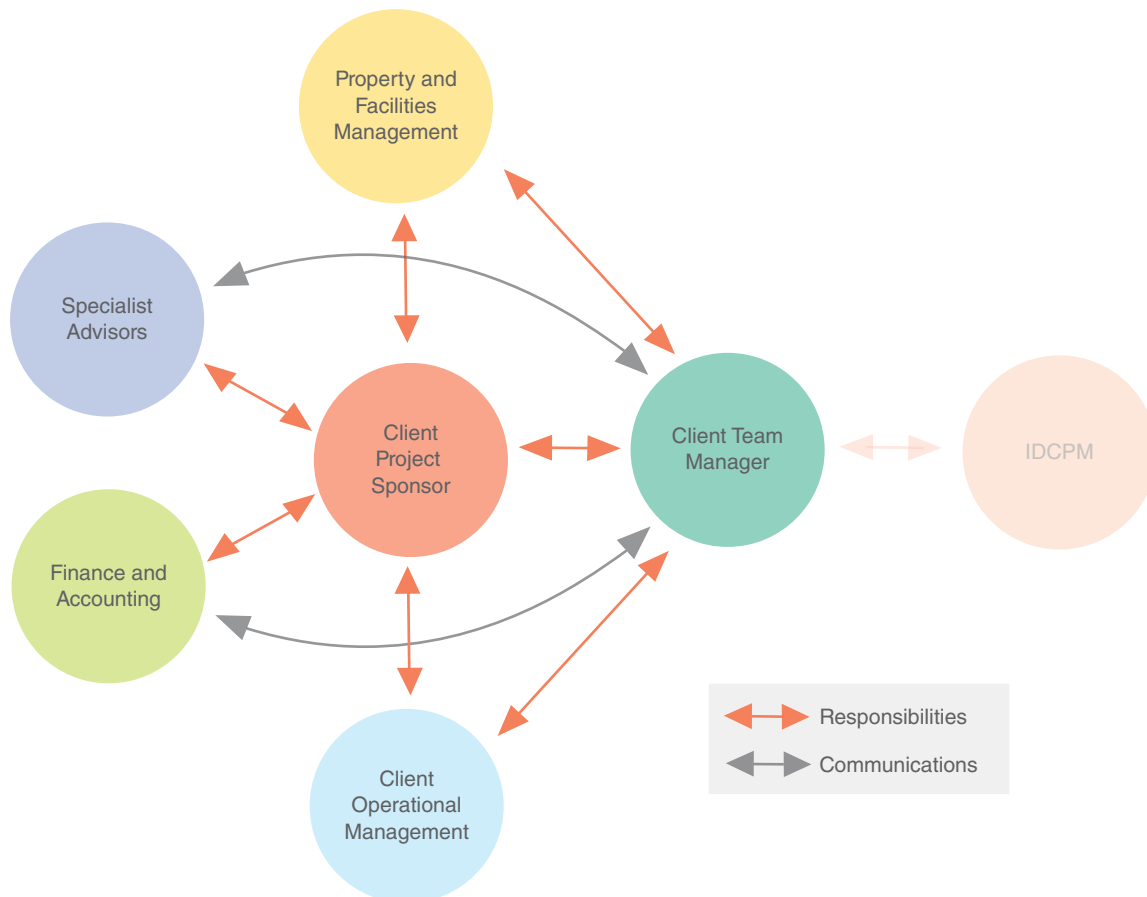


Figure 7 IDCsr client project team responsibilities and communications.

Although everyone in the client team is directly responsible to the CPS (Figure 7), it is important that some of them are able to communicate directly with the CTM (using the project intranet) and at appropriate stages communicate either directly or through the CTM with IDCC team members as illustrated in Figures 14, 17, and 18.

3.2 Client team roles, responsibilities and skills within the IDCsr process

3.2.1 Client project sponsor

The *Client Project Sponsor* (CPS) will typically be a senior director who is preferably one of or has direct access to the Client's key decision makers and executive management team. The CPS will delegate day-to-day responsibility for the project to the CTM, but retaining overall authority to lead the Client Team through the entire process, facilitating all necessary organisational support to ensure the success of the project.

The responsibilities of the Client Project Sponsor include the following:

- Identifying, defining and championing the project
- Developing the project-related business plan and testing its feasibility
- Keeping the project aligned with business need and organisational goals
- Taking ownership of the project and be the key link that communicates with stakeholders to ensure that any project issues are resolved effectively within the Client Team
- Supporting the CTM in preparing the detailed Project Definition and Client Requirements
- Selecting the most appropriate IDCsr Constructor/Constructors
- Continually checking throughout the process that the project's intended needs and benefits continue to be realised

The skills expected of the Client Project Sponsor include the following:

- Leadership, diplomacy and effective delegating skills
- Presence and standing to decisively lead and manage the client role
- Confidence and authority to take decisions
- Effective communication
- Excellent interpersonal skills.

3.2.2 Client team manager

The CTM's role is to guide and assist the CPS and the Client Team in developing the best possible brief and project definition from which the IDCsr Constructors can develop their proposals. For best results, the CTM, who will be named in the contract, should live and breathe the IDCsr approach and be involved right at the start of the process. The CTM then goes on to become the client's interface with the IDCsr Constructor's Project Manager (IDCPM) to devise and deliver the best design and construction solution to the agreed budget.

The responsibilities of the IDCsr Client Team Manager include the following:

- Understanding the client's processes and needs for the project and be committed to the ethos of integrated design and construction
- Advising the CPS on the development of the business case and investment appraisal
- Advising the CPS on the development and testing of the feasibility study
- Instigating and assisting in the development of the client requirements and project definition
- Assisting in the preparation of the client's overall budget
- Advising on the identification and selection of appropriate IDC constructors to bid
- Preparing guidance on how the bids will be evaluated
- Facilitating the brief transfer and bidding process, including dealing with IDCsr Constructor queries

- Encouraging client team members to make timely decisions while keeping them informed of any issues surrounding progress and so on.
- Identifying, prioritising and mitigating client risks
- Co-ordinating work on the project with any other projects with which the client is engaged. If the client has several projects running at any one time, they should consider engaging a Programme Manager to rationalise work on them all.
- Liaising with the IDCPM on project information control and data management
- Fostering positive working relationships internally as well as with IDCPM and team
- Monitoring the project to ensure that it is continuously meeting the business needs.

The skills expected of the Client Team Manager include the following:

- Extensive communication, leadership and management skills
- Ability to quickly grasp a full understanding of the client's strategic goal
- Ability to pro-actively interface with project stakeholders
- A thorough understanding of the overall IDCsr design and construction process
- Comprehensive understanding of relevant IT skills including BIM.

Special Note 4

Because the IDCC accepts complete overall responsibility for the project, including quality of the product, backed up by the IDCsr Project Insurance policy, the CTM's role specifically excludes 'supervision', but instead includes pro-active monitoring with the IDCsr Project Manager (IDCPM), Site Manager and Quality Manager to confirm that quality assurance and management systems throughout the process are working effectively to target the goal of zero defects. The CTM will also confirm that stage payment goals have been reached (in terms of both completeness and user need quality), agree and implement appropriate signing off procedures at completion with the IDCPM, plus managing the handover of commissioning and maintenance information to facilities management and so forth.

3.2.3 Finance director/accounts controller

The client's senior finance officer will normally supervise the initial business and financial investigations into the proposed project, arrange funding and supervise project payment procedures.

Responsibilities of the Finance Director/Accounts Controller include the following:

- Leading client need, business plan and feasibility studies
- Negotiating appropriate funding/investment arrangements
- Dealing with taxation and accounting issues

- In conjunction with the IDCC Commercial Manager, setting up and closely monitoring the Project Bank Account and stage payment systems
- Identifying and communicating the financial requirements of the projects to the project team
- Consulting with the organisation's external advisers (Accountants, Investment Advisors etc.)

Skills expected of the Finance Director/Accounts Controller include the following:

- Ability to work collaboratively with Client and Constructor teams
- Confidence to delegate to appropriate specialists
- Understanding construction funding market
- Commitment to integrated and innovative approaches

3.2.4 Client's process director

The role of the Client's Process Director, the person responsible for the client's process in the proposed new facility, together with leaders of all appropriate process sections, is to assist and collaborate in the development of the business case, feasibility study and the development of the project definition and client requirements.

Responsibilities of Client's Process Director include the following:

- Set-up and lead department project team, including all appropriate sections
- Prepare information required to build business case
- Assist in testing the feasibility study
- Prepare process layouts and so forth and list specific requirements to be included in the project definition

Skills expected of Client's Process Director include the following:

- Ability to work collaboratively with client and constructor teams in IDCsr mode
- Ability to clearly describe what is required from the project to satisfy the client's process needs.

3.2.5 Specialist Advisors could include the following

- Client need/feasibility
- Funding/investment
- Tax and accounting
- Planning
- Preliminary site investigation (Figure 8)



Figure 8 The IDCsr integrated team.

4

IDCsr project insurance conditions

Traditional procurement and management systems dictate that contractors take out an overall insurance policy or policies to cover each and every project, joining in the client as necessary. This is backed up and replicated many times by the contractor's, their supply chains and consultant's individual policies, which tends to create adversarial responses if things go wrong.

Much work has been carried out under the Government Construction Strategy 2011 in developing new models of procurement that enable early engagement of the whole team including key members of the supply chain, facilitating integrative collaborative working with the use of Integrated Project Insurance (IPI). The IDCsr system represents the final step to complete integration of the design and construction process, where a single legal entity takes full responsibility for both process and end product under a product sale form of agreement.

This has enabled the same insurance brokers who have supported these Cabinet Office initiatives to devise a similar product specifically for IDCsr, called IDCsr Project Insurance (IDCPI). One of the IDCsr Sale Agreement's model conditions is the use of IDCPI on all IDCsr projects.

The IDCPI product will provide the following cover:

1. *Construction phase*
 - a. IDCC controlled project insurance covering material damage to the works plus (non-professional indemnity) liabilities to third parties arising from the works.
 - b. Financial losses consequent upon the damage set out in 1(a) including additional costs of construction, loss of profit, loss of rental income and so on.
 - c. Project-specific Professional Indemnity insurance covering defective design, specification and advice.
 - d. The 'Insured' would encompass the client plus all practitioners within the IDCC with a full waiver of subrogation rights.
2. *Post-completion cover*
 - a. Latent defects insurance (including component failure) for a period of 12 years from completion.
 - b. The definition of 'Insured' for the purposes of this cover would be as per 1(d) plus any building owners/funders/tenants as appropriate.

The levels of premium will be driven by the specifics of each project together with the make up of the IDCC teams that work within them. As a general rule, the smaller the contract, the more expensive (relatively) the premium will be. It is expected that a benchmark of IDCPI premium cost will be 2.5% of project value.

It is recommended that prospective IDCCs contact their insurance brokers to set up an IDCPI facility. Then, early in the bidding stage, ask the brokers to confirm that cover will be available for that particular project team and once the concept designs have been finalised to confirm the premium. See Stage 2.3. Premiums will be disclosed within the Stage 2 Bid to enable the Client to decide with the preferred IDCC whether to invest in IDCPI cover. If it is decided not to take IDCPI cover, then both Client and the IDCC Team will need to fall back on their traditional Design and Build/Contractors All Risks insurance policies.

However, it is expected that as the IDCsr system becomes established and more widely used, premiums will gradually fall, and at that stage, IDCPI will become mandatory on all IDCsr projects.

Reference: www.griffithsandarmour.com/linkedin

5

IDCsr project payment system

The Integrated Design and Construction (IDCsr) project payment system is intended to provide completely secure, regular and timely payments from the Client to all IDCsr Constructor (IDCC) team members through Project Bank Accounts. For clarity, the entire project payment system set out in stages 1.6, 1.7, 2.3.4, 2.6 and 3.17b is summarised here for the convenience of readers and practitioners.

- (Stage 1.6 and 1.7) Once the client budget for the project has been settled, a funding package should be agreed in principle with the Client's funder/bank, including the availability of a project-specific Project Bank Account (PBA), through which all payments to the IDCC and suppliers will be made. Full details of the PBA's terms and conditions will be set out in Schedule 4 of the Agreement.
- (Stage 2.3.4) All bids in Stage 2 will include a design stage cost draw down schedule (Schedule 5).
- (Stage 2.6) As soon as both the IDCC and the Client have signed the Agreement, the Client will activate the PBA by paying in the first sum specified in Schedule 5. This payment will complete the Agreement and empower the IDCC to commence work on the full project design.
- (Stage 3.7) Payments to design stage trade suppliers are released and payments made in accordance with Schedule 5 as the detailed design develops.
- (Stage 3.17b i) When the full design has been completed, the client signs the second part of the Agreement confirming acceptance of the design, project delivery date, total cost and the Construction Stage Payment Schedule (Schedule 6). At the same time, the Client will pay into the PBA the first Client Payment set out in Schedule 6, so authorising the IDCC to proceed with construction.
- (Stage 3.17b ii) {Agreement clause 5} The PBA procedures will be based on the release of monies triggered by the completion of stages in both the design and construction stage payment plans, Schedules 5 and 6. For example, 'the Client Purchaser shall satisfy the contract price by making payments to and on behalf

of the Constructor Seller and Trade Suppliers through the PBA in accordance with the design stage payment plans set out in Schedule 5 and the construction stage payment plan as set out in Schedule 6'.

- (Stage 3.17b iii) A list of trustees/signatories including contingency arrangements for replacement in case of death, incapacity due to illness or leaving the organisation concerned will be included in Schedule 4. It is recommended that both the Client Team Manager and the IDC Project Manager are trustees.
- (Stage 3.17b iv) All payments into the PBA shall be made in cleared funds by the due date of Client Payment set out in Schedules 5 and 6 without any deduction counterclaim or set off by electronic transfer in favour of the IDCC into the PBA account at XXX Bank, Sort Code YYY, Account Number ZZZ. There are no retentions.
- (Stage 3.17b v) Should the Client fail to make agreed scheduled payments on time, this will be deemed to be a postponement of the works.
- (Stage 3.17b vi) {Agreement clause 6} Terms of Payment. The Client Team Manager will when requested by the IDC Project Manager or the IDC Commercial Manager confirm within 3 working days from request that payment stages set out in Schedule 6 have been reached and that the work is in accordance with the specification/design so that payments can be released to the supply chain payees as the terms in (3 17b vii).
- (Stage 3.17b vii) {Agreement clause 7} Payment. Stage payments will be paid within 3 working days of Client Team Manager authorisation with the exception of the final payment, which will be made on the day of handover in exchange for possession of the project and handover information.
- (Agreement Clause 5) Project Bank Accounts (PBAs) are a form of Escrow Account that ring fences client payments to ensure that all suppliers are paid directly in accordance with the agreed payment terms. PBAs have trust status with Trustees likely to be the Client Team Manager and the IDC Project Manager in whose names the PBA will be opened and operated. Under IDCsr PBAs, payments in and out will be pre-agreed as Schedules 5 and 6 of the IDCsr Agreement.

Reference: Project Bank Accounts. Policy Paper: 2012: Cabinet Office

6

IDCsr model sale agreement terms and conditions

These model terms and conditions have been prepared to assist individual IDCC companies prepare their own terms and conditions of sale for IDCsr projects. As the IDCC accepts total, single responsibility for the entire design and construction process as well as the finished product, all the mechanisms within traditional construction contract forms designed to apportion authority, responsibility and blame are inappropriate and redundant. The IDCsr Sale Agreement has therefore been prepared as a standard product sale agreement supported by the suggested model standard and site-specific terms and conditions set out in the following section.

As the IDCsr process becomes established, it is intended that the CIOB will publish standard IDCsr Terms and Conditions to facilitate comparability during the bidding process and inhibit abuses of the system.

Until these are available, it is important that Clients and IDCCs check these model terms and conditions with their own legal advisers

Special Note 5

The principal focus of IDCsr is centered on the pro-active management of the total process rather than on reactions to traditional externally imposed contract terms. Collaboration stemming from mutual trust and respect within Client and IDCC Teams is therefore essential at all stages of the process to produce successful outcomes. The Code of Practice and the Model Terms and Conditions have both been prepared on the basis that all IDCsr practitioners will have the commitment and ability to collaborate within and between the teams. As spelt out in Special Note 1, if clients, constructors or their suppliers are uncomfortable with any of the Agreement terms or the principles set out in this Code of Practice, then they shouldn't use IDCsr, choosing one of the many alternative traditional contracting systems that are readily available.

MODEL SINGLE RESPONSIBILITY INTEGRATED DESIGN AND CONSTRUCTION SALE AGREEMENT

This Agreement is made on

Between:

The Constructor Seller (The IDCsr Constructor Special Purpose Vehicle) having its registered office

at

..... (The Constructor)

and

The Client Purchaser having its registered office

at

..... (The Client)

Agreement to Design and Construct

The Constructor agrees to design and construct the (Description of the Project) in accordance with the Terms and Conditions of this Agreement

.....
.....

at (Address of Project Site)

.....
.....

and

The Client agrees to purchase and take possession of the completed Project in accordance with the Terms and Conditions of this Agreement.

List of associated documents

The Model IDCsr Sale Agreement shall consist of the following:

- 1) This Agreement
- 2) The concept bid design cost and specification packages agreed at Stage 2.5 as set out in Schedule 1
- 3) The full design, construction and specification package, the phasing/completion dates and confirmation of final costs as agreed on between the Constructor and the Client at Stage 3.15, as set out in Schedule's 2 and 3
- 4) The Project Bank Account conditions and payment plans as set out in Schedules 4–6
- 5) The signed site Licence as Schedule 7

Definitions and defined terms

Add list

IDCsr sale agreement model terms and conditions

1) Design and specifications

The Project shall be designed to a standard of reasonable skill and care and constructed in accordance with current regulations, British Standards and Codes of Practice (or European Standards/U.S. standards or other appropriate standards for International Projects) in collaboration with the Client and Client Team following good management practice as described in the CIOB Code of Practice for Single Responsibility Integrated Design and Construction together with other conditions as set out in the following section.

