Roles in construction projects: analysis and terminology

Book

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Roles in construction projects:

Analysis & Terminology

A Research Report undertaken for the Joint Contracts Tribunal Limited

By

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Roles in construction projects

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Will Hughes and John Murdoch
University of Reading, April 2001

Roles in construction projects

Foreword

This year (2001) celebrates the 70th anniversary of the appointment in 1931 of the Joint Contracts Tribunal by the Royal Institute of British Architects and the predecessor pf the Construction Confederation, NFBTE,

"with the objects of keeping the Form up-to-date with modern practice and removing any difficulties which may arise in connection with its use."

It is therefore fitting for this publication to provide part of that celebration as well as a continued output of important research sponsored by the Joint Contracts Tribunal ("JCT") through its Research Projects Committee.

Much has happened since the publication of the 1931 Standard Form of Building Contract, none more so that the demands placed on the participants in the construction process. In 1998 the Research Projects Committee under the Chairmanship of my predecessor, Michael Millwood OBE, commissioned Will Hughes and John Murdoch from the Departments of Construction Management and Law, respectively, at the University of Reading, to carry out research into terminology in construction contracts. This work is now complete and this publication is the final report of their research. I am delighted that the Council of JCT has agreed that the recommendations in Chapter 8 (Terminology) should form the basis for future drafting of its contracts.

This publication undoubtedly enhances JCT's portfolio. I commend its valuable recommendations and research to all who are involved in using contract specific terminology and particularly to those involved in the production of construction contracts. In the hope that a greater degree of uniformity and clarity may be achieved.

Neil Smith
Chairman
HCT Research Projects Committee
April 2001

Executive summary

- Standard form contracts are typically developed through a negotiated consensus, unless they are proffered by one specific interest group.
- Previously published plans of work and other descriptions of the processes in construction projects tend to focus on operational issues, or they tend to be prepared from the point of view of one or other of the dominant interest groups.
- Legal practice in the UK permits those who draft contracts to define their terms as they choose. There are no definitive rulings from the courts that give an indication as to the detailed responsibilities of project participants.
- The science of terminology offers useful guidance for discovering and describing terms and their meanings in their practical context, but has never been used for defining terms for responsibilities of participants in the construction project management process.
- Organizational analysis enables the management task to be de-constructed into its elemental parts in order that effective organizational structures can be developed.
- Organizational mapping offers a useful technique for reducing text-based descriptions of project management roles and responsibilities to a comparable basis.
- Research was carried out by means of a desk study, detailed analysis of nine plans of work and focus groups representing all aspects of the construction industry.
- No published plan of work offers definitive guidance.
- There is an enormous amount of variety in the way that terms are used for identifying responsibilities of project participants.
- A catalogue of concepts and terms (a “Terminology”) has been compiled and indexed to enable those who draft contracts to choose the most appropriate titles for project participants.
- The purpose of this terminology is to enable the selection and justification of appropriate terms in order to help define roles.
- The terminology brings an unprecedented clarity to the description of roles and responsibilities in construction projects and, as such, will be helpful for anyone seeking to assemble a team and specify roles for project participants.

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LIST OF ABBREVIATIONS

ACE	Association of Consulting Engineers
BPF	British Property Federation
BS	British Standard
BSI	British Standards Institution
CDM	Construction (Design and Management) Regulations 1996
CIB	Construction Industry Board
CIC	Construction Industry Council
JCT	Joint Contracts Tribunal
NHS	National Health Service
PACE	Property Advisers to the Civil Estate
PPM	Process Protocol Map
R 1964	RIBA Plan of Work, 1964
R 2000	RIBA Plan of Work, 2000
RIBA	Royal Institution of British Architects

1 INTRODUCTION

The Joint Contracts Tribunal is the drafting body responsible for negotiating the contents of the standard forms of building contract in general use in the building industry (excluding civil engineering). It is generally accepted in the construction industry that standard forms of contract are the best way of arriving at a set of contract terms (for example, Minogue 1997).