Further consideration by IDCC's legal advisers needs to be given to the Sale of Goods Act 1979 paragraph 14 (3) where the buyer expressly or by implication makes known any particular purpose, which will be the case here, it is implied that the goods are reasonably fit for that purpose. This also needs to be considered in relation to the acceptance that the agreed design will be fit for purpose as set out in the Execution – part 2a.

2) Contract price

The Constructor Seller agrees to sell and the Client Purchaser agrees to purchase the Project, which is described by the designs and specifications in Schedule 2 and the conditions of this Agreement for a consideration of £ XXX as set out in Schedule 3, exclusive of VAT (or similar tax for overseas jurisdictions), which shall be satisfied by the stage payments to be made as set out in the Design and Construction Stage Payment Schedules 5 and 6 or otherwise in this agreement.

VAT where due will be paid at the rate current at the date of payment.

The IDCC will need to prepare a Design Stage Payment Schedule with the concept bid (Schedule 5) to be completed with the other details at agreement signing stage and a Construction Stage Payment Schedule (Schedule 6) to be completed when the full design and price and so forth are confirmed and the Client Purchaser signs Part 2 of the agreement.

3) Completion dates/phasing and so forth

These should be set out in tables and/or charts and included as Schedule 3. Phasing stages, where possible, should also be delineated on a site plan

Liquidated and Ascertained Damages need to be set out against each section/phase as appropriate be a genuine mutually agreed pre-estimate of loss initially set out in the Client Brief/Project definition.

Completion needs to be defined, for example, completion of all works save for very minor snags, evidence of sign-off of all statutory planning, fire and building control requirements and evidence/sign off of training for use of the building and its systems.

IDCC's legal advisers will need to draft appropriate 'postponement' clauses.

Contingency arrangements may be considered to cover delays by Statutory Authorities beyond control of the IDCC.

However, all matters directly under the control of the IDCC such as safety manual and so forth must be handed to the client at completion in exchange for the final payment.

4) **Possession of site**

Possession of the site will be granted by the Client by way of a license to the Constructor to occupy the site (attached as Schedule 7) expressed to be an exclusive right to occupy only to be determined on completion of construction and the full payment of the agreed completion price or in the event of the agreement being breached by the Constructor, say in not proceeding and so forth.

This license will need to be drawn by a property specialist. See note in Term 20.1 about registering the license to give priority to the IDCC in case of Client default. The license must be signed and in place prior to signing of this agreement.

5) **IDCsr project bank accounts**

Clause committing Client and IDCsr Constructor to the setting up and use of a Project Bank Account (PBA) for all payments. All payments into the PBA by the Client Purchaser will be transferred at least 1 month ahead of payments out to Trade Suppliers, Constructor Seller and so on to ensure that there are always sufficient funds in the PBA at least 4 weeks ahead, to make payments as set out in Schedules 5 and 6

The PBA procedures should be based on the release of monies triggered by the completion of stages in both the agreed Design and Construction Stage Payment Plans described in Schedules 5 and 6, for example, 'The Client Purchaser shall satisfy the contract price by making the following payments to and on behalf of the Constructor Seller and Trade Suppliers through the Project Bank Account in accordance with the design stage payment plan set out in Schedule 5 and the construction stage payment plan as Schedule 6'.

Add list of trustees/signatories and contingency arrangements for replacement in case of death/incapacity due to illness.

All Payments into the PBA shall be made in cleared funds by the due date of Client Payment set out in Schedules 5 and 6 without any deduction, counterclaim or set off, by electronic funds transfer, in favour of the account of the IDCsr PBA at XXX Bank, Sort Code YYY Account Number ZZZ and so on.

Should the Client fail to make agreed scheduled payments on time, this will be deemed to be a postponement of the works.

6) **Terms of payment**

The Client Team Manager will when requested by the IDCC Project Manager confirm within 3 working days from the request that payment stages set out in the Stage Payment Schedule 6 have been reached and that the work is in accordance with the specification/design so that payments can be released to the supply chain payees as the terms in (7).

There will be no retentions.

Schedule 6 will include payments to all trade suppliers on the Schedule as well as those to the IDCC.

7) Payment

- 7.1 Stage payments will be paid within 3 working days of Client Team Manager authorisation with the exception of the final payment, which will be made on the day of handover in exchange for possession of the project and handover information.
- 7.2 Appropriate VAT/sales tax clause.

8) Changes

The Constructor is not obliged to accept any variations or additional work after the Agreement has been signed, but by mutual consent, to a pre-agreed fixed price and payment schedules (which must include the costs of any consequential delay or disruption to the principle IDCsr Agreement), such work should be carried out under a separate IDCsr Sale Agreement.

One of the key principles behind IDCsr is that of certainty. Certainty that the design has been professionally completed before work starts, certainty that construction management will perform professionally to guarantee cost and delivery, both linked to certainty that the client will pay on time, not change its mind or request significant post-contract signing additions. That is the only way to guarantee client certainty of quality, fixed price and delivery date.

Unless CTMs and IDCPMs are firm from the start, anything less than a 'no-changes-to-the-contract' policy will rapidly drag the system back to the current chaos. Ideally, if proposed changes will significantly affect the cost, progress or delivery date, they should be postponed until the principle works have been completed (on time).

9) Minor modifications (not withstanding the above!)

The Client may request the Constructor (by mutual consent) to make minor design/specification changes that have no financial or completion date consequences.

The Constructor may seek the Client's approval (by mutual consent) to make specification changes (similarly without cost or time implications) to respond to the unavailability of materials, components or equipment, the introduction of improved materials or production methods or otherwise, provided such modifications are of comparable or superior quality, performance and functionality as described in the specification.

In both cases, agreement should not to be unreasonably withheld.

10) Quality assurance and management

All Constructors must commit to producing a Project Quality Plan (PQP) in accordance with a Quality Management System (QMS) compliant with BS: EN 9001 and commit the IDCPM, IDCsr Construction Manager and IDCsr Quality Manager to implementing it supported by the CTM. As part of the defined completion process, this should include all test certificates, product warranties and guarantees handed to the client.

11) CDM

The Constructor has a responsibility to safeguard all parties direct and indirect employees engaged on the project as well as all 3rd parties and members of the

public and will comply with all legislation in respect of Health and Safety especially the Construction Design and Management (CDM) Regulations. Registration to ISO BE:EN 18000 is a preferred route. It is the Constructors' clear responsibility to act as 'principal contractor' and to ensure that all parties engaged with the project understand the procedures and policies in place and be committed to the promotion of good health and safety.

12) **IDCsr project insurance**

The Constructor together with the Client will take out a joint IDCsr Project Insurance (IDCPI) policy, which will provide the following cover:

12.1 Design and construction phase

- a) IDCC controlled project insurance covering material damage to the works plus (non-Professional Indemnity) liabilities to third parties arising from the works.
- b) Financial losses consequent upon the damage set out in a) above including additional costs of construction, loss of profit, loss of rental and so on.
- c) Project-specific Professional Indemnity insurance covering defective design, specification, advice and so on.
- d) The 'Insured' to encompass the client plus all practitioners within the IDCC with full waiver of subrogation rights.

12.2 Post-completion cover

- a) Latent Defects insurance (including component failure) for a period of 12 years from completion.
- b) The definition of 'insured' for the purposes of this cover would be as 12.1 d) above plus any building owners/funders/tenants as appropriate.

13) **Warranties**

IDCPI cover will replace collateral warranties, but both Clients and IDCCs should provide performance bonds and/or guarantees with step in rights for Constructor, Client and Funder. *These need to be carefully drafted by experienced legal professionals.*

IDCsr Project Insurance cover and the 12-year post-completion cover can be assigned to new owners.

14) **Force majeure events**

Legal advisers to prepare suitable wording to cover this.

15) **Naming of IDCs and CTM**

The IDCs and the CTM will be named personally, with an obligation on Client and Constructor to replace them immediately by mutual consent (not to be unreasonably withheld) should something happen to either of them.

16) **Delays, liquidated and ascertained damages (LADs)**

Legal advisers to draft appropriate LAD clause required to avoid potential problems with unlimited damages.

As this is to be a genuine pre-estimate of loss, it should be calculated and agreed on between the Client and the Constructor.

17) **Commissioning, handover and user training**

Detailed explanations and instructions will be required for each element of the building. Adequate time must be specifically allocated for commissioning plus pre-completion and ongoing post-completion training and balancing of the building and its services. There must be comprehensive operation and maintenance manuals, which are explained to the client's FM team, as set out in the CoP [stages 3.7 and 3.17b, i, j and k] as part of the full design and delivery processes.

18) **Signing off procedures, zero defects and so on**

IDCCs must aspire to provide a finished product that is for practical purposes defects free that can be 'signed off' by the CTM as part of the PBA payment structure. This will require a structured transition between the IDCC's handover and maintenance team and the Client's FM team as (17).

19) **Maintenance and after-care services**

Arrangements for maintenance and after-care services should be described in the Client Requirements and the IDCC's final overall bid package included in Part 2 of the Agreement. (CoP stages 3.14 and 3.15)

20) **Breaches and defaults**

When either of the parties breaches the conditions of a traditional fragmented responsibility construction contract, the result is invariably litigation and/or the involvement of the insolvency industry with its associated delays, inefficiencies and wasted costs. IDCsr with its total integration, collaboration and mediation facilitates a new approach to construction dispute resolution. The commitment to 'mediation' and the appointment and naming of a 'Project Mediator' should be a basic term of all IDCs Sale Agreements.

One of the principal reasons why it is recommended that all IDCC legal entity companies be set up as Special Purpose Vehicles (SPVs) is to facilitate the application of optional Step-In Rights for Clients, Funders and IDCCs. This will enable 'distressed' IDCsr projects to be completed with the original IDCC management and suppliers without resort to the wasteful and disruptive insolvency process.

20.1 **Client Default**

Most client payment defaults are likely to be concerned with the payment process, and any delays will trigger a 'postponement' of the work. The Mediator should be involved immediately to broker a solution that allows the postponement to be lifted and work to proceed.

In the case of terminal financial difficulties by the client, the funders or guarantors have the option to exercise their step-in rights, take over the Client role (including the PBA payment system), working with the original IDCC Team to complete the works as the Agreement.

Alternatively, depending on the particular project circumstances, the Constructor could exercise his own step in rights with a new funder to complete the project and so recover its full value.

The Constructor will still retain the exclusive license to remain on site, and if the license has been registered, the Constructor should have priority over any insolvency practitioners.

Should the Client default and the funders do not exercise their step in rights, procedures need to be in place to allow the Constructor to recover any outstanding payments and costs, keeping possession of the site until they are paid.

20.2 Constructor default

In the case of Constructor default, the client/funder can exercise their step in rights to take over the IDCC SPV completing the project with the original IDCC Team, suitably supported.

21) **Dispute escalation and resolution**

First step IDCPM and CTM to resolve and if unsuccessful, Mediation second. Mediator to be agreed in advance between Client and Constructor and named in the Sale Agreement.

The mediator should be passively involved through the project intranet or the e-design system and aware of project progress and issues as work proceeds, so that if called upon, the mediation can take place swiftly. Note: mediation is a facilitative process for the parties to arrive at their own solution. The mediator does not make a decision but facilitates the parties settling the matter between them.

If mediation fails, to comply with the Construction Act in the UK an Adjudication Clause is compulsory.

Where used internationally, the Agreement will require the appropriate rules and seat where the arbitration is to take place, for example, London.

22) **Notices**

A clause will be needed to set out what notices are required and when they should be served, including where they should be sent.

A key notice trail will be required for the stage payment process as well as sectional and final sign off and completion.

23) **Copyright and confidentiality**

Clause needed to deal with intellectual property rights and any royalty free license issues.

24) **General and assignment provisions**

- a) Effective Date
- b) Assignment of rights and liabilities of partially completed project
- c) Exclusion of liability
- d) Entire Agreement
- e) Third Party Rights
- f) Consent and Deemed Consent
- g) No waiver of Rights

Execution

Form of wording to express

Part 1

- a) The Constructor Seller, by signing commits to develop the full project design and specification from their concept bid for the budget specified in the bid and once that full design, specification and budget have been confirmed by the Client Purchaser (as Part 2) to proceed with construction and delivery of the project within the agreed time frame.
- b) The Client Purchaser, by signing commits to purchase and take possession of the completed project, to initially paying for the development of the full design through the design cost draw down stage payments set out in Schedule 5 and then to pay for the construction of the project through the construction stage payment plan as Schedule 6.

Part 2

- a) To be signed by the Client Purchaser as soon as the full design has been completed (Stage 3.15), confirming acceptance of that agreed design, project delivery date, contract price and construction stage payment schedule, so authorising the Constructor Seller to proceed with construction.
In doing so, the Client Purchaser also confirms acceptance of the collaborative interpretation of the Client Brief and Project Definition, and provided the Constructor team deliver the project in accordance with the agreed designs and specifications (including any agreed changes), the Client Purchaser accepts that the finished product will be suitable for its intended purpose.
- b) The Client Purchaser has granted a license to the Constructor Seller to occupy the site made expressly to only be determined when construction is completed and all payments have been received by the Constructor Seller or in the event of the agreement being breached by the Constructor Seller. A signed copy of the license is included as Schedule 7.

List of schedules

Schedule 1 The concept design cost and specification package

Schedule 2 The full design construction and specification package confirmed between the Client and Constructor at Stage 3.15

Schedule 3 The agreed cost and project delivery/phasing dates as confirmed between the Client and constructor at Stage 3.15

Schedule 4 The project bank account conditions

Schedule 5 The design stage payment plan

Schedule 6 The construction stage payment plan

Schedule 7 The signed license to occupy the site

7

IDCsr information and communication technology (ICT)

Construction is an information-intensive industry, thus establishing and demanding its own brand of information management. The traditional extensive range of direct and indirect stakeholders demands exploitation of sophisticated information technology in a highly coordinated manner. This fragmentation of stakeholders has created significant barriers to effective communication amongst these actors, and the exchange and management of a vast array of information and documents that are provided and shared, throughout the whole of project life cycle.

The most important feature of IDCsr, however, is the integrative nature of working throughout all constituent phases of design and construction, which addresses most of these old communication problems. Under IDCsr, the principal issue is how the IDCsr Constructor team members can access and manipulate the project information in their collaborative space. The key features include administration tools for distributed, personal, team and project information. Also imperative is seamless access to building models and information, while taking account of appropriate systems management and protection issues for sharing and rules for the ownership of the information. In addition, there is a need for a form of knowledge management to capture the diverse knowledge of various projects and varying team members. These features of the IDCsr process impose a number of stringent constraints on the ICT platform, but the resulting benefits are likely to be overwhelming.

The scope of ICT coordination applicable to IDCsr can vary from a simple project extranet and CAD system to a fully integrative collaborative environment based on a fully interoperable Building Information Modelling (BIM) platform. There is also a range of possibilities that exists in-between the two scenarios, and there are examples of teams combining level 2 BIM with CAD and other e-business tools. The choice of an option is governed by several factors, including the maturity and capability readiness of the key players not least the client, as well as the development and reliability of these emerging systems.

An example of the implementation of an extranet/CAD system option is the use of a typical project extranet that facilitates efficient inter-project communication, as well as document management system. The designers produce and share the relevant project information on the IDCsr Constructor's central system. On the basis of their specific access rights, specialists and other users access, add to or manipulate the necessary information on demand under the supervision and guidance of the e-Design Systems Manager and the Design manager.

7.1 Project management ICT

The concept of project management has existed ever since a group of people pursued achieving a specific goal with limited resources and under certain constraints. In the late 19th century, F. W. Taylor and later his student, H. Gantt, laid the foundation for a systematic approach to planning and control technique. However, it was in the 1950s that project management was recognised as a distinct discipline, supported by scientific underpinning. DuPont and Remington developed Critical Path Method. Around the same time, the U.S. Navy commissioned a work leading to the development of Programme Evaluation and Review Technique (PERT). PERT was designed to accommodate the uncertainties associated with projects and project scheduling, and it was a manifestation of the use of statistics to forecast project progress on the basis of probability.

Project management is the field of managing change to achieve a specific goal. While it is a disciplined science of planning, organising and controlling resources, its soft side addresses interpersonal and motivational aspects of change management: it places the emphasis on the influence of people and culture on management of projects.

Typically, project management tools enable project planning, execution, monitoring, control and resource planning. They define activities and show their dependencies. The critical path diagram offers means by which project information is visualised. Through identification of the critical path, early start, late start and slack for each activity is also provided. Additional time and cost optimisation is achieved through techniques such as activity crashing of critical activities, which tend to produce a minimum increase in the cost for a maximum time crash.

The process view of project management enables performance enhancement through analysis and understanding of construction processes in projects and facilitates mapping of resources and technology on project activities. The process view has paved the way for the development of radical theories and practices. A more advanced managerial skill expected of the construction project manager is to facilitate integration of design and production and instigate alternative strategies for lean processes that offer value with reduced time and waste. Also, Benefit Realisation Management (BRM) shifts the emphasis from the product or output to the benefits of the project and its outcome, thus redefining the way project success is measured; as well as Agile Project Management (APM), proposed by the software development community to address the complex and dynamic nature of some projects where iterative planning is undertaken in an adaptive rather than the traditional pre-determined manner.

The critical systems thinking approach to project management places project management within a host of system methodology tools such as linear programming and operations research, modelling and simulation and Optimisation. Project Systems Management is typically aided by the use of one or more of many software tools for managing project, resources and cost by addressing such issues as the following:

- Principles of Management
- Estimating the duration

- Preliminary actions
- Pricing the project; indirect cost, labour and equipment
- Management input
- Construction methods
- General time schedule
- Construction Equipment
- Summary sheet
- Labour units
- Project overhead
- Fees/mark-up
- Gantt chart
- CPM and PERT
- Project success and failure factors
- Project manager responsibilities
- Project quality management
- Project risk management
- Project cash flow and financial management
- Project cost control
- Earned Value analysis
- Activity Crashing, time cost trade-off

Typical project management systems offer Project Planning; Time and Expense Tracking; Scheduling; Budgeting, Billing and Invoicing as well as extended provisions such as Multi-user interface; Risk Management; Inventory management; Document Management and Customer Management.

There are numerous project management and project tracking systems ranging from free online systems to highly sophisticated systems that integrate project management with a number of other systems, such as Customer Relations Management (CRM), Enterprise Resource Planning (ERP) and project portfolio management. Some are cloud based, while others offer traditional powerful generic project management systems. There are a number of packages that are designed specifically for construction Projects. Also, over the past two decades, 4D construction planning and visualisation of construction schedules has gained popularity.

The extended application of project management concepts and technologies makes use of Web-based solutions, cloud computing, virtual team/environment, mobile computing and smartphones. They offer the suitable environment for IDC to operate and achieve its wider objectives of facilitating a collaborative system that supports multiple users with links to the client and integrated systems that combine project management with other enterprise systems. It also enables seamless communication with all parties including the client and team.

7.2 Summary of other ICT tools available for IDCsr practitioners (see Appendix for details)

Business process

Construct IT for Business

Interoperability

International Alliance for Interoperability (IAI) Building SMART – UK Chapter

e-Business

The Network for Construction Collaboration Technology Providers (NCCTP)

Electronic document management systems

Electronic trading

Construction Industry Trading Electronically (CITE)

Enterprise resource planning

Concurrent engineering

Information visualisation

Mobile technology

Health and safety

Drawing distribution and usage

Goods received notes

Maintenance inspection

Monitor hazardous activities

Monitor progress

Onsite people monitoring

Quality inspection

Site design problem resolution

Site diaries

Task allocation

Construction Opportunities for Mobile IT (COMIT)

4D PROJECT MANAGEMENT

BUILDING INFORMATION MODEL(LING) – BIM

BIM Task Group

BIM Academic Forum – BAF

Visual Approach to Operation and Maintenance

Construction Operations Building Information Exchange (COBIE)

8

Process Stage 1 inception

Stage 1 Inception

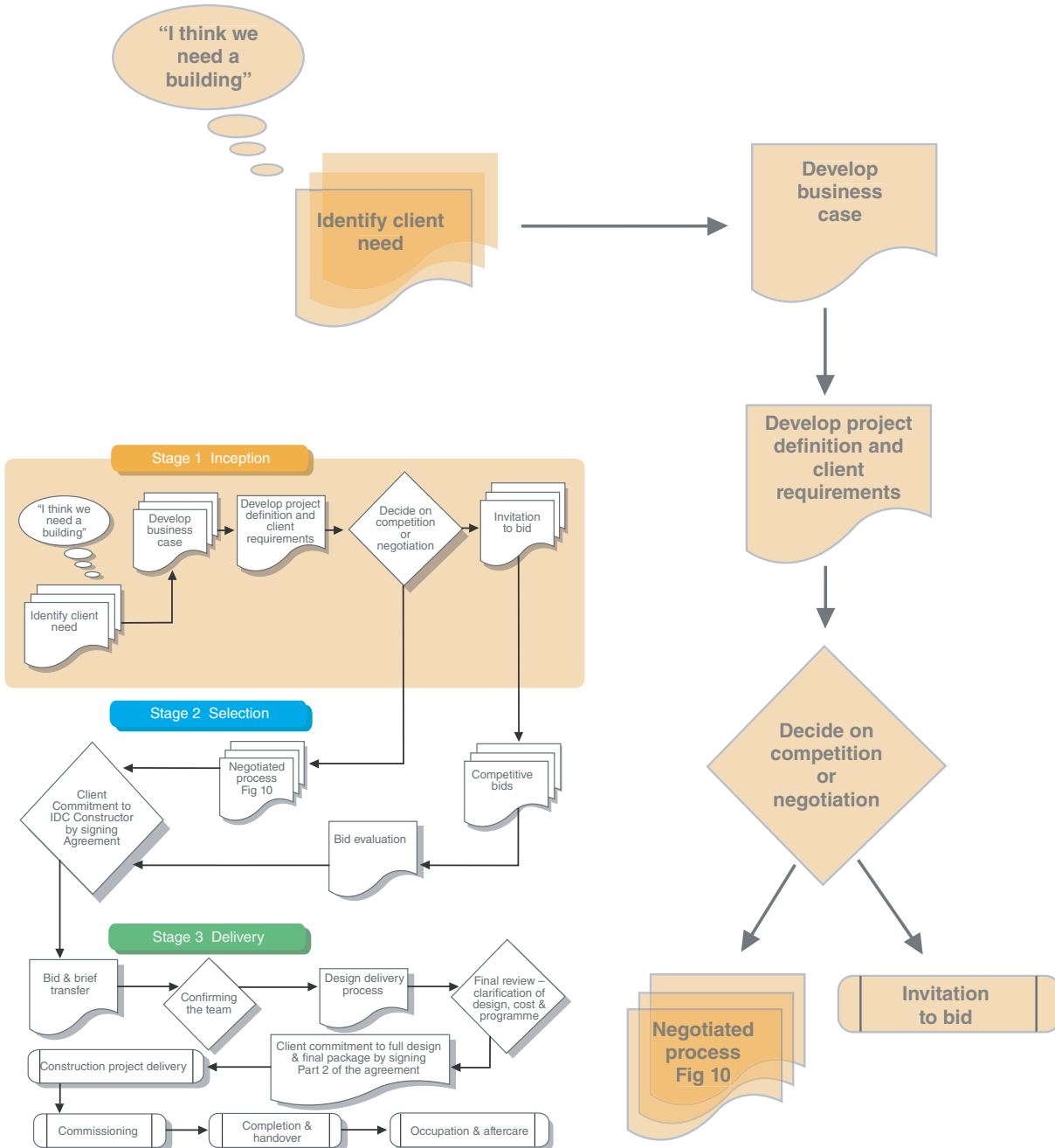


Figure 9 Stage 1 flow chart.

Integrated Design & Construction – Single Responsibility: A Chartered Institute of Building Code of Practice, First Edition. Colin Harding.
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Stage 1 Client team set-up, client need, business case/feasibility and client brief preparation

This chapter describes ways of building the client team, preparing a statement of need, development of the business case, testing its feasibility, developing the clients project definition, project budget, funding, payments and summaries the bidding process for both competitive as well as the negotiated IDCsr process (Figure 9)

Stage 1.1 Set-up client team

As soon as a client organisation has decided to consider the need for a construction project under the IDCsr process, the first step should be the appointment of their Client Project Sponsor (CPS). The CPS should then immediately appoint an appropriately experienced Client Team Manager (CTM). Together, they should select members of the Client Team, those who have sufficient expertise and experience to develop the business case, client requirements and project definition. It may be that the expertise (including that of the CTM) is already available within the client organisation, but if not, external specialist appointments should be made (Figure 6).

The focus of selection should not be solely on skills, expertise or experience, but also on attitude, soft skills and commitment to the successful outcome of the collaborative project, measured against the business need. The members of the team should have appropriate leadership skills, be capable of facilitating and managing people, as well as having an open-minded approach that encourages innovation and fosters a true team-based approach to delivering the project. The overall success of the project will be influenced as much by the quality and leadership of the client team as that of the IDCsr Constructor's.

In most cases, the team will be a mix of internal staff supported by external specialists, but either way, the team should include or have input (as necessary) from the following:

- Finance/Accounting personnel
- Tax and Accounting advisors
- Investment and Funding advisors
- Property and Facilities Management
- Client Process Management
- Project Office/Support/Admin
- Land/Planning Advisors
- Operational or Asset Management Teams.

On formation of the team, the CPS should call them all together for an introduction and briefing meeting to get the project started. Agenda items could include the following:

- Introductions
- Summary of executive management's expectations of the project
- Explanation of overall IDCsr process and culture
- Allocation of tasks to team members
- Discussion and agreement of expected overall design and construction programme.

Stage 1.2 Client need

The perceived need to embark on any construction project requires an investigation by the client to check that the potential project represents the best way of meeting a defined need by:

- Preparing a Project Mandate
- Preparing a formal 'Statement of Need'

A sound Project Mandate will:

- Be driven by needs
- Be based on sound information, reasonable estimation and forecasts
- Contain rational processes
- Be aware of the risks associated
- Contain flexibility
- Maximise the scope of obtaining best value from resources
- Utilise previous experience
- Embrace project sustainability.

In assessing the need for construction, key questions should include the following:

- Why is the project needed?
- How can it be justified?
- How best is the need fulfilled (e.g. a new building, refurbishment, extension of existing structure or move to new site)?
- What are the maximum estimated capital and running costs that 'the need' can justify?
- How many months/years before the finished project is needed?

The outcomes of these questions will form the Statement of Need

Reference: Code of Practice for Project Management for Construction and Development 5th Edition: 2014: CIOB/Wiley Blackwell – Chapter 1 Inception & Briefing Note 1.03 Project Mandate Template

Special Note 6

The CTM will be able to guide and assist the client, but it is important that the Client's internal team themselves clearly establish their real needs through their own Statement of Need. This will facilitate the development of a comprehensive Project Definition and through that ensure that the project design incorporates all the process needs and requirements.

Stage 1.3 Business case and testing its feasibility

The main objective at this stage for the client is to review the Statement of Need in order to invest wisely in the construction project and to prepare the business case (capital expenditure programme) for the project involving careful analysis of its business, organisation, present facilities and future needs.

Experienced clients may have the necessary expertise to prepare their business case themselves. Less resourced clients may need help from appropriate specialists, as advised by their CTM.

Special Note 7

This part of the IDCsr process varies significantly from traditional construction project inception and business planning. The IDCsr Business Case is concerned solely with the impact of the proposed construction project on the client's on-going business. IDCsr Business Cases are prepared before any building design concepts are developed and will form an important part of the Client brief, from which the IDCsr Constructors will formulate their design and construction concepts and bids for the Client's consideration.

1.3.1 The development of the business case

The need for a construction project must be tested vigorously and fully explored within the client's organisation, as with any other capital purchase. For example, a car buyer will consider their needs and priorities before making the purchase, that is, size, user, efficiency, make, model, colour, interior, finances and so on. In the same way, the client team should take time to understand the requirement for a project by using an overall holistic approach and then testing its viability. This should not be limited to the immediate Client Team, but shared with the whole organisation, with the CTM coordinating and involving other professionals and stakeholders as required.

A business case is required to obtain management commitment and approval for funding or investment through demonstrating a rationale for the funding or investment. The business case provides a framework for planning and management of the proposed development, as well as a monitoring benchmark for the on-going viability of a project.

Consideration should also be given to the following:

- a. Operation of the proposed new facility – what are we looking to get from the project, what is its function and what is the need that it will fulfil? What will be the

day-to-day issues that need to be considered at the early stages?

- b. Who will operate the facility and what are their needs? Facilities and maintenance staff/teams should be involved at the initial planning stages and made aware of the objectives of the project.
- c. Health and Safety – Health and safety teams within the organisation will have a part to play at design stage, during the project and when operational. They should be involved not only in health and safety issues, but also in discussions surrounding project information and how it is to be managed and accessed during operation.
- d. Environmental performance – what level of environmental performance is required and what environmental assessment/rating system should be employed?

Reference: Code of Practice for Project Management for Construction and Development 5th Edition: 2014: CIOB/Wiley Blackwell – Briefing Note 2.05

Template for the development of a business case:

1. Definition of the project proposal
2. Objective of the project proposal
3. Strategic fit
 - 3.1 Business need
 - 3.2 Organisational overview
 - 3.3 Contribution to key organisational objectives
 - 3.4 Stakeholders
 - 3.5 Existing arrangements
 - 3.6 Scope (minimum, desirable and optional)
 - 3.7 Constraints
 - 3.8 Dependencies
 - 3.9 Strategic benefits
 - 3.10 Strategic risks
 - 3.11 Critical success factors.
4. Options appraisal
 - 4.1 Long and short list of options
 - 4.2 Opportunities for innovation and collaboration
 - 4.3 Service delivery options – who will deliver the project?
 - 4.4 Environmental, social and economic criteria
 - 4.5 Implementation options

- 4.6 Detailed options appraisal demonstrating value for money and sustainability
- 4.7 Risk quantification and sensitivity analysis
- 4.8 Benefits appraisal
- 4.9 Preferred option
5. Commercial aspects
 - 5.1 Output-based specification
 - 5.2 Sourcing options
 - 5.3 Risk allocation and transfer
 - 5.4 Contract length
 - 5.5 Implementation timescales
6. Affordability
 - 6.1 Budgetary issues
 - 6.2 Income and expenditure
 - 6.3 Cash flow
7. Achievability
 - 7.1 Evidence of similar projects
 - 7.2 Project roles
 - 7.3 Delivery strategy
 - 7.4 Risk management strategy
 - 7.5 Benefits realisation plan
 - 7.6 Contingency plan

Reference: Code of Practice for Project Management for Construction and Development 5th Edition 2014 CIOB/Wiley Blackwell – Briefing Note 2.05

1.3.2 Testing the feasibility of the business case

The effectiveness of a business plan should be judged on the basis of the following key criteria:

- Is the need for the project clearly stated?
- Have the benefits been clearly identified?
- Are the reasons for and benefits of the project consistent with the overall strategy?
- Is it clear what the preferred option is and why?
- Is it clear what will define a successful outcome?
- Is it clear how the necessary funding will be put in place?
- Is it clear how the benefits will be realised?
- Are the risks faced by the project explicitly stated and is there a mitigation plan in place?

Reference: Code of Practice for Project Management for Construction and Development 5th Edition 2014 CIOB – Section 2 Feasibility

Stage 1.4 Developing the client's project definition

One of the most important parts of the CTM's overall role in the IDCsr process is to assist the Client Team in establishing what they really expect from the project, expressed in the form of the Project Definition (PD). It must embrace both the quantification of client needs and the notion of 'IDCsr design quality', where every architectural feature adds real value to the final product. In other words, the basic purpose of the PD is to provide the clearest possible and most detailed description of what the client needs and wants from the project. This together with the Client Requirements will form the Client's overall brief.

It will be made up of information from the business plan, supplemented with any data that adequately help to describe the client's needs and objectives. This can be in a variety of different forms including spatial requirements, process layouts and room data sheets, ranging up to technical concept sketches, specifications of any specialist equipment required, site and initial planning assessment reports and so on. The client team, led by the Client Team Manager (CTM), will produce the PD. The CTM has a particular responsibility to communicate to the IDCCs the required level of appropriate/necessary design quality in relation to user needs. The PD must also provide a clear understanding of the client's design and construction needs and requirements alongside the brief that will detail the client's budget, required project delivery date, any specific phasing and so forth. The information contained within the brief and PD must be sufficient to enable the IDCCs to carry out the initial design, pre-project planning and cost and time assessment necessary to submit a competitive bid in Stage 2.

Essential to this stage is that the PD reflects the client's business values and drivers, as well as the significance of the role of the intended project. If the client team, for whatever reason, is unable to prepare an adequate PD, then negotiation with an experienced and trusted IDCC should be considered, or otherwise (but less satisfactorily) the use of a more traditional form of project procurement.

References: The Design Manager's Handbook : Eynon J: 2013 : CIOB/Wiley Blackwell

The Code of Practice for Project Management for Construction and Development 5th Edition: 2013: CIOB/Wiley Blackwell

Special Note 8

The better the Project Definition, the greater the opportunities it will create for the IDCsr Constructors to develop the design and to consider options for creating and adding value, through design ideas, systems selection, alternative specifications, construction logistics and so on.

Stage 1.5 Budget

One of the key principles of IDCsr is that client need, particularly cost certainty, takes precedence over designer's personal aspirations. It is important therefore that the overall budget is prepared directly and only from the statement of need and business case and not (as traditionally) with half an eye on what might be the new building concept. Under IDCsr, the client needs to establish the maximum budget that both the overall business and the process that is planned for the new building facility can support. That is the budget figure within which the IDCCs will develop their own concept designs and bids. To achieve the best value from the three bid designs, the budget should be as accurate and realistic as possible, tempered only by the CTM's assessment against generic square meter comparative price indices and the Client's expectation of quality standards.

Stage 1.6 Funding and accounting

Consideration must be given not only to the level and sources of funding, but also to the finance structure over the lifecycle of the project, that is, long-term cash flow, timing of expenditure and payments and reporting formats that integrate into existing systems. It should be made clear to funders at the enquiry stage that the IDCsr Agreement conditions, particularly those relating to retentions (none), stage payments and the IDCsr Project Bank Account (PBA), form an essential part of the overall package and cannot be amended. Provisional arrangements to open a PBA must be made at this time with the client's funder/bank as part of the overall funding package, as the Form of Agreement that will be signed at the end of Stage 2 cannot be completed until the first payment by the client has been transferred into the PBA.

Because the IDCsr Agreement is in the form of an all-inclusive, fixed price product sales contract, without old style 'variations' or 'extras' and associated delays and claims, traditional budget/actual cost comparisons are no longer relevant to clients. However, all IDCC progress and programming information, particularly that related to the stage payment schedules, will be shared with the client through the transparent document management system.

Stage 1.7 Payments

The IDCsr payment system has been designed to provide completely secure, regular and timely payments to all IDCC team members, including trade suppliers. IDCsr projects are substantially designed, and the construction phase is fully scheduled before Part 2 of the Agreement can be endorsed and construction work commences. It is therefore feasible and practical to utilise a system that is based on releasing payments as soon as pre-agreed, scheduled sections of the works have been completed.

The schedules will list the completed stages with an expected date of payment to allow the client's accounts department and the project coordinator to pre-plan payments. Payments will only be released within a maximum 3 working days of confirmation by the IDCPM/CTM that the relevant stage has been satisfactorily completed. All payments will be made direct via electronic transfer. The Client/CTM will regularly receive all progress and

programming information from the IDCC to assist payment management, as in 1.6.