The Latham Report (1994) observes that the JCT's traditional focus on the contract between builders and their employers resulted in a plethora of mis-matched contracts for the construction project team. Latham also recommends the preparation of a consultants' agreement. The JCT commenced preparation of a consultants' agreement, which reflects and complements the main forms of building contract. This is entirely new territory for the JCT. Similar work has recently been completed by the Association of Consulting Engineers (ACE) who have drafted a consultant's agreement that meshes with the Institution of Civil Engineers' construction contract. A major problem faced by the JCT Consultants' Agreement Working Party was in developing a consensus about what labels to apply to the various responsibilities in the construction process, especially during the design stages. The JCT commissioned a research project at the University of Reading to provide guidance for the choice of terms to apply to the roles encountered in construction projects. This report details the analytical work that has been undertaken to develop a terminology of contract roles based upon an analysis of the processes of design and construction and presents a terminology that explains the terms in common use and the relationships between them.

Since the Latham Report was published, Egan (1998: 12) has proposed that design and construction processes should be explicit and transparent to the industry and its clients. The creation of consultants' agreements that fit into a clear articulation of the construction process is an important part of clarifying the design and construction process. Similarly, a detailed analysis of consultants' roles, with particular reference to de-constructing how consultants are managed and how they manage the process, will go a long way to responding to Egan's call for improved management skills at all levels (1998: 18). One major problem identified by Egan (1998: 9) was the lack of integration in the process, evidenced by the largely sequential and separate operations undertaken by individual designers, contractors and suppliers with little commitment to the overall success of the project. In developing a clear articulation of roles and the relationships between participants and a project, this report illustrates how an overall view of the process can be developed from familiar patterns of responsibility.

Current developments in the procurement of finance for construction (such as Public/Private Partnerships, formerly known as the Private Finance Initiative) can make a significant difference to way that participants approach construction projects. Similarly, innovative working practices, such as partnering, are being developed in an effort to influence the way that construction business is carried out. While the importance of these developments is recognized and acknowledged, the underlying contracts that commit participants to a project are generally dealing with issues at a greater level of detail. Of course, any terminology is rooted in a particular time and place. The work reported here is intended to be indicative of typical contemporary vocabulary, rather than comprehensive for all sectors of construction business or permanently definitive.

1.1 Political consensus is difficult to achieve

The process of negotiation within the JCT used to require a full consensus before contract terms could be published. Since being reconstituted and re-organized, the system of colleges involves restricting the right of veto to the colleges who represent parties to a particular contract. Since each institution and association is representing the interests of its members and, by extension, the interests of the public as they view it, it can take a long time to achieve agreement.

1.2 Contract law permits drafters to define their terms

Much has been written about good contract drafting practice. Most of this consists of suggested model clauses or model amendments to existing standard forms of contract (Pike 1993). There are texts dealing generally with legal drafting (Blake 1993, Rylance 1994). Some indirect assistance may also be obtained from works relating to business leases (Ross 1994, Lewison 1996) or computer contracts (Klinger 1994).

The objective of anyone who drafts a contract should be to ensure that each clause will be interpreted (by a court, if necessary) in the way intended. A discussion of the legal principles governing interpretation is found in every standard text on contract law (see, for example, Guest 1994). The major specialist work is Lewison (1989), from which the following description is drawn.

The object of interpreting a written contract is to discover the intention of the parties as to their rights and obligations. For this purpose, the intention of the parties consists entirely of the meaning of the words they have used. It must be ascertained from their language, considered in the light of the surrounding circumstances.

In addition to the words of the contract, the court may also be assisted by considering its commercial purpose, and to do so may rely on its own experience of contracts of a similar character to that under examination. In a case where the contract is based upon a standard form of commercial agreement, the court recognizes the desirability of certainty and is reluctant to disturb an established interpretation. However, where the words of a contract are clear, the court will give effect to them, even if they have no discernible commercial purpose.

The underlying principle on which interpretation is based is that of freedom of contract. The parties are at liberty to agree whatever they choose. Thus, while there are a number of so-called "rules of construction", these are presumptions rather than rules of law, and accordingly will only be applied in the absence of a contrary intention expressed in the contract. Indeed, where it is found that the parties have attributed their own peculiar meaning to words, it is the duty of the court to give effect to that meaning.

As a general principle, the words of a contract are interpreted in their grammatical and ordinary sense, except to the extent that some modification is necessary in order to avoid absurdity or inconsistency. For this purpose, the ordinary meaning of a word is its meaning in its plain, ordinary and popular sense, although that sense may be a sense among a particular group of persons. However, where a contract contains a legal term of art the court will normally give it its technical meaning in law, unless there is something in the context to displace the presumption that it was intended to carry its technical meaning.