All payments from the funder/client will be transferred directly into an IDCsr form of Project Bank Account (PBA). The Client will be committed to paying-in to the PBA 1 month in advance of outgoing payments, in accordance with the Client Paying In Schedules 5a (design) and 5b (construction) the terms of which are set out in the IDCsr model sale agreement. The first payment into the PBA will be on signing Part 2 of the Agreement, so authorising construction work to commence. No individual or company, including the client, funder or IDCC can independently interfere in the release of monies from the PBA except those named personally as Trustees within the terms of the Agreement.

The payment stages will be structured to commence from the start of the design stage with the last payments at handover, on the day that possession is granted and the client takes over full responsibility for the product. There will be no retrospective 'final account' negotiations, as the project cost account will be continually updated as the work and payments to the Trade Suppliers progress. This project payment account will be finalised by the time of completion and handover and form the final completion statement.

Special Note 9

The IDCsr Stage Payment system, through the project Bank Account is designed to take out the risk of payment delays, uncertainties and conflicts that have bedevilled the traditional fragmented contract systems for so long. All IDCC team members are treated with equal respect, with secure, pre-agreed, regular payments without retentions.

Stage 1.8 Client choice between competition and negotiation

Clients can choose at this stage whether to seek up to three (maximum) competitive bids or to negotiate the project with one Constructor.

1.8.1 Competitive bidding

The IDCsr competitive process is intended to provide clients with a choice of two or three (maximum) design and construction concept proposals that have been separately worked up from the same client brief. These bids will provide the client with a comparable choice between the three architectural designs, overall layouts, materials, timescales and compliance (or otherwise) to budget.

The concept bids must be sufficiently developed not only to allow the client to make an informed, objective choice, but also to enable the IDCCs to commit to the client's budget or above/below that budget, as specified in the bids. The full design, which is then developed by the selected IDCC working integratively with the Client Team in Stage 3 must be delivered to that agreed budget.

The concept proposals will take account of likely planning issues, but of necessity, will be subject to the formal planning/development control approval process in Stage 3.

Special Note 10

Clients are strongly advised not to exceed the maximum three invitations to bid, if they wish to attract concept bids from the best IDCCs. IDCsr bids involve far more cost and commitment than tenders for traditional fragmented procurement systems and the IDCC's decision whether to bid will be influenced by their chances of success.

1.8.2 Negotiation

The same basic IDCsr design and construction process is followed, where the client wishes to negotiate with one IDCC. Negotiation from the start of the process is the best and most productive form of integration, particularly for repeat business clients whose regular constructors know and understand their business aims and objectives. Innovations and economies devised on one project can be incorporated in the next, progressively improving the standard of service, value for money and the finished product.

Clients negotiating under IDCsr with a known and trusted IDCsr Constructor enable the IDCPM and team to assist the Client Team in developing their Project Definition and working on the concept and then the full design together, so effectively merging Stages 1, 2 and 3 into a seamless and considerably shortened process. Negotiation is particularly recommended when there is insufficient time or resources for the Client to develop an adequate PD (Figure 10).

Special Note 11

In an integrated industrial process, real costs are reduced over time through organisational learning, improved productivity, simplified processes and so on. The total integration of the IDCsr design and construction team enables IDCCs to transfer such positive learning from project to project and client to client. This can lead to continually improving the quality, efficiency and value for money that IDCC teams can provide through the IDCsr competitive process as well as the negotiated form. IDCsr offers the opportunity of better value for the client and better returns for constructors, designers and their teams, so improving future performance.

Stage 1.9 Identifying appropriate IDCsr constructors

The IDCsr process offers many benefits to both would-be clients and aspiring IDCCs, but it should not be seen as an easy option. Clients and constructors must be prepared to accept IDCsr's unique concept of risk management and allocation of responsibilities. The identification and selection of appropriate IDCCs should be based therefore on experience of and commitment to the IDCsr culture and process, as well as the overall quality of their bids.

Assessment Criteria that can be used include the following:

- Objective assessment of client's past experience (if any) of working with IDCCs from their own staff who were directly involved in such previous projects
- Reputation and references from other clients

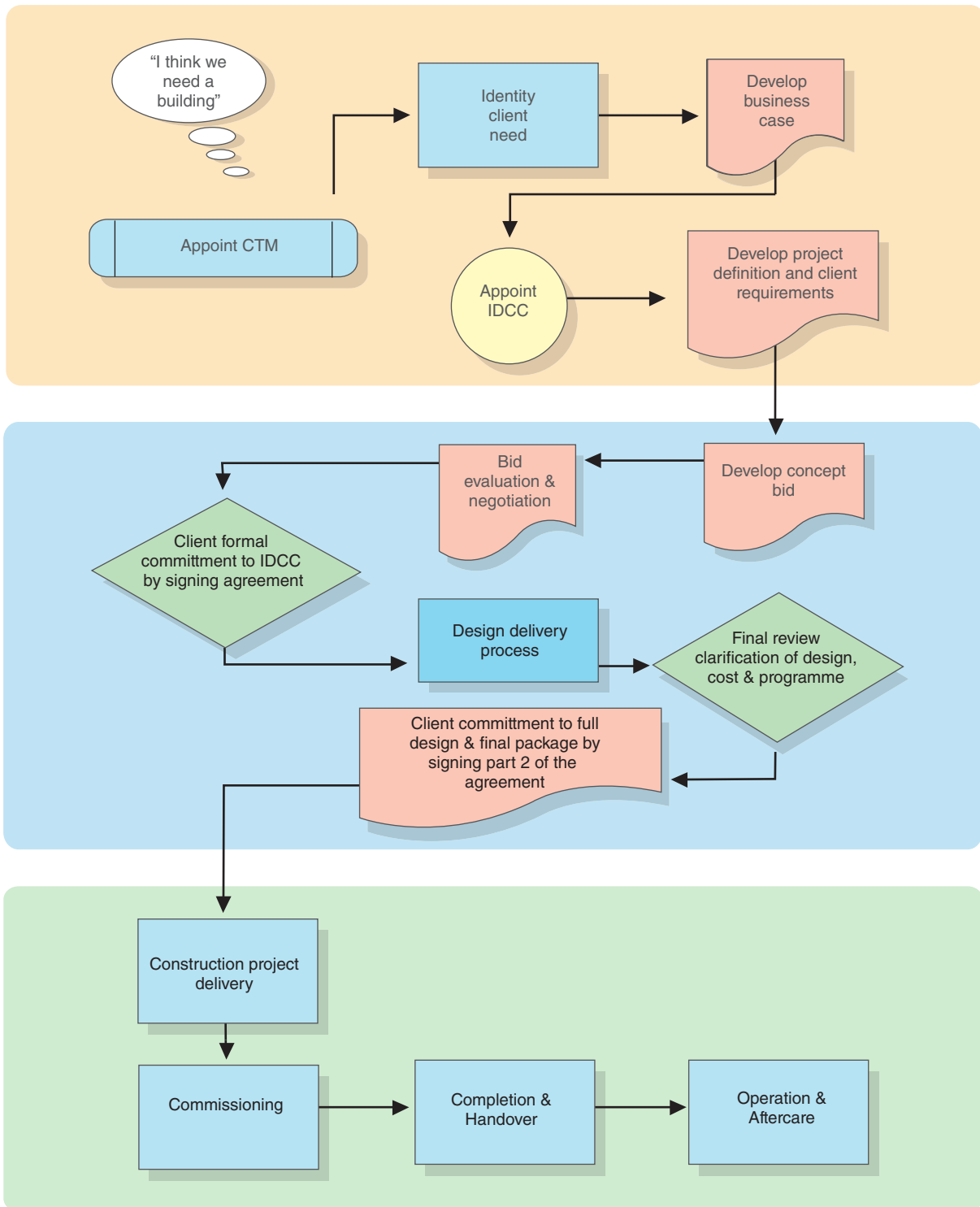


Figure 10 The negotiated IDCsr process.

- Confirmation IDCC's can provide an IDCsr Project Insurance Policy
- Corporate responsibility for health, safety and environmental matters
- IDCsr's relationships with their staff and trade suppliers

- Ethos of the IDCC – are they truly committed to the collaborative integration of IDCsr?
- Trust and respect – is it mutual?
- Financial stability.

Stage 1.10 Competitive bidding process

1.10.1 Criteria that can be used as basis for competition

- Rating of concept design including style, overall layout, spatial economy and flair, environmental standards and whole life costs
- How will it satisfy the aspirations of the project definition and client requirements?
- Appropriateness for intended use
- Strength of IDCC's quality management systems
- Compliance to budget or above/below
- Time to design and time to complete delivery
- Compatibility and confidence in the IDCC's team leaders, staff, specialists and suppliers
- Project/Client specific criteria.

This criteria list should be included in the client requirements/bidding documentation to help everyone understand at what they are aiming!

1.10.2 Bid evaluation process

The evaluation of IDCsr bids requires a quite different approach from that of the traditional contract tendering process. Issues of competence and experience of the bidders should have been cleared at the invitation to bid stage. IDCsr bid evaluation is less concerned about budget/cost and more on how much value (in the design, investment and performance of the project/structure) can be added through the integrated detailed design stage (3.7). It is about confidence in clients and constructors being able to successfully work together and develop good personal relationships between both teams to secure the most satisfactory design and delivery.

The CTM and CPS will develop a scoring matrix on the basis of the criteria used to identify appropriate bidders (1.10.1), together with concept project specific criteria such as those listed as follows:

- Confidence in being able to work with the IDCC's key team leaders
- Quality and ability of IDCC's complete team
- Confirmed budget
- Design delivery period and project completion date
- Concept style and materials

- Functionality of concept
- Value engineering experience and strengths
- Environmental performance criteria
- After-sales services and support.

References: (Although these are designed for traditional procurement procedures, many of the key principles are pertinent to IDCsr project scoring matrices):

The procurement Toolkit good practice guide, Guide to Tender Evaluation: Dec 2012 OGC

Tender Evaluation using Weighted Criteria: OGC

Stage 1.11 Preparing the client's brief/bid documentation

The IDCsr Client Brief will be formed of two parts.

1. The Client Requirements including all procedural issues such as the following:
 - How the bidding process will work
 - Dates and arrangements regarding how the bids will be presented
 - Criteria to be used to evaluate and assess the bids
 - Results of Client's preliminary investigations including all feedback from initial discussions with planners, ground investigations and so on
 - Minimum information required in IDCC's bid
 - IDCC's time required completing full design to Stage 3.8
 - IDCC's proposed construction time
 - Confirmation of budget, or above or below
 - Full concept presentations and supporting documentation including the form and format in which the presentations and so forth should be made.
2. The client's 'design and construction' brief in the form of the Project Definition as set out in 1.4.

Reference: Code of Practice for Project Management for Construction and Development 5th Edition: 2014: CIOB/Wiley Blackwell – Chapter 2 Feasibility

Special Note 12

The Project Definition and the Client Requirements together make up the IDCsr Client Brief. Unlike traditional contract tendering, under the IDCsr Form of Agreement, it is in the Client's best interests to openly disclose in the Brief, in its clearest form, all available project information to the IDCCs, including a realistic (rather than tactical) budget. Failure to disclose such a budget together with all significant site and associated project knowledge could result in less than satisfactory concept bids.

9

Process Stage 2 selection

Stage 2 Selection

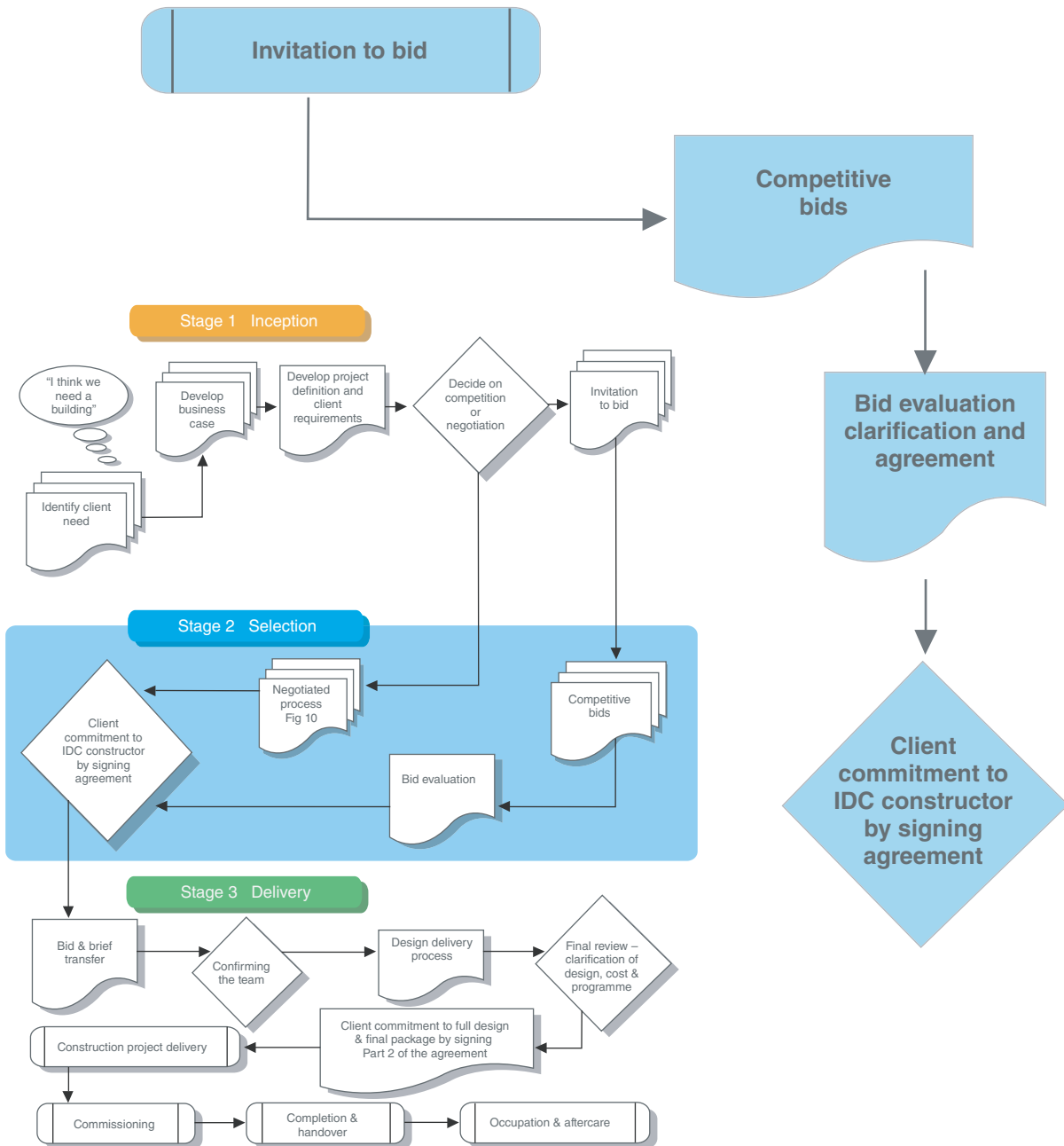


Figure 11 Stage 2: flow chart – competition.

Stage 2 IDCC competitive bid process, IDCC concept, client evaluation and commitment

This chapter describes the IDCC competitive bid process including effective transfer of the project definition and client requirements to the bidding IDCCs team leaders. It then describes the IDCCs bid preparations, concept design process, estimating, programming, preparing the design stage cost drawdown schedules and the assembly and presentation of the bid. Also the client’s evaluation of the bids and selection of the preferred IDCC, agreeing any outstanding issues, signing the IDCC Sale Agreement and activating the IDCC project bank account (Figure 11, 12 and 13).

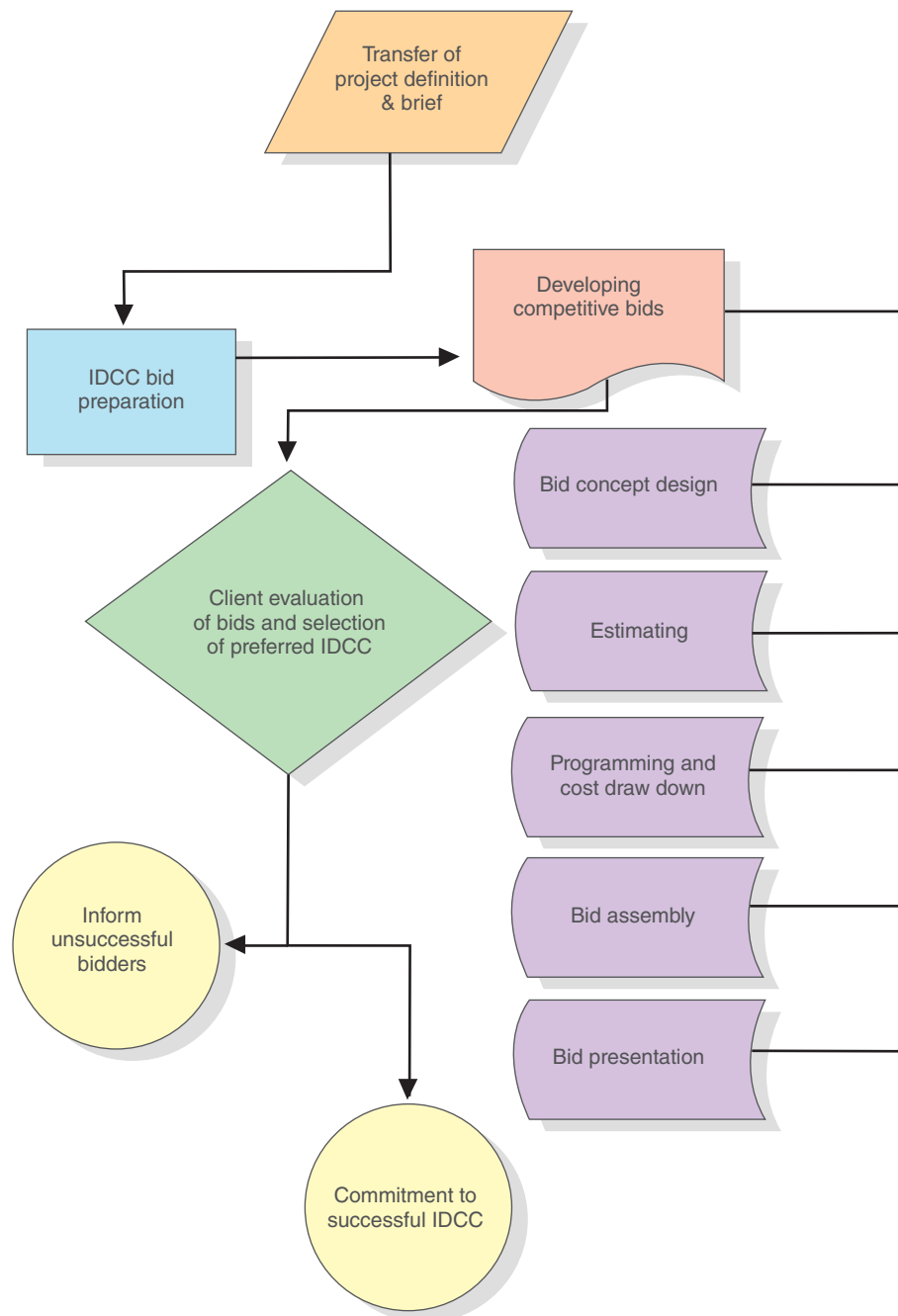


Figure 12 Competitive bidding process flow chart.