1.3 Guidance from terminology and taxonomy

1.3.1 The relevance of terminology and taxonomy

There is a wide-ranging literature on the sciences of terminology and taxonomy. Ananiadou and McNaught (1995) explains how terminology practice may help technical translators. Barrows *et al.* (1994) discuss the mapping of special clinical terms to a more general medical terminology. There may be insights from the methodology used for developing a terminology from the field of learning disabilities (Bowden 1997), although it remains to be seen whether work from such a different field helps with general principles. Similarly, work has been done in the area of food technology and this provides clues for developing a systematic terminology for areas in which no consensus of terms currently exists (Raats and Shepherd 1996). For present purposes, there are potentially important lessons to be learned from interdisciplinary communications, where it may be expected that many problems might arise (Sonneveld *et al.* 1993).

1.3.2 Lexicography and onomantics: two routes to the same result

In general terms, lexicography is the science of developing lists of words with meanings attached to them (Hartmann 1983). This is a different approach to the science of onomantics, which involves beginning with a description of something, then attaching to that description a term which is used to denote the particular concept (Riggs 1996a, 1996b, 1996c). Both approaches result in a list of terms with definitions attached to them, but the former begins with a list of words that need definitions, whereas the latter begins with the identification of the concepts to which labels are applied.

1.3.3 Terminology offers useful methods

Terminology is the science which links these two approaches, in that lists of terms are organized according to the relationships between the concepts they are intended to convey. It is clear that for the purposes of identifying and defining contractual roles, the relationships between roles are just as important as the definitions of the individual roles. Thus, a **terminology** of contractual responsibilities, rather than a mere **glossary**, will be the most effective tool in meeting the needs of contract drafters. In other words, what is required is an analysis of responsibilities followed by an analysis of the terms used to portray each of the responsibilities. This is the approach adopted in this work.

1.4 Lack of independent means for defining terms

The need to identify responsibilities in construction projects is certainly nothing new and there are many documents that already achieve this to varying extents (Chartered Institute of Building 1982, Royal Institution of British Architects 1992, 1995, 1997). What is new is the need to develop more widely applicable descriptions of these responsibilities in a way that is acceptable to all parties, coupled with the need to separate managing from doing work.

1.5 Research method

The research was structured in three phases; a desk study, in-depth analyses of published plans of work and focus group interviews. Each stage informed the next and the approach was designed so that the work would finish if an existing ideal solution were discovered.

1.5.1 Desk study and matrix analyses

The initial work consisted of searching for any existing reference work that might provide a glossary of the kind required by contract drafters. The construction literature reveals a few broad and superficial glossaries, which contained little about contractual roles (for example, British Standards Institution 1985), and several detailed pieces of research that go into great depth about only one role (for example, Krueger and Townsend 1988). Neither of these types of work was adequate for the purposes of identifying alternative terms, and their connotations.

There were several reports about the processes involved in construction projects, but their focus was on operational issues, not management issues. These are dealt with in Section 2.2.

The literature on construction contracts revealed that contract drafters can define words and phrases for the purposes of each contract. There is no definitive guidance in this literature on how to choose terms for roles.

The inconclusiveness of the literature meant that it was necessary to go deeper into the principles of role definition and work organization. This entailed re-visiting organizational theory and organizational mapping with a view to developing a technique that would enable comparative assessments to be made of a range of published plans of work. These analyses revealed the amount of conformity between plans of work and also helped develop outline lists of a wide range of nouns used to describe job titles and stages of work. The analysis (presented in sections 4 and 5) showed that there was some degree of consistency in the way that construction project work is described. However, there was little consistency in terms of the nouns used to describe the roles of the various participants, or the verbs that describe how they relate to the various outputs at each stage.

1.5.2 Focus groups

The subsequent stage of the work involved a series of focus groups that were organized to collect data about how practitioners used role terms in their conversations about construction project work. The focus groups enabled the generation of a list of words in everyday use. Moreover, by recording the conversations it was possible to analyse the context in which each word was used. This enabled the researchers to form a view about the importance and meaning of many of the terms that were in common use. It also formed a useful addition to the data collected in the earlier part of the work.