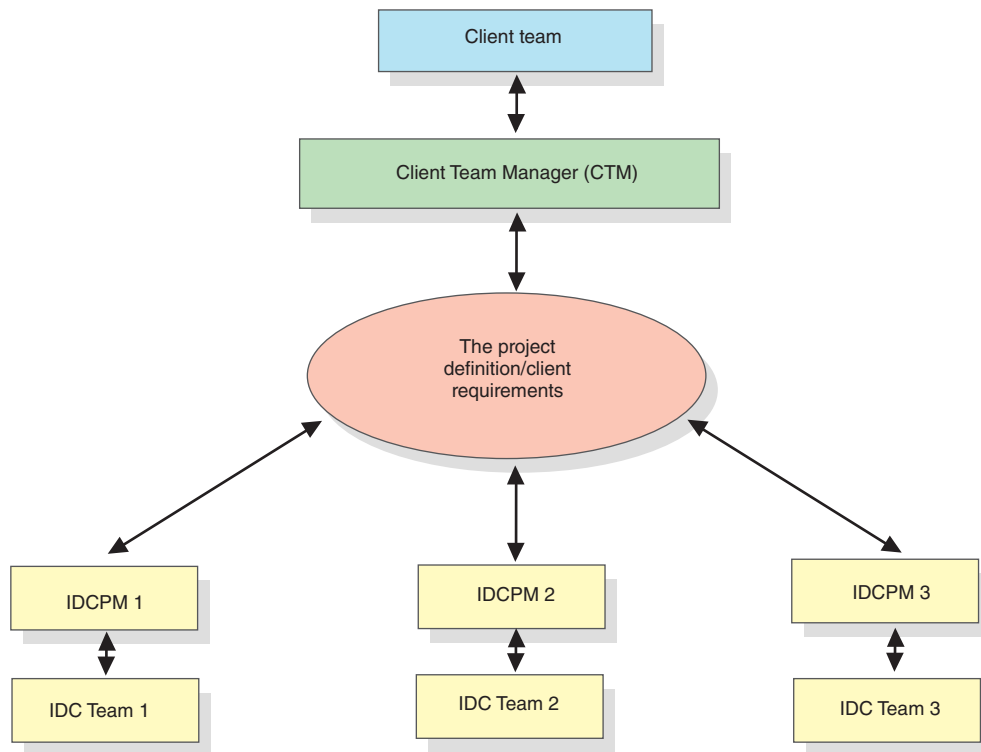


Figure 13 Bidding management structure.

Stage 2.1 IDCsr competitive bid process

The transfer of the project definition and the client requirements by client team leaders to IDCCs should be carefully planned by the CTM to achieve the most effective communication of the client's requirements to the IDCsr team leaders, so that they in turn can disseminate them effectively to each of their own teams.

It is recommended that client team leaders:

- 2.1.1 Arrange a joint meeting between client team leaders together with the IDCPMs of the three IDCCs who have agreed to bid. It is important that the meeting is carefully structured and takes place in comfortable, appropriate surroundings, conducive to the open exchange of information that is so necessary.
- 2.1.2 Present a clear summary, description and explanation of the client's brief and project definition, including the preferred bid structure and content, as well as how and when to submit the bid.
- 2.1.3 Issue electronic and/or hard copies of the project definition and client requirements, including copies of all preliminary investigations, such as ground investigations, environmental surveys, planning consultations and so forth and any relevant knowledge regarding the site or locality including any potential problems/issues.
- 2.1.4 Reiterate client's budgeted parameters on price, time, style and so on (should all be clearly set out in the brief)

- 2.1.5 Confirm the preferred method of electronic transfer of all information and communication throughout the bid and project progress.
- 2.1.6 Confirm the criteria on which bids are to be evaluated.
- 2.1.7 Facilitate an open forum between all participants on the practical issues of delivering and presenting their bids.
- 2.1.8 Agree date when IDCCs have had time to assess the brief (7–10 days depending on complexity of the project) for all three IDCPMs to re-assemble with the CTM so that they can clarify issues raised by their teams and confirm that they will be able to submit a bid in accordance with the terms specified (or otherwise).

Stage 2.2 IDCC bid preparations

- 2.2.1 IDCPM to reflect on brief transfer and consider possible team personnel and support required.
- 2.2.2 IDCPM to bring team leaders and all key practitioners together to transfer the knowledge to them, setting milestones.
- 2.2.3 Design build contractors without previous experience of IDCsr should consult guidance on staff development/creating effective teams/collaborative working/action learning and so on in order to build up effective teams.
- 2.2.4 Re-assemble whole group after 2 or 3 days for feedback, comments and suggestions regarding the feasibility of the bid/client's aspirations/resources required and so on to brief IDCPM in preparation for the feedback discussion with client and other bidders (as 2.1.8).

References: Action learning in a medium-sized construction company: Davey C L, Powell J A, Powell J E, Cooper I: 2002: Routledge Taylor Francis
Action Learning in Practice: Pedlar M: 2011: Gower
Partnering in the construction industry: a code of practice for strategic collaborative working: Bennet, John, and Sarah Peace Eds : Routledge 2006

Stage 2.3 IDCC developing the competitive bids

The purpose of the IDCsr competitive process is for the client to be able to identify and appoint the most appropriate IDCsr Constructor at the conclusion of the bidding stage. The client and their team will need to be satisfied that the successful constructor has understood the overall brief, that their concept proposal meets the project definition and client requirements and provides the confidence that they can deliver the project, as a minimum achieving the client's requirements within the overall parameters of time, cost and quality. It follows that the bid concept proposals must therefore include sufficient detail to enable the client and their team to

evaluate the submission against their criteria. In a BIM environment, the submission could consist of geometric and other datasets to be validated by the client team.

The bid concept proposals will also need to include reasonable outline evidence that the concept can be expanded and delivered to the fully developed design, within the specified budget and time and confirmation that the project will be covered by the IDCC's IDCsr Project Insurance conditions.

2.3.1 IDCC bid concept design process

- Assess and evaluate the client brief and project definition
- Prepare concept design that (depending on the client's overall brief) could include the following:
 - A. Outline design
 - B. Spatial layouts
 - C. Process layouts
 - D. Structural concept
 - E. Building services concept
 - F. Consultation with personnel who will be involved in the construction process on site (Figure 14)

References: The Design Manager's Handbook: Eynon J: 2013: CIOB/Wiley Blackwell
BS7000 Part 4 Design Management Systems: 2013: BSI
Digital Plan of Work– <http://www.bimtaskgroup.org/digital-plans-of-work/>

2.3.2 IDCC estimating

Under the IDCsr system, estimators can be directly involved in the design process from the transfer of the client brief to the design and construction stages. They are therefore able to start building their estimate template for the project as the design evolves and decisions on systems, materials and trade suppliers are made. They can also provide advice to the design team from their database and previous experience and make significant contributions to the value engineering/value management reviews in Stage 3. The template for the bid concept estimate can then be expanded during the development of the full design in Stage 3.4–3.9. The concept bid needs to be sufficiently researched and developed to enable the IDCC, when formally submitting the bid to confidently commit to delivering the eventual full design and construction of the project to the contracted budget.

Reference: Code of Estimating Practice 7th Edition 2009 CIOB/Wiley-Blackwell

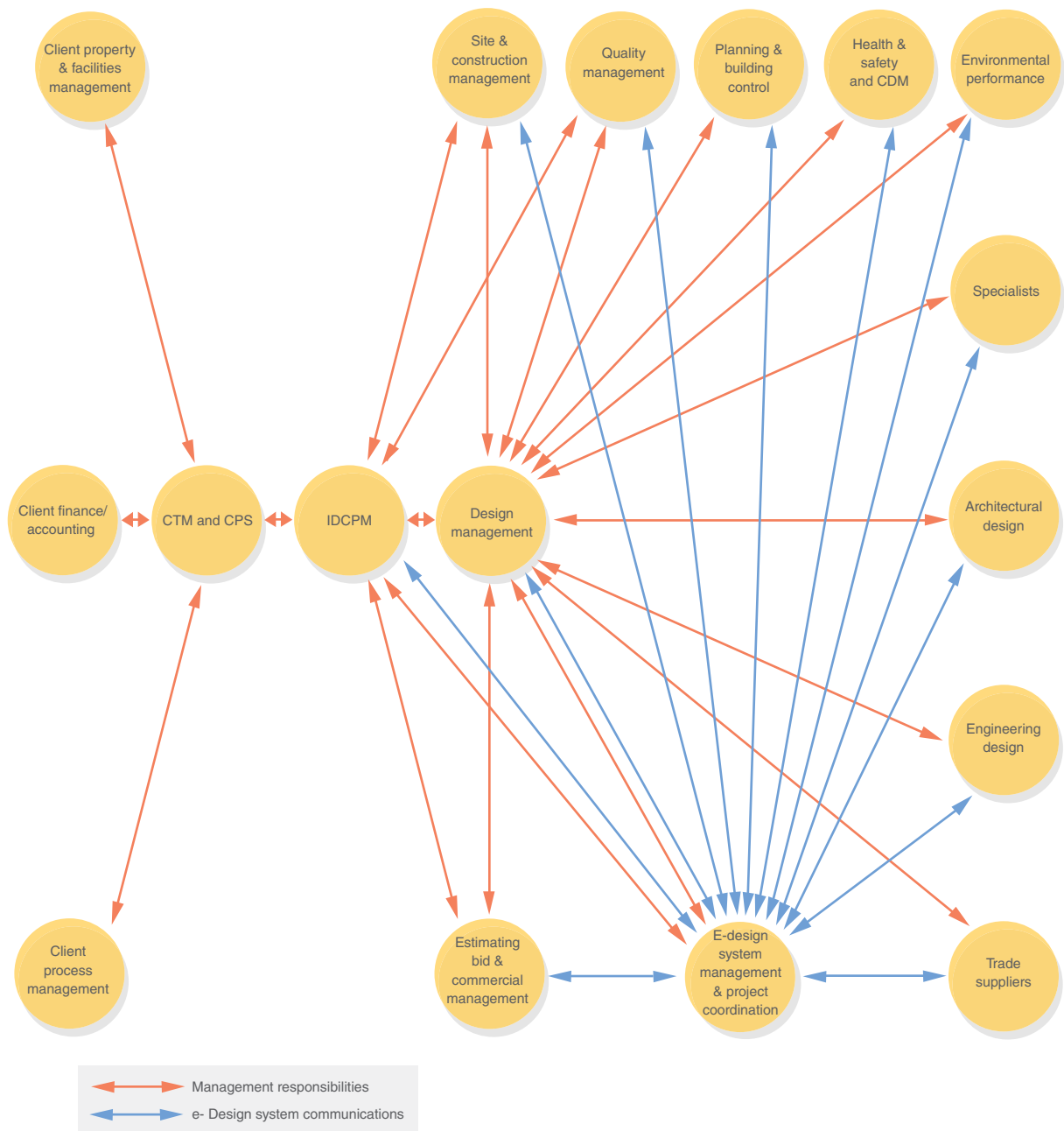


Figure 14 Concept and bid management responsibility and e-design communications.

Special Note 13

Under the IDCsr system, appropriate specialists and trade suppliers should be selected through competition at concept stage from the IDCC’s running list of known and trusted preferred suppliers, which should be continually updated and refreshed with performance assessments from current and recently completed projects. If a specialist or supplier’s bid is used in the IDCC’s concept stage bid, that supplier should be included in the preparation and negotiation of the full design in Stage 3.7 and construction in Stage 3.16. Such continuity is a fundamental element of the IDCsr integrated process, driving value engineering and underscoring the mutual trust and respect between all team members that are essential to its success.

2.3.3 IDCC programming

One of the key factors in the client's evaluation of the bids will be the time it will take for the IDCC to produce the full design on signing the agreement, as well as completing the construction delivery of the project. This will necessitate the preparation of a concept master programme based on the information available in the brief and/or concept bid, to confirm dates specified in the client brief or to commit to dates to be included in the bid.

Reference: Code of Practice for Project Management for Construction and development: 5th Edition: – Briefing Note 3.06: CIOB/Wiley Blackwell: Guide to Good Practice in the Management of Time in Complex Projects: 2011: CIOB/ Wiley Blackwell

2.3.4 IDCC design stage cost draw down schedule

The bid must include a detailed, staged cost draw down schedule for the full design process, to which the client will commit on signing the agreement.

2.3.5 IDCC's sale agreement terms and conditions

Refer to Chapter 5 and 6 for details of IDCsr project payment system, IDCsr project bank accounts and IDCsr model sale agreement terms and conditions.

2.3.6 IDCC bid assembly

The bid manager, in conjunction with the IDCpm, will then coordinate and compile the IDCC's bid in electronic and hard copy format as specified in the client brief or requested by the CTM.

2.3.7 IDCC presentation

The bid manager should then finalise the presentation, involving all team leaders who will be contributing to it and carefully rehearse and prepare, to ensure the IDCC's bid is put over to the client team in the best possible way. This could include highlighting how IDCsr allows the IDCC team to concentrate on improving quality, productivity and value for money of the product, rather than the traditional emphasis on the process.

Special Note 14

IDCCs must be aware that, whether they accept the client's budget specified in the brief or they quote an alternative figure, this price will become the contract price for the fully designed project, subject only to changes to the concept or client brief made in response to client requests. It is not a traditional budget figure to be increased or decreased to suit the developing design in stage 3. The design and designers must work within the parameters set by their concept bid and the client brief – particularly the budget. The IDCC team must therefore be confident and prepared to disclose at the appropriate time, reasonable outline evidence that their concept can be fully designed and delivered for the specified and agreed budget and time scale; for their own as much as for the client's benefit.

Stage 2.4 Client evaluation of bids and selection of preferred IDCC

This is made easy if the process is set out clearly from the start, and a carefully tailored project-specific scoring matrix, as set out in 1.10.2, is prepared by the CTM for the client team to follow. The key issue at this stage is judging whether the client team is quite clear which concept bid they prefer and that they can work successfully with that bidder's team. If not quite sure, then the CTM should ask to see the preferred bidders team again and (only if really necessary) the closest under-bidder to seek further clarification of the main issues.

References: The references given below are designed for traditional procurement practices, but many of the key issues and questions are pertinent to IDCsr and can be incorporated in IDCsr project specific scoring matrices. The Procurement Toolkit Good Practice Guide, Guide to Tender Evaluation: Dec 2012 OGC
Tender Evaluation using Weighted Criteria: hertingfordbury.org.uk

Stage 2.5 Client commitment to the successful IDCC

As soon as the client has decided on the preferred IDCC and cleared any outstanding issues, the client and the IDCC legal entity sign an IDCsr sale agreement. This commits them both in principle to the purchase and delivery of the finished product at the agreed budget price and specifically to the payment of the cost draw down schedule covering the full design process.

Stage 3.15 describes how, once the full design has been completed, the client signs the second part of the IDCsr agreement confirming acceptance of the full design, project delivery date, total cost and the construction stage payment schedule and authorising the IDCC to proceed with construction.

In doing so, the client also confirms that the interpretation of the client requirements and project definition has been collaborative, and, provided the IDCC team deliver the project in accordance with the agreed design and specifications, the client accepts that the finished product will be suitable for its intended purpose.

Stage 2.6 Client and IDCC to activate IDCsr project bank account

The PBA will have been set up in principle as part of the client's funding/banking arrangements, as in stage 1.6. As soon as both the IDCC and the client have signed the agreement, the client must activate the PBA by paying in the first sum specified into the Client Paying In Schedule 5a, to complete the agreement and so empower the IDCC to commence work on the full project design.