The research process involved setting up a meeting of six to eight practitioners, each time focusing on one category of practitioner. For example, the first group was lawyers. This group was chosen to begin with as they were likely to have more generalized knowledge than the other groups, and therefore this was a useful group with which to develop the technical aspects of dealing with focus groups.

Each focus group involved some initial guidance from the researchers about the purpose of the focus group and the overall aims of the research. The aim was to record the participants talking to each other, rather than being interviewed by the researchers. This enabled the participants to develop the issues that seem most important in their perception, using the vocabulary that they chose. The initial focus group showed that occasional interventions by the focus group moderators could keep the conversation on the topic of construction processes and roles, without suggesting which aspects should be talked about.

The conversations were recorded using two stereo mini-disc recorders. These are highly portable, and therefore unobtrusive. Also, they enable 74 minutes of uninterrupted recording time, avoiding the distractions caused by turning over or changing tapes at more frequent intervals. Stereo recording was used to help in separating voices during the subsequent transcription, and two machines were used, partly to continue recording on one while the disc was being changed in another, partly to provide backup in the event of malfunction, and partly to provide different sound sources in the event that multiple voices were difficult to separate.

The soundtracks were transferred to a computer, using digital recording and splitting the soundtrack into tracks of three minutes each, for ease of transferring, storing and finding parts of the conversation. Initially, five-minute tracks were used, but these proved too large for convenient handling. The tracks were then transferred to audio CD for archival purposes.

Transcription was done by using the computer to play back the audio track through stereo headphones, so that the typist could make an accurate verbatim transcription. Using the balance control to filter out the stereo tracks, most multiple voices could be separated. Whenever it was too difficult to discern who was saying what, the alternative recording was used and in every case, the different microphone position made it possible to disentangle the voices.

The typed transcript was then checked against the CD for accuracy. These transcripts were analysed using qualitative analysis software whose purpose is to help discover and explore meanings within unstructured data. The software enables texts to be marked up (coded) with ideas and concepts. These codes can then be structured and used for developing questions that can then be investigated through the data, which, in turn, generates further coding. This process enables text to be explored, searching for ideas, concepts and categories, developing themes in the data and, ultimately, develop a comprehensive picture of the kinds of words used and the meanings attached to them.

Some of the meetings of the research steering group were also recorded and transcribed in this way. The primary purpose for doing this was to practice using the techniques. A useful spin-off from this was that many of the most

useful conversations in the steering group were captured and used to inform the research as it progressed.

The output from the qualitative analysis of the focus groups produced list of words with associated meanings. These were then added to the lists developed in the earlier stages of the work, so that the definitions emanating from the work were rooted in both the literature and the way that contemporary practitioners used the words.

1.5.3 Developing the terminology

The final stage of the work involved using the structures identified in the analytical work. The published plans of work were the basis for much of the structure in the systematic description of the outputs (stages of work) that were produced from the research. The verbs that describe the activities undertaken were largely drawn from the analysis of organizational theory. The nouns were largely structured from the qualitative analysis of the focus groups, but this was complemented by the other phases of the work, so that the glossary was rooted in all of the work undertaken on this project.

1.6 Structure of the report

In section 2, previously published texts are discussed in terms of the extent to which they offer guidance on defining and labelling the various roles (and the relationships between them). Three issues are important:

- The comprehensiveness of the descriptions of the work of consultants.
- The extent to which the various source documents offer a comprehensive description of the work of consultants during the design and construction processes.
- The extent to which the responsibility for managing the process is distinguished from operational responsibility.

As well as considering the literature on construction project management, this section also examines the legal literature on construction project roles and responsibilities.

Section 3 looks at the use of organizational theory for identifying roles and mapping relationships. This provides the theoretical underpinning for a series of ideas which lead to a mapping technique that is described in detail in section 3 and then used in section 4 to undertake a detailed examination of a series of published plans of work in common use. These charts are summarized and compared in section 5, identifying their diversity and relative utility. The work shows that there is not a ready-made solution to

the problem of identifying and describing the various roles during the design and construction stages of a project.

Section 6 deals with the focus groups that were carried out for the purposes of ascertaining how words and concepts are used in practice. Section 7 contains the analyses and summary of the focus group data.

The terminology is presented in section 8. This is followed by the list of references to documents used in the study, and a comprehensive index.