10 Process Stage 3 delivery

Stage 3 Delivery

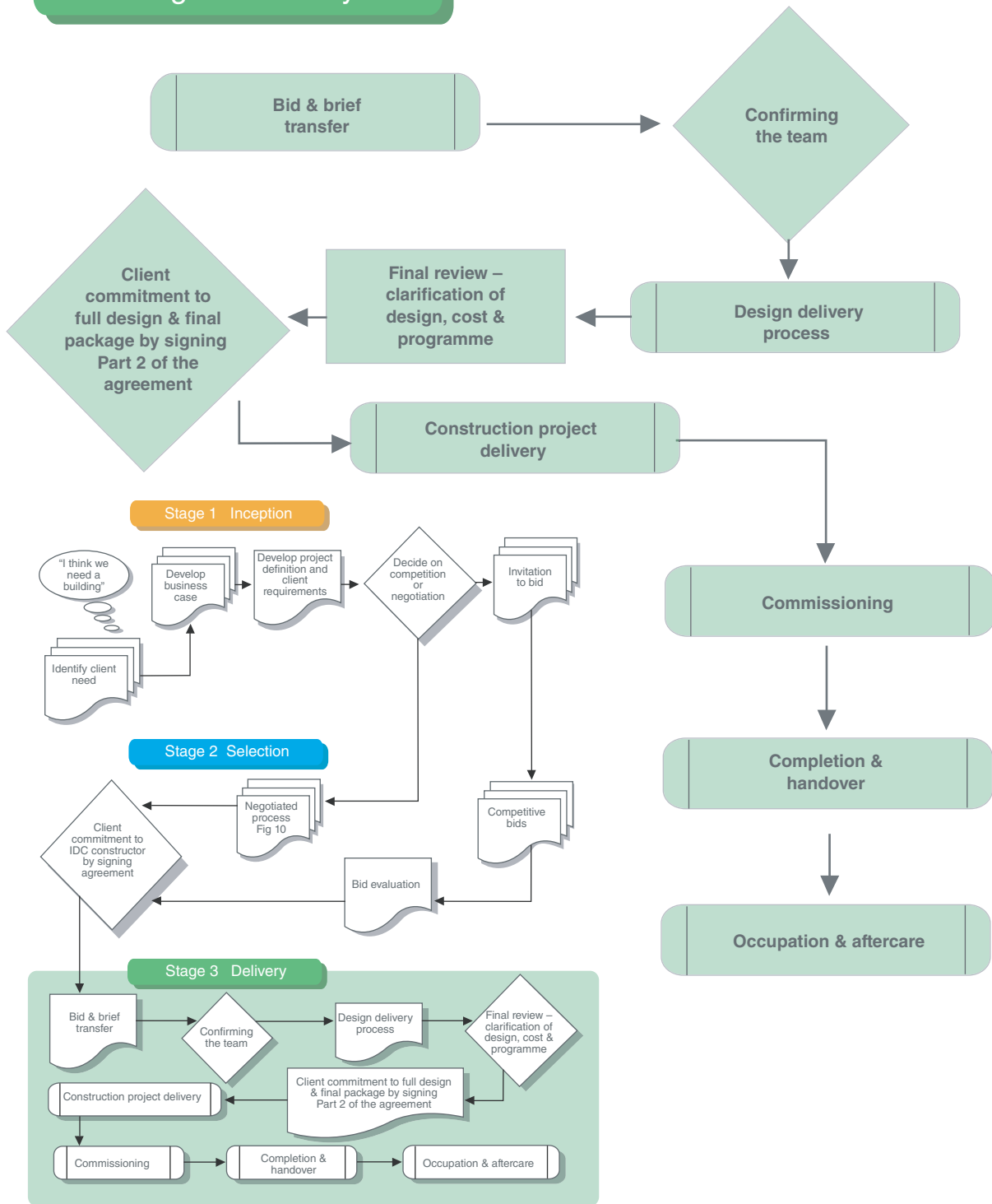


Figure 15 Stage 3 flow chart.

Stage 3 IDCC design and construction

Following the signing of the agreement, the IDCPM and team leaders review the bid and overall design and construction process, empowering the design manager to confirm the design programme to allow the full detailed design to proceed through to value management, design freeze, estimating, programming and safety/CDM reviews. Client team leaders and IDCC team leaders together review the complete final package and agree all outstanding issues. The client signs the second part of the sale agreement confirming acceptance of the full design and construction package, so authorising the IDCC to proceed with construction. The final section summarises (with references) the essential construction management procedures covering cost management, sale agreement, progress reporting, ICT management, quality and safety, records, environmental management, commissioning, completion, occupation, manuals and post occupancy reviews and evaluation (Figure 15).

Stage 3.1 Bid and brief transfer review meeting

As soon as the IDCsr form of agreement has been signed, the IDCPM calls a bid and brief transfer review meeting between the key IDCC team leaders, including (Figure 15):

- Construction manager
- Design manager
- Commercial manager
- Estimator
- Bid manager
- Project coordinator
- Site project manager

Together, they will:

- Review the bid, note and discuss any last-minute bid changes/issues and establish key project drivers.
- Review and confirm design programme.
- Confirm and empower design manager and team.
- Review and confirm the overall construction process to site completion, highlighting any critical issues or stages for special consideration (Figure 16).

Stage 3.2 Handover of bid to design and construction delivery team

This is the key formal handover of all the information and knowledge related to the client's brief and the IDCC's bid for the project. It is essential that all personnel who have been or are going to be employed on the bid and delivery are actively involved in this process. The meeting should be structured in the form of a workshop, chaired by the IDCPM but led by the bid manager.

Those to be involved should include the following:

- IDCPM
- Bid manager

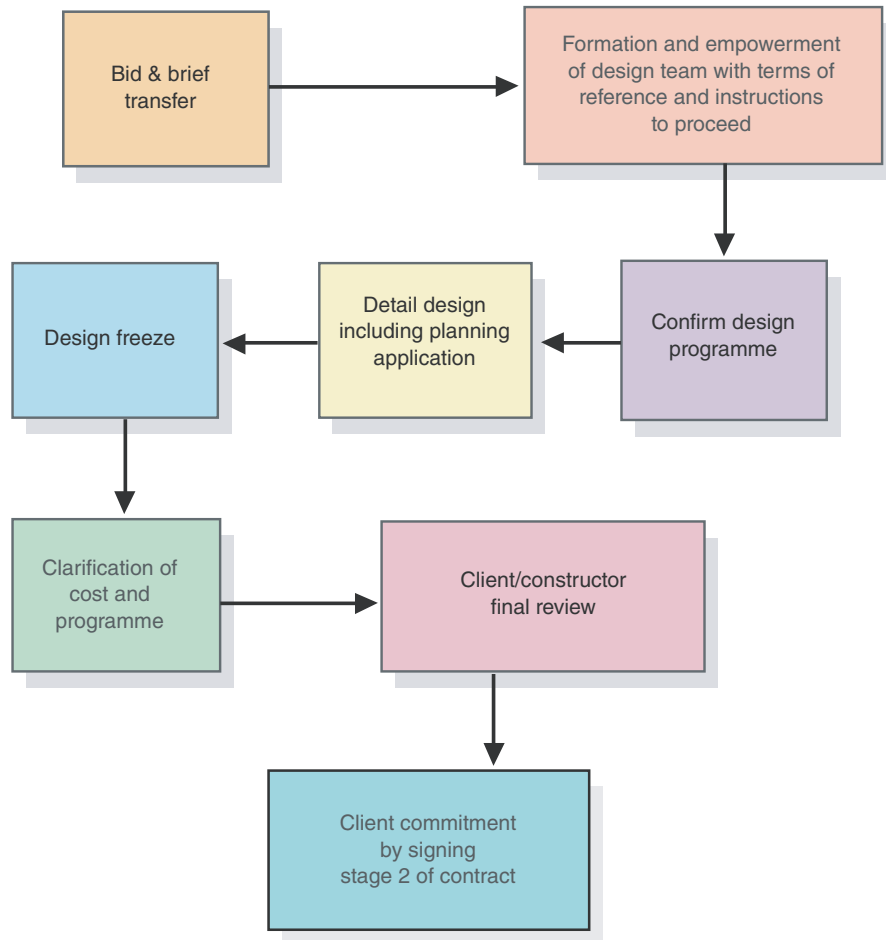


Figure 16 IDCC design delivery process.

- Estimating director and team
- Design manager and team (including environmental performance advisors)
- Construction director and team
- Quality manager
- Site manager and key team
- Health and safety manager

The workshop should start with an overview of the complete project to the whole team, before breaking down into smaller groups, with the team leaders fronting presentations to their own sections.

Stage 3.3 Managing the design delivery process

Design delivery team could include the following:

- Architects (including interior designers and landscape)
- Structural engineer
- Project Coordinator
- M&E specialists
- Acoustic, fire and other specialists
- Building control
- Key trade suppliers

- Commercial management team
- Construction and site management team
- Safety/health
- Environmental performance
- Quality management team
- ICT coordinator
- Commissioning management (Figure 16)

Stage 3.4 Empowerment of design teams and instruction to proceed with the designs

All members of the design team to be given clear terms of reference including any e-design or BIM protocols/access codes and instructions to proceed with their section of the design (Figure 16).

Stage 3.5 The use of building information modelling in the IDCsr process

Considerable benefits can be realised through the implementation of an IDCsr BIM-based system (supplemented if required by team members existing CAD systems), controlled and managed by the IDCC to create a shared virtual workspace. That enables everyone in the design and construction team (as well as the client team) to fully and openly collaborate on the design and its buildability, helping to achieve one of IDCsr's key objectives – creating value via increased efficiency and reduced waste through the whole of the project's lifecycle.

Using BIM, all of the above-mentioned operations can be carried out in a digital common data environment or integrated data via an intranet. Many of the aforementioned factors can be checked on the model and data sets using BIM compliance, validation and simulation tools. The BIM information manager/systems manager for the project, will lead and coordinate this process with the design team and specialist designers. Reviews will be carried out by exchange and testing of model data and interactive design team meetings. Outputs can be provided for the client in COBIE, if required.

It is critical that all relevant project BIM protocols are put in place and agreed on with every design contributor, before starting the process, to enable the design manager through the BIM information manager/systems manager to manage and protect the BIM model. Key documents include BIM scopes of services for designers, specialists and trade suppliers, Project BIM execution plan, Model progression specification, responsibility matrix and project processes to be in compliance with PAS1192 Part 2 2013 and COBie UK 2012.

References: PAS1192 Part 2 2013
COBie UK 2012

Eynon J: The Design Manager's Handbook: 2013: CIOB/Wiley Blackwell
BS7000 Part4 Design Management Systems: 2013: BSI
Digital Plan of Work – <http://www.bimtaskgroup.org/digital-plans-of-work/>

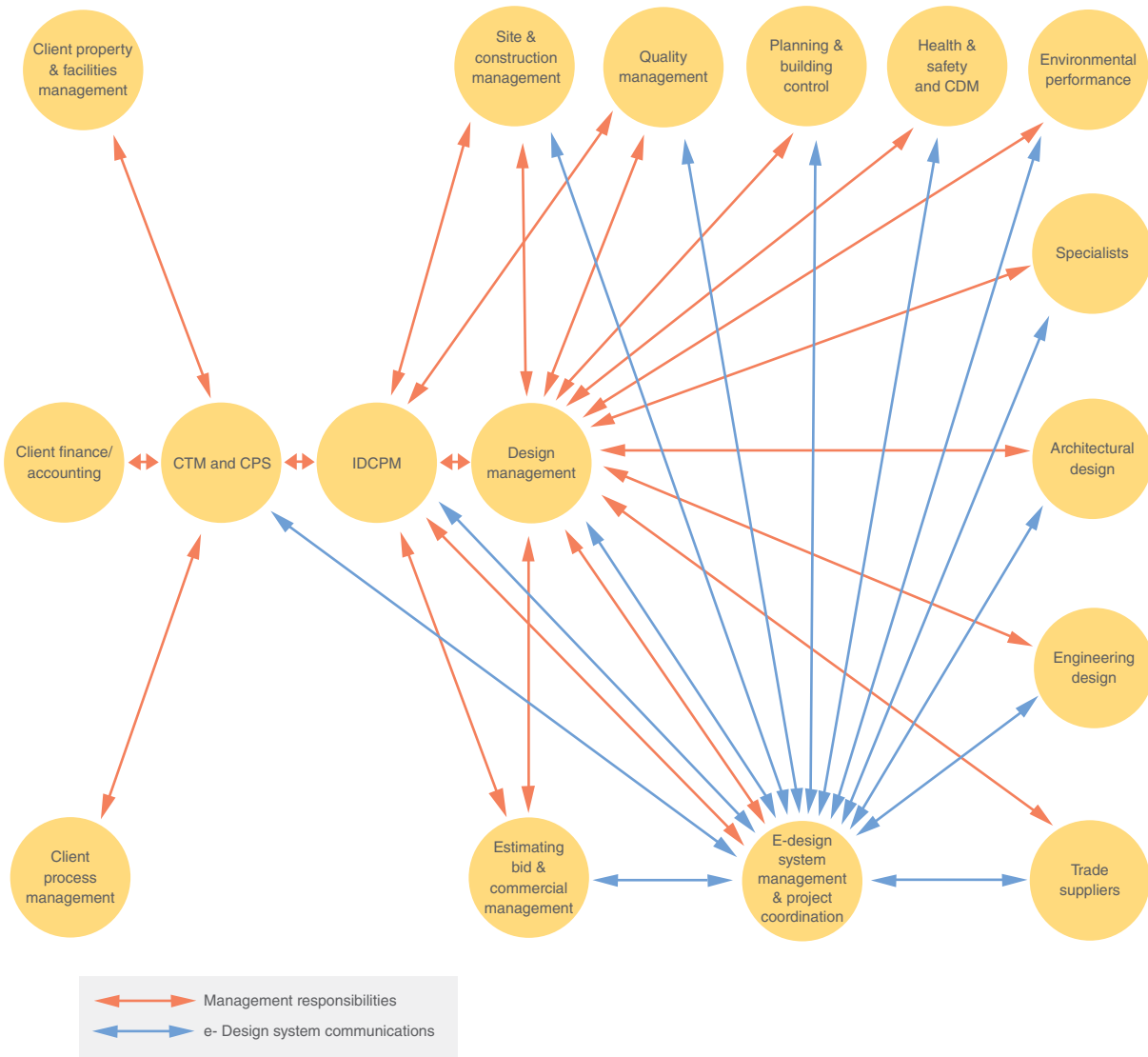


Figure 17 IDCsr constructor design delivery: management responsibilities and e-design communications.

Stage 3.6 Design programme

To prepare the design programme, the design manager, in conjunction with the construction manager, should consider the overall pre-construction and construction programmes and identify the key milestones such as planning application and approval, lead-ins required for trade supplier design, manufacture and installation, start on site and completion dates.

Reference: Code of Practice for Project Management for Construction and Development: 5th Edition BN 3.06 Project Planning: 2014: CIOB/Wiley Blackwell

Stage 3.7 Detailed design

The development of the full design then proceeds with the preparation of production information involving the client team and the IDCC design team, working with the trade suppliers, cost management, estimating and delivery teams. This will include regular reviews to ensure compliance with the client brief.

Other on-going reviews during this stage will include the following:

- Design coordination and integration: (ensuring coordination of all design inputs)
- Supervision of design quality: to avoid architectural features that add cost but contribute little of real value and to ensure design quality and style conforms with the client brief
- Buildability: review with the delivery team, ensuring the design is buildable, taking into account sequencing and logistics required
- Value management: systematic review and challenging of design, element by element to ensure that required value is being met at minimum cost:
see 3.8
- Statutory compliance: (on-going checks for compliance with planning guidance and conditions and also code compliance for building regulations and any other regulations) including on going negotiations with planners and building control departments
- Sustainability: (ensuring any sustainability requirements are being achieved, such as BREEAM, CfSH or LEED ratings)
- Environmental: (ensuring that the asset as designed is achieving the required environmental performance such as carbon emissions, energy consumption or other resource requirements)
- Quality (that the standard of specification and finishing is in accordance with the client brief and can be reasonably achieved on site)
- CDM, health and safety reviews and residual risks, if any, leading to completion of the health and safety file and the O&M files for use by site management and the client following completion and occupation
- Delivery logistics (on-going reviews of the design by the site team to ensure site logistic requirements are understood and taken into account, such as access and handling requirements and plant, site accommodation, layout and any temporary works to facilitate the construction process)
- FM/Operational requirements for handover and operation (consideration of particular Facilities Management requirements that impact on the design and delivery process)
- 'Soft Landings' planning (using the 'Soft Landings' process to ensure a smooth commissioning, handover and operational process).

Reference: Soft Landings guidance to download: <https://www.bsria.co.uk/services/design/soft-landings/free-guidance>

In conjunction with the Client, prepare, submit and negotiate planning application and approval.

Reference: The Design Managers Handbook: Eynon J: 2013: CIOB/Wiley Blackwell (Figure 17)

Stage 3.8 Value management

In most branches of manufacturing industry, technological innovation and the close integration of design and production have, over time, reduced real costs and improved quality as well as reliability. But the relentless separation of design from production has drastically reduced construction's ability to deliver maximum value to the client for any given budget. The complete integration of the IDCsr process and management structure will now enable IDCCs to maximise the delivery of value (defined as the ratio of utility to cost) to clients and end users through the effective application of Value Management.

It is the historic classification of construction as a contracting service rather than a manufacturing industry that has impeded the progress of construction industry modernisation. Nevertheless, the differences between the two sectors are important. Buildings are designed for a much longer life than most industrial products and may serve several purposes over that life. They are part of the public realm and have aesthetic and cultural value beyond the instrumental purposes for which they are conceived. These broader considerations must not be ignored in the systematic maximisation of value and elimination of waste.

Value Management (VM), which tends to be favoured by the construction industry, takes a wider view than the closely related Value Engineering and places more emphasis on the participative processes employed. VM involves structured analysis of the ways in which functionality can be achieved at minimum cost. The characteristic approach to applying VM is a series of workshops throughout the design process, in which team members dispassionately interrogate and challenge the overall design together with that of products and components. This should involve contributions from estimators, commercial, construction and site managers, together with key specialists and trade suppliers as well as the design team. VM can reduce production costs, assist with decarbonisation, reuse and recycling, improve spatial economy and reduce life cycle costs. Probably, the most important opportunity created by the IDCsr process is that of utilising fully, for the benefit of clients and end users, the collaborative expertise that has been developed within the construction management profession over the last half-century. Through the VM technique, IDCsr will enable the skills of the construction manager to be utilised 'upstream' in a value-based approach to construction design.

References: Value Management: 3.11.04: Constructing Excellence
Managing Value: 7.02.06: Constructing Excellence
The Value Workshop Hayles C & Simister S: BRE

Stage 3.9 Design freeze

Completion of design development for final costing

Once planning approval has been secured, in order to comply with the programme requirements, 'design development and optioneering' has to be stopped at this point, to allow final checks on programme, cost and quality to be completed and then agreed with the client with complete certainty – the 'Design Freeze'.

This is an important message to get across to all those involved in the design process, as traditionally design continues being embellished and enhanced, resulting in the cost plan being out of step with the design, which cannot happen under IDCsr.

From this point on, any further design information that is produced can only be for clarification to the delivery team and is within the already established project envelope of time, cost and quality.

Once Part 2 of the Sale Agreement has been signed, there can be no variations or changes under the agreement and should be avoided if at all possible.

The discipline this stage imposes and the formality of the decision cannot be emphasised enough, and it needs to be rigidly applied by the IDCPM and CTM working together. All IDCsr projects must be fully designed, scheduled and priced (which is fixed) before site construction work can commence. This is in the best interests of all parties and for the overall success of the IDCsr project.

Stage 3.10 Estimating

As in Stage 2, with the estimating function embedded within the design process, the estimators will already have started to work up and monitor their estimate from the concept cost template. The trade suppliers and specialists will have been selected at concept stage so that as their design work develops, cost information can be shared instantaneously with the estimators, expanding the concept template into the full bid form.

Reference: Code of Estimating Practice 7th Edition: 2009: CIOB/Wiley Blackwell

Stage 3.11 Programming

Starting from the concept master programme, site and construction management, working with the design team can refine the programme as the design develops and matures to produce the project master programme, which will be included in Schedule 03 of the Form of Agreement.

Reference: Code of Practice for Project Management for Construction and Development 5th Edition - BN 3.06 2014 CIOB/Wiley Blackwell

Stage 3.12 Safety/CDM

The IDCsr Health and Safety systems will be compliant with BS OHSAS 18001, and the IDCC will provide a working environment that is safe and healthy for all site personnel and those affected by the construction process. All management staff will be appropriately qualified for the job they are doing, and all trade suppliers must be compliant with relevant Health and Safety Assessment schemes. All activities will comply with the current CDM Regulations.

Stage 3.13 Construction management and bid management to coordinate final overall package

This is the final opportunity for IDCC's team and the CTM to double check that everything has been considered and included in the design, construction and cost package.

Stage 3.14 Client team leaders and IDCC team leaders review complete bid, agree on all outstanding issues

The Client and IDCC must review the overall package, agreeing any last-minute consequent amendments and close the deal.

Special Note 15

One of the most important principles of the IDCsr system is that the full design, cost and construction method statement must all be settled before Part 2 of the Agreement can be signed and construction work starts. This enables the IDCC team to concentrate on the efficient construction delivery of the project without the distractions of variations, extras or lack of information and so on that come with the traditional systems.

Stage 3.15 Client confirms commitment by signing Part 2 of the agreement

Once the full design has been completed, the client signs the second part of the IDCsr Sale Agreement, confirming acceptance of the full design, project delivery date, total cost and the construction stage payment schedules, so authorising the IDCC to proceed with construction.

In doing so, the client also confirms that the interpretation of the Client requirements and Project definition has been collaborative, and, provided the IDCC team deliver the project in accordance with the agreed design and specifications, the client accepts that the finished product will be suitable for its intended purpose.

Special Note 16

If it becomes really necessary for the client to vary or add to the design after Part 2 of the agreement has been signed, such work can only be carried out by mutual agreement with the IDCC under a separate IDCsr sale agreement. Unlike traditional contract conditions, IDCCs are under no obligation to accept changes and the costs (which will reflect the disruption to the pre-agreed programmes) could well be prohibitive. In most cases, it could be more economic and satisfactory to wait until the project has been completed before carrying out such change work. The best solution is for the CTM and client team to ensure that they have clearly included all their requirements in the project definition in Stage 1 and thoroughly reviewed the final designs before signing Part 2 of the Form of Agreement.

Stage 3.16 Construction project delivery team

- IDCPM
- Construction Management
- Site Management
- Commercial management
- Project Coordination
- Design management

- Specialists
- Trade Suppliers
- Site Support Staff
- Quality management
- E-design/BIM Systems Management
- Health and Safety

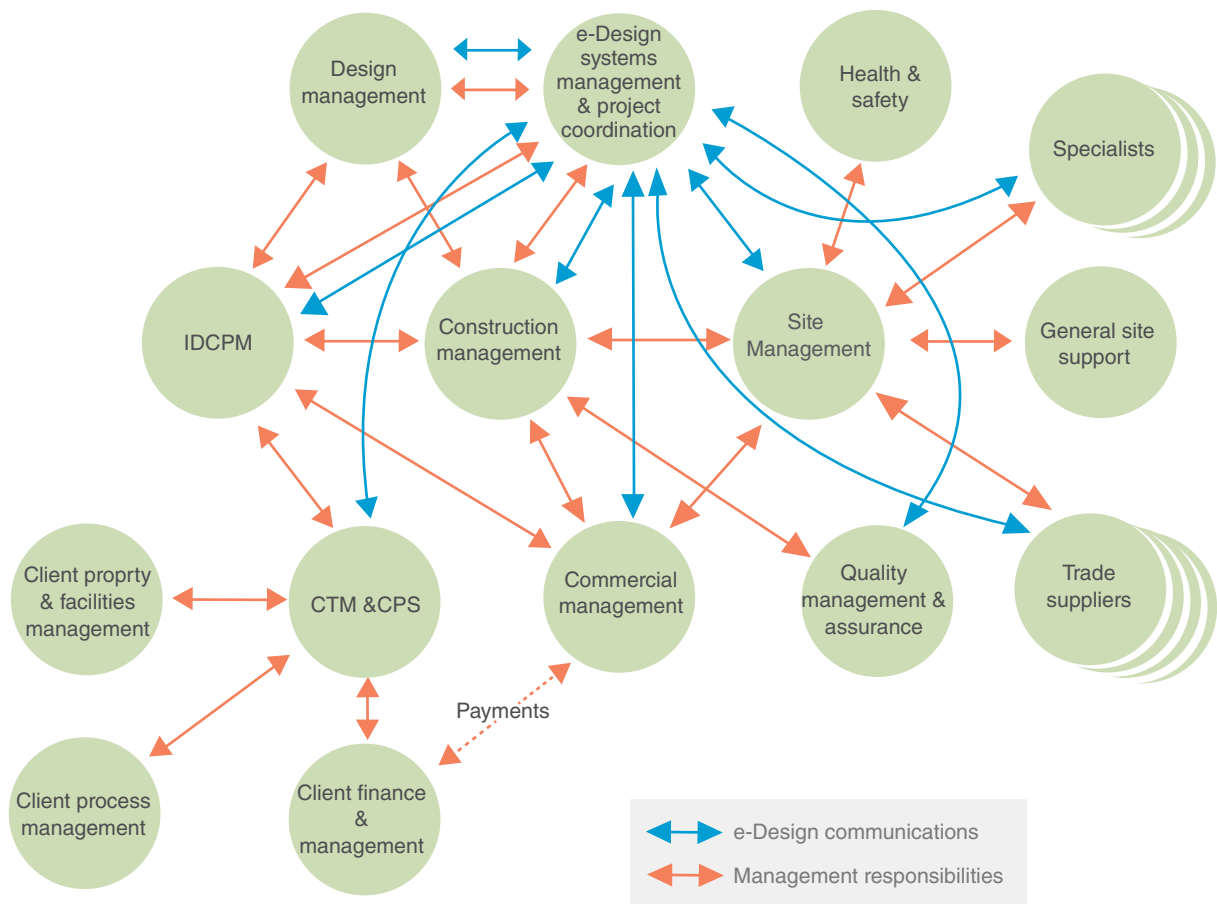


Figure 18 IDCC Stage 3.16 construction delivery responsibilities and e-design communications.

Stage 3.17 Construction management standard procedures

Best practice IDCsr Constructors will have prepared and implemented construction management standard procedures covering the whole of the delivery stage. Some procedures will be included as part of the quality and safety management plans, but for ease of reference, the key ones are listed individually in the following section.

a) Cost Management and Reporting

The total integration of the IDCsr system and the dearth of significant changes or additions to the design can considerably simplify cost management and reporting systems. However, it is important that IDCCs maintain a continual, accurate record of

actual cost against budget for future estimating and continuous improvement purposes.

Please note that many of the references given below were devised for traditional fragmented construction procurement and management systems, although, with common sense most of the basic principles described can be applied to IDCsr.

References: Construction Cost Management: Learning from Case Studies: Potts K: 2008: Taylor & Francis
Cost Management of Construction Projects: Towey D: 2013: Wiley Blackwell

Financial Management in Construction Contracting, Ross A and Williams P: 2012: Wiley Blackwell

Modern Construction Management: Harris F, McCaffer R & Edum-Fotwe F: 2013: Wiley-Blackwell

b) Payments, Project Bank Accounts and Model Sale Agreement

- b i When the full design has been completed, the client signs the second part of the Agreement confirming acceptance of the design, project delivery date, total cost and the Construction Stage Payment Schedule (Schedule 6). At the same time, the Client will pay into the PBA the first Client Payment set out in Schedule 6, so authorising the IDCC to proceed with construction.
- b ii {Agreement clause 5} The PBA procedures will be based on the release of monies triggered by the completion of stages in both the design and construction stage payment plans, Schedules 5 and 6. For example, 'the Client Purchaser shall satisfy the contract price by making payments to and on behalf of the Constructor Seller and Trade Suppliers through the PBA in accordance with the design stage payment plans set out in Schedule 5 and the construction stage payment plan as set out in Schedule 6'.
- b iii A list of trustees/signatories including contingency arrangements for replacement in case of death, incapacity due to illness or leaving the organisation concerned will be included in Schedule 4. It is recommended that both the Client Team Manager and the IDC Project Manager are trustees.
- b iv All payments into the PBA shall be made in cleared funds by the due date of Client Payment set out in Schedules 5 and 6 without any deduction counterclaim or set off by electronic transfer in favour of the IDCC into the PBA account at XXX Bank, Sort Code YYY, Account Number ZZZ. There are no retentions

- b v Should the Client fail to make agreed scheduled payments on time, this will be deemed to be a postponement of the works.
- b vi {Agreement clause 6} Terms of Payment. The Client Team Manager will when requested by the IDC Project Manager or the IDC Commercial Manager confirm within 3 working days from request that payment stages set out in Schedule 6 have been reached and that the work is in accordance with the specification/design so that payments can be released to the supply chain payees as the terms in (b vii).
- b vii {Agreement clause 7} Payment. Stage payments will be paid within 3 working days of Client Team Manager authorisation with the exception of the final payment, which will be made on the day of handover in exchange for possession of the project and handover information.

c) Planning Schedules and Progress Reporting

Under IDCsr, all parties involved in the construction stage will have access through the E-design/Management system to all schedules and reports related to work planning and actual progress. There is a need therefore for a fully detailed overall site progress plan that can be broken down into smaller stage plans for day-to-day use by site management staff, specialists and trade suppliers.

References: Code of Practice for project Management for Construction and Development 5th Edition: 2014: CIOB/Wiley-Blackwell - BN 3.04 Application of Project Scheduling Software and BN 3.06 Project Planning, CIOB Guide to Good Practice in the Management of Time in Complex Projects: 2011: Wiley-Blackwell

d) Information and Communication Management

See pages 40–43 (ICT) and Appendix

Reference: Code of Practice for Project Management for Construction and Development: 5th Edition - BN 3.05 Building Information Modelling: CIOB/Wiley-Blackwell 2014

e) Quality Management

Project Quality Plans will follow the standard format and will be fully compliant with BS: EN 9001

Reference: Code of Practice for Project Management for Construction and Development: 5th Edition: 2014: CIOB/Wiley Blackwell - Section 5 Construction BS: EN 9001

f) Safety and Health

The Health and Safety Plan should be compliant with the standard format set out in BS OHAS 18001 (see 3.12).

References: Code of Practice for Project Management for Construction and Development: 5th Edition: 2014: CIOB/Wiley Blackwell

BN 3.01 Health & Safety including CDM guidance
BN 6.01 Contents of the Health and Safety File

g) Diaries and Records

Although many people rely on mobile technology for diaries, a central project site diary should be maintained within the project e-design/e-business system.

h) Environmental Management Systems

Much of this work will have been addressed and included in the design, but there are still important site issues to manage as the following:

- Compliance with environmental and sustainability requirements and assessments of the design
- Use of Site Waste Management Plans (SWMPs): Although the Site Waste Management Plan Regulations (2008) were repealed in December 2013, IDCCs will prepare their own SWMPs on a voluntary basis for use as efficient resource management and recycling tools.

Reference: WRAP Site Waste Management Plans <http://www.wrap.org.uk/content/site-waste-management-plans-1>

- Compliance with the Environment Agencies Pollution Prevention Guidelines PPG 6. The Guidelines explain what you are required to do by law and describes good practice measures to reduce the risks of a pollution incident.

Reference: Environment Agency, Working at construction and demolition sites: PPG6 Pollution Prevention Guidelines

- All IDCsr project sites will be registered with the Considerate Constructors Scheme.

Reference: www.ccscheme.org.uk/

i) Government Soft Landings (GSL)

By following the culture and practice set out in this Code of practice, IDCsr Constructors will comply with the 'Guiding Principles' of Government Soft Landings procedures for Government contracts.

References: GSL Documents:

Policy <http://www.bimtaskgroup.org/digital-plans-of-work/>
Guidance Documents <https://www.bsria.co.uk/services/design/soft-landings/free-guidance>

Code of Practice for Project Management for Construction and Development: 5th Edition: CIOB/Wiley Blackwell
BN 1.05 Government Soft Landings 2014

j) Commissioning, Operating and Maintenance

The planning of the commissioning process under IDCsr starts at the design stage and develops through the project's progression with the designers, installers/constructors and commissioning practitioners working together in the same team. IDCCs should maintain a specialist handover and after-sales services team, which overlaps with that of the Clients maintenance and FM team, to ensure a smooth transition. Commissioning should include guiding and instructing the client's maintenance and facilities management team in the care, operation and maintenance of the structure (internal and external), services and fittings.

References: Commissioning Job Book : a Framework for Managing the Commissioning Process: Hawkins G: 2010: BSRIA

Project Management Handbook for Building Services: 2009: Pennycook K and G Hawkins, BSRIA

Code of Practice for Project Management for Construction and Development 5th Edition: 2014: CIOB/Wiley Blackwell: Section 6 Testing and Commissioning:

BN. 7.01 Client Commissioning Check List

BN. 7.03 Engineering services commissioning checklist

BN. 7.04 Engineering services commissioning documents

k) Completion and Handover

The checking and signing off procedures (agreed on between the CTM and IDCPM) that will be in place for the stage payment authorisations, together with the on-going implementation of the Project Quality Plan, act as a progressive inspection and approval system. The final handover checking process should therefore be relatively straightforward, so that most of the IDCC/Client teams' resources and effort can be directed at the orderly and timely handover of the technical, safety, maintenance manuals or files.

References: Code of Practice for Project Management for Construction and Development 5th Edition: 2014: CIOB/Wiley Blackwell

Section 7 Completion, handover and operation:

BN. 7.02 Introduction to facilities management

BN. 7.05 Handover checklist

BN. 7.06 Practical completion checklist

l) Occupation and After-Sales Service

Irrespective of the quality of the design and construction of the project, there will always be 'loose ends' and Client 'afterthoughts' as well as minor defects/rectification to be dealt with during the commissioning, completion, occupation and immediate after-sales period. Established IDCCs, employ experienced 'handover and after sales services teams' to manage such work and assist the Client to take possession as smoothly as possible. The records maintained by these teams can positively assist the post-completion and occupancy reviews facilitating continuous improvement.

m) Maintenance Manual

References: Code of Practice for Project Management for Construction and Development 5th Edition: 2014: CIOB/Wiley Blackwell:

BN. 6.02 Contents of a building owners manual
BN.6.03 Contents of occupiers handbook Wiley-Blackwell

n) Health and Safety File Post-Contract Review

References: Code of Practice for Project Management for Construction and Development 5th Edition: 2014: CIOB/Wiley Blackwell -

BN. 6.01 Contents of the health and safety file,

o) Post-occupancy evaluation check list (Figure 18)

Reference: Code of Practice for Project Management for Construction and development 5th Edition: 2014: CIOB/Wiley Blackwell

BN 8.01 Post occupancy evaluation process chart, Wiley-Blackwell 2014

Special Note 17

This comprehensive section has been designed to assist IDCsr practitioners, particularly IDCC's, who will probably find it necessary to adapt proprietary systems to suit their own IDCsr project management procedures. It is the IDCC who is responsible for setting up IDCsr ICT & project management systems. Although much of the following content comes from academic sources, it has been included to assist IDCsr practitioners to navigate through this complex environment to develop practical ICT solutions for their IDCsr processes. Hopefully, as IDCsr becomes established IDCsr specific ICT products will emerge.

The success of construction companies is to a large extent contingent upon the success of their projects. The latter is highly data intensive and reliant upon the seamless exchange of heterogeneous data among a diversity of actors who may be dispersed geographically and in terms of their business models and systems. Inevitably, the industry has taken full advantage of the information and communication technology, albeit somewhat later than other industries such as manufacturing and aerospace industries. This section provides a brief account of some of the technologies that have been exploited to varying degrees, before homing in on the details of a typical project management system. In order to avoid assuming that IT is not just about technology, the section commences by looking at process issues.

A.1 Business process

A business process is 'a collection of related structured activities that produce a service or product that meets the needs of a client'. Business Process Management (BPM) is a field of management that combines effectiveness and innovation to align organisations with the needs of clients.

The long-established success of process approach in manufacturing promoted the notion of construction as a manufacturing process and paved the way for its recognition with construction as an effective way of increasing performance and consistency. However, it was with Egan (1998) that this view made its way to the forefront of business, policy and research community alike. Basically, a process is a sequence of steps to achieve an objective through integration of people, procedures and technology. It expedites business reengineering and provides a framework for continuous improvement. Subsequently, it lays the foundation for supply chain integration. While process is a perspective, it is also a methodology. *Cooper defines process as '... a formal blueprint, roadmap, template or thought process for driving a new product project from the idea stage through to market launch and beyond'.* The adoption of this methodology

by the Construction Industry culminated in the development of the Construction Process Protocol developed at Salford University. Indeed, Construct IT's perspective on information technology is through construction processes.