2 ANALYSIS OF ROLE DESCRIPTIONS IN THE LITERATURE

The construction industry has produced a plethora of reflective reports looking at what people do and how projects are organized. In terms of the legal literature, there is little definitive guidance available. These two aspects of the literature are dealt with in more detail below.

2.1 Role descriptions in construction literature

Textbooks often contain introductory passages to help explain roles in the construction industry, primarily for people new to the area. One example (Butler 1970), aimed at courses for technicians, describes in broad terms the roles of client, architect, structural engineer, services engineer, quantity surveyor, clerk of works, local authority, building inspector, factory inspector, builder, sub-contractors, nominated sub-contractors, suppliers and nominated suppliers. Since the purpose of the book is introductory, the descriptions are informative, but lack any analytical detail.

Those who prepare standards will frequently need to define terms, and the British Standards Institute (British Standards Institution 1985) give straight-forward definitions for a series of roles in construction projects. For example, the architect is defined as the *person who designs buildings and superintends the execution of building works*; the quantity surveyor as the *person who provides financial and contractual advice and services for planning, execution and completion of construction works.* While serving to clarify the roles, such definitions do not provide a sufficiently comprehensive basis for the purposes of drafting legal agreements.

Some papers describe particular responsibilities. For example, one paper reviews how occupational safety may be improved in the process, from the Canadian point of view (Anstruther 1997). In a similar vein, it is essential for contracts in the UK to take account of the role of Planning Supervisors and Principal Contractors, under the terms of the *Construction (Design and Management) Regulations*. Another example is Hays (1988), who identifies a potential role for chemical engineers in construction projects. While there is little doubt that there are circumstances when the advice of a chemical engineer is essential, the notion of a routine construction project role for such engineers is, perhaps, politically motivated. Similarly, a view is put forward for a more central role for accountants in construction projects (Krueger and Townsend 1988), something that is sure to irritate the quantity surveying profession. A more salient role description is given for the activities of budgeting and forecasting (Khosrowshahi 1988), although the emphasis is on the mathematics of estimating, with only a little attention given to the relationship between the estimator and the project. Most of

these descriptions and analyses provide detailed information about what one member of a project team might typically do, but with such a focus they offer little in terms of developing an overall view of how to manage the construction process.

There are several interesting analyses of specific roles. Cherns and Bryant (1984) described a major, in-depth study of the way that clients interact with the construction process. They criticize construction management researchers' tendency to oversimplify the role of the client. Since then, much more in-depth analysis has taken place, for example a seminal study about construction industry clients, undertaken by Bresnen and Haslam (1991), which shows that there are, in practice, few real alternatives to traditional methods of organizing and managing projects. Despite many claims to the contrary, the construction industry has great difficulty in organizing work in any way other than the traditional.

In their examination of the role of the designer under civil engineering design-build contracts, Hodgson and Jeffry (1999) show that some clients, such as the Highways Agency, demand a more active supervisory and certification role than others. This calls for a permanent site presence on the part of the designer and a number of design representatives, which is not usually the case on other kinds of civil engineering projects, where even the most complex might only have one resident engineer.

Scott and Assadi (1999) undertook a survey to ascertain the usefulness of site records kept by construction supervisors on civil engineering sites. They discovered that many site records were inadequate for the purposes to which they might be put. They conclude that supervisors of construction need clearer guidelines on record keeping if overviews of progress are to be improved.

There are many analyses of the procedures that have been or ought to be routinely adopted for construction projects (for example Sidwell 1990, Samad 1994, Shoesmith 1996). As a preliminary indication of what takes place, these are useful but it must be remembered that they have each been developed for their own reasons, often political. They are also simplified models of what would routinely be required. They are discussed below in more detail. One exception among these writings, notable for the rigour of its examination of particular role, is about responsibilities for site investigation work (Bröchner 1994b, 1994a). Other works that may prove useful are the analysis of the client's role, in terms of pitfalls to be wary of (Jaynes 1994), and the useful analysis by Price (1994) of the role of sub-contractors in the process. Although these texts provide very helpful descriptions of the operational inputs of various parties, they tend to be somewhat silent about the details of the control and management structures.

Textbooks tend to provide overviews of the construction industry. For example, Murdoch and Hughes (2000) provide general descriptions of the main roles in the process. Builders are described in terms of their historical

evolution from master masons in charge of a craft