Construct IT For Business is an industry-led non-profit-making collaborative membership-based network, comprising leading edge organisations representative of the construction industry supply chain in addition to professional institutes and R&D/academic institutions. Their aim is to improve industry performance through the innovative application of IT and to act as a catalyst for academic and industrial collaborations. Their mission is 'to be an effective enabling and co-ordinating force (agent) in the application of IT within the construction process as a contribution to innovation and development of best practice'.

A.2 Interoperability

There are many independent and yet inter-related disciplines involved in the realisation of a construction project throughout its lifecycle. Each discipline is dependant on the use of its software tools that rely on input from applications in other disciplines and in turn provide an output into them. These interactions are not always sequential, and decisions may involve a number of iterations. Lack of compatibility of these application has crated disjoints in the project development process as well as loss of information.

Interoperability has been defined by IEEE as 'ability of two or more systems or elements to exchange information and to use the information that has been exchanged'. Within the context of construction systems and processes, it invariably refers to the seamless exchange of data among various software systems. Interoperability enables integration of systems within an organisation as well as those employed by their business partners. Subsequently, it has the ability to save time and money, as well as promote collaborative working that yields several other advantages. By its nature, the implementation of interoperability requires the development of standards. Interoperability can be achieved in various ways. However, by far, the most comprehensive and consistent way of achieving interoperability is through Industry Foundation Class (IFC), which is an object-oriented data model class-based structure that facilitates sharing of information. IFCs provide the means for communication between applications. However, the use of IFC model server offers a more efficient way of data exchange in a multi-disciplinary environment. These developments are a global effort that is coordinated by the International Alliance for Interoperability (IAI), which was started by 12 companies in September 1995 as a not-for-profit global alliance of construction and facilities management industries. IAI aimed to address representation of construction physical objects such as doors and walls, as well as abstract objects such as process and space.

International Alliance for Interoperability (IAI) Building SMART – UK Chapter is the International Alliance for Interoperability that specialises in establishing standards for the use of object technology in construction and facilities management. Building Smart is the new branding of IAI started in 2005 specialised in using Building Information Modelling (BIM) and IFCs as the trigger to smarter ways of working. Its aim is to offer smarter ways of working, which will directly affect the processes and skill sets used in the industry and

other issues such as contracts, payment systems, insurance, education and training which IDCs address. It will require information links with business activities. They also aim to seek alliances with other similar motivated organisations, which provide complementary standards and/or support processes, which deliver faster, better, less expensive and more predictable results than can be achieved with traditional methods. Their mission is 'to provide a universal basis for information sharing and process improvement in the construction and facilities management industries'.

A.3 e-Business

One definition of e-business ventured by Construct IT is '*... as automated business processes(both intra-and inter-firm) over computer mediated networks and also the integration of all business activities that include redesigning of business process or reinventing of business model through information and communication technologies'.*

e-business solutions are technologies for construction project lifecycle collaboration. They are typically recognised as project extranet and software-as-a-service.

It is argued that successful implementation of e-business and e-commerce is contingent upon having a foundation of readiness. Furthermore, e-business framework needs to be complemented with business processes reengineering and change management.

The Network for Construction Collaboration Technology Providers (NCCTP) was formed in 2003 to bring the e-business providers together in a coordinated manner. Over the past few years, NCCTP has lost its momentum, although its infrastructure remains in place.

The NCCTP was formed in December 2003. The network will help to promote the effective use of online technology to support collaborative working on projects and capital developments in the UK constructions. It provides a single independent body with which organisations can communicate regarding the future development of collaboration technology. Their aim is to develop and implement an agreed set of data exchange standards between all members to enable bulk transfer of data from any one system to another. They also aim to develop and implement an agreed set of data exchange standards between all members to enable routine transfer of information between systems for cross-project working. They will establish a group whose membership broadly represents the collaborative technology providers working within the construction industry and provide a vehicle to address generic market and technology issues. Their mission statement is 'NCCTP seeks to promote the benefits and use of collaborative technology in the construction and related industries'.

A.4 Electronic document management systems

Electronic Document Management Systems (EDMs) have proven to be a highly efficient way of exchanging and managing documents particularly within those industries where relationship between partners is long term. Despite extensive

automation and digitisation, much of data and information communication during the traditional design and build processes of construction is still paper based. This is partly due to contractual and legal reasons and partly due to the culture of the industry. Other than the consequential inefficiencies, the paper-based medium deprives re-use of the knowledge and lessons contained within these documents. The industry being highly data intensive, the concept of Document Management has developed some interest within the industry. The low satisfaction with the solutions offered by vendors has led some larger companies to develop their own document management system. These systems have been criticised for being non-user-friendly and difficult to integrate with other systems such as CAD. They also have the security issues associated with protection and ownership of the data. However, the main pitfall of EDM has been the upfront work required to setting up the system for all participating partners. Indeed, every partner within the project must use the same EDM system on a project in order to be able to access and share documents. It is incumbent on IDCC's to provide a workable electronic document management system that addresses all these issues facilitates the completely open exchange of information between client and IDCC teams.

A.5 Electronic trading

Electronic Trading is an attempt to minimise paper transactions. It is about sending and receiving transactional data either directly or through a HUB, the role of which is to apply the rules of connectivity. Depending on the nature of the business and choice, there may be more than one HUB.

It is evident that considerable cost and time saving can be achieved through the implementation of e-trading. Additional advantages include increased visibility, control and certainty. There are already a large number of companies connected for e-invoicing. A study of actual customer case has shown that a 57% saving can be achieved through electronic automation of the simple invoicing. While electronic trading is applicable to transactions throughout the lifecycle of construction processes that involved collaborative working like IDCSr, it tends to offer greater advantages in areas involving tenders, requisitions, orders, invoices, acknowledgement, delivery, statements and remittance.

Construction Industry Trading Electronically (CITE) is a collaborative electronic business initiative for the UK construction industry where data exchange specifications are developed by the industry for the industry, enabling the industry to move forward together. It was launched in 1995 and formally marked the start of a major collaborative undertaking with active participants from consultants, contractors, sub-contractors and suppliers. The over-riding aim of CITE is to extend the operational use of electronic business across the construction industry in the widest context and by so doing, create an open trading environment for all. Where extending services or standards apply, CITE seeks to adopt these and build on best practice. Their mission is 'to develop and promote the adoption of e-business standards in the construction and facilities management industries'.

A.5.1 Enterprise resource planning

Enterprise resource planning (ERP) is an enterprise-wide information system that helps an organisation to integrate, optimise and manage its various

functions ranging from product planning, material purchasing, inventory control and product distribution, to taking orders, finance, accounting and human resource management. It uses one application, one database and a unified interface across the whole enterprise. While the concepts of Inventory Management & Control System, Materials Requirement Planning and Manufacturing Requirements Planning date back to the 1960s, 1970s and 1980s, respectively, it was during the 1990s that ERP started to play an important role in integrating the information systems of the whole enterprise, thus enabling efficient management and use of resources including human, materials, finance and information. ERP systems are designed to underpin both process-oriented aspects of the business and business processes that are standardised across the enterprise. Despite their slow start, their use within the Construction Industry has been on the increase and likely to continue so as IDCsr develops.

A.5.1.1 Concurrent Engineering

Concurrent Engineering is another concept adopted from manufacturing industries in order to reduce cost and time, as well as improve the overall quality of the product. Concurrent Engineering helps to minimise ambiguity and unforeseen issues relating to the design, as it allows consideration of the downstream product lifecycle issues during the early design stages. This feature applies through the lifecycle. In construction, the concept has embraced detail design, environmental impact, space planning, maintenance, operational issues, emergency evacuation, security and construction. Subsequently, Concurrent Engineering has facilitated collaborative working of many actors including architects, contractors, planners, engineers and maintenance engineers and in some ways has been superseded by BIM, IDCsr and similar systems.

A.6 Information visualisation

Human vision and domain expertise are powerful tools that (together with computational tools) make it possible to turn large heterogeneous data volumes into information (interpreted data) and, subsequently, into knowledge (understanding derived from integrating information). Visualisation can encompass a variety of topics ranging from information visualisation to scientific visualisation, virtual reality, multi-media and so on. In this sub-module, the issues relating to visualisation are grouped under three sections. This relatively new field of science is gaining significant importance because it has become rich in tools and techniques within a wider multi-disciplinary scope and could be of future use to IDCsr practitioners.

A.7 Mobile technology

Mobile technologies have been used in various ways within the construction industry. They have made considerable inroad towards eliminating paper works associated with numerous processes within this data-intensive industry. The real benefit of mobile technology is indeed its inherent characteristic of being mobile, thus exploitable anywhere anytime. This feature, in conjunction with the fact that all of its transaction are in digital format, makes mobile

technology an imperative part of construction management. Most popular are the types of robust PDA and rugged Tablet PC devices for semi-automated or fully automated data collection in a structured way, so they can be synchronised with the back-office systems via WLAN or GPRS. The ability to communicate upstream allows operatives with a PDA to access necessary distributed helpful data/information. Issuing orders, GRNs, Quality inspection reports, Method statements and RFIs are just a few examples where operatives on site can communicate with relevant stakeholders or systems to archive, take actions or check compliance.

PDAs are becoming more sophisticated in terms of both hardware and software technologies. The latter includes devices that are capable of receiving updated revisions of drawings to the site and return updated information back. This is just as true about documents such as drawings as is for data relating to project progress, which can be captured by site management and synchronised with the master project management system or a project-integrated database. Applications have been developed for mobile devices to undertake specific tasks. For instance, the Mobile Manager by Primavera allows interaction with the main Primavera project management software. In effect, mobile technologies become extension of main systems.

PDA devices can be enhanced or complemented with RFID readers, thus used for inspection, tracking and, if necessary, issue hazards notification (e.g. for equipment misuse or prolonged duration of exposure to hazardous materials or equipment) and issue automatic alerts via email or SMS. The sharper end of the technology can take advantage of camera, smart hard hats and even augmented reality for the identification of maintenance equipments, material and operatives. The latter could be with the aid of operatives' mobile phones.

The innovative exploitation of mobile technology in the UK construction industry is coordinated by Construction Opportunities for Mobile IT (COMIT). They have identified several areas where mobile technology can be exploited within the construction industry. These include the following areas for which practical solutions are offered and where necessary their process maps are generated:

HEALTH AND SAFETY

Collection of audit/inspection data the field

Notification hazards to be remedied

Retrieving the training records of operatives

DRAWING DISTRIBUTION AND USAGE

Delivery of drawings to site

Notification of revisions to drawings (not applicable to IDCSr)

Capture of as-built information

GOODS RECEIVED NOTES

GRN creation and distribution

Tracking of delivered goods

MAINTENANCE INSPECTION

Delivery of work orders to the field

Collection of maintenance information

Locating spare parts and equipment

MONITOR HAZARDOUS ACTIVITIES

PDA form for capturing time undertaking hazardous activities

Automatic identification of hazardous activities and operatives

MONITOR PROGRESS

PDA form for capturing progress made

Integrating with back-end systems

Benefits of mobilisation

ONSITE PEOPLE MONITORING**QUALITY INSPECTION****SITE DESIGN PROBLEM RESOLUTION****SITE DIARIES****TASK ALLOCATION**

Delivery of method statements to site operatives

Capture of briefing acknowledgements

Capture of progress information

Construction Opportunities for Mobile IT (COMIT) Started as a 2-year research and development project (from August 2003 to December 2005) partially funded by the DTI. The project brings together representatives from construction, technology, research and dissemination organisations to form the COMIT Community. In September 2005, a self-funded organisation was established. COMIT's aim is to help its members to realise benefits from the use of mobile information and communicate technologies (ICT). Their mission is 'to become the European centre of Excellence for the exploration, development and implementation of emerging ICT within the construction industry'.

A.8 4D project management

An alternative approach to construction planning and project management is to develop a visual representation of the building and manage the construction process by visualising the process and the product at any point in time. As a complementary tool to the traditional project management tools, the visual approach yields additional capabilities: visual inspection of clashes, the identification of the spaces needed for resources at any time and access to a common database are a few of many examples. In this environment, project participants can increase productivity and reduce waste visualising and analysing

construction schedule and communicating in an environment that is conducive to collaborative working.

The potential benefits of the visualisation of construction progress as an alternative or complementary method to the traditional methods has been realised as early as in the early 1990s. The methodology relies on the combination of the traditional project management tools with a CAD-based visualisation tool. Further enhancements have been achieved through the introduction of decision support systems for the planning process. In some ways, these efforts laid the foundation for what was later known as BIM. In particular, the opportunity for collaborative working of the main parties engaged in the design and construction phases.

A.9 Building information model(ing) – BIM

The origin of BIM as a concept can be traced back to the ancient Egyptian days of 27th century BC when the very first recorded architect, engineer and constructor, Imhotep, drew on papyrus. During the 1960s, the traditionally inefficient manual process gave way to Computer-Aided Design (CAD), which later in the 1970s evolved from 2D to 3D representation. The next development came with the advents of object-oriented technology resulting in object-oriented CAD systems (OOCAD) where building elements were indeed objects. Within the construction industry, there has been a significant drive towards creating integration among application. CAD systems in the industry offer limited scope for sharing building information. The need for virtualisation of a building as a combination of intelligent objects paved the way for the development of BIM. The first glimpse of BIM was the ArchiCAD in 1987 by Graphisoft, before Autodesk officially coined the term to describe '3D, object-oriented, AEC-specific CAD'.

BIM stands for 'Building Information Modelling', which is different from 'Building Information Model'. On one side, BIM has been defined as a philosophy, a new way of working and paradigm shift, and at the other end, BIM has been seen purely as technology. Under the IDCsr system, BIM is both of these and everything in between. Under the IDCsr process, BIM is the representation of a multi-disciplinary data model of a building. The open, totally integrated design and construction management structure, free from the traditional contractual restraints that is created by IDCsr, provides the ideal platform for evolving e-Design systems from CAD to BIM.

BIM Task Group: With their announcement on May 31, 2011, the UK Government instigated an important step towards the promotion of BIM within the construction industry. The Cabinet Office announced that it is the Government's intention to require collaborative Level 2 BIM on its projects by 2016. Subsequent to this, the BIM Task Group was formed to help deliver this objective.

BIM Academic Forum – BAF: On December 2, 2011, representatives from eight UK universities and a technology organisation formed the BIM Academic Forum (BAF) to promote the academic aspects of BIM. The vision of BAF is 'to foster integrated collaborative working over the lifecycle of the asset through academic enhancement of BIM' and its mission is 'to create a dynamic collaborative group to enhance and promote the T&L and research aspects of BIM.' The initial objective of BAF was to develop a BIM academic framework for the delivery of BIM at undergraduate levels 4, 5 and 6, as well as level 7 at the Masters level. BAF has also laid the foundation for the identification of leading edge research issues associated with BIM. Without prescribing the pedagogic and

delivery methods, BAF offers a concerted approach to developing a consensus among the UK academics, which also enjoys the support of the BIM Task group and a number of policy and technology organisations. The proposed framework that has been outlined in BAF report 'Embedding BIM within the Taught Curriculum' (published by Higher Education Academy) was the result of two workshops and reflects the role of industry training needs as well as requirements by the professional institutions.

A.9.1 Visual Approach to Operation and Maintenance

Lifecycle planning has gained significant importance over the past two decades, and the momentum is ongoing. Amongst other benefits, lifecycle planning yields considerable economic advantages, as the financial implication of alternative design and material options can be examined at the outset. Further advantages are rendered through optimised maintenance planning. The lifecycle decisions can be significantly enhanced through the use of visualisation technologies. Virtual reality (VR) is a medium that enables participative immersive visualisation and simulation of virtual worlds. Unlike animation where a series of pre-determined images are sequentially displayed, virtual reality environments offer real-time and seamless visual examination from an infinite number of perspectives. VR systems have been used for both design and evaluation of operational and maintenance requirements of buildings. The current VR systems facilitate the visualisation of an object such as building in a static manner – view or walkthrough the building as it is now. In other words, a building in a given static state is viewed 'in time'. However, buildings are dynamic systems, and the state of their components changes with the passage of time. To this end, work has been carried out to facilitate the visualisation of the building 'through time'. This enables visual evaluation of building degradation, which can be used to implement a just-in-time approach to maintenance planning.

Construction Operations Building Information Exchange (COBIE) An effective operation and maintenance of a building relies on the availability of a host of historical (project history) data about the project. Typical handover documentation on traditionally managed projects consists of volumes of papers about such issues as product data, equipment lists, spare parts and so on. At one point or another, this data is created and made available, but frequently mislaid or not properly archived. The IDCSr system requires that all handover information should be handed over to the client on the day the project is complete and the client pays the final stage payment. COBIE offers a simple and cheap way of accumulating these as-designed and as-built data and recording them in a simple standard format. The COBIE simplicity has the added advantage of being platform independent, thus ready for use by all. Indeed, the spreadsheet can be amended to meet specific needs by adding fields. COBIE is an IFC reference standard that captures data on spreadsheet during design, construction and commissioning, which can be used for maintenance, operations and asset management. From design to handover stages, COBIE incrementally gathers basic building asset information such as spaces, material, equipment and product schedule.

COBIE is based on the Industry Foundation Class (IFC), and its data is interoperable, typically presented in STEP, ifcXML, Open Document XML or SpreadsheetML. As a result, it is capable of providing software-to-software

interoperability, as well as software-to-human understanding of the nature of the information.

COBIE may be developed manually in spreadsheet or use commercial systems to create and exchange COBIE data. Alternatively, COBIE spreadsheet can be produced directly from BIM software IFC files. In addition, there are applications that generate COBIE files that are opened in Spreadsheet (e.g. excel) and saved as an XML file (e.g. Excel 2003 XML). These files are rather colourful: the colours represent the assignments relating to different categories of information associated with different parties. This is facilitated through what is known as COBIE Responsibility Matrix. At the other end, there are a number of maintenance management systems that allow direct import of COBIE information.

A.10 Project management

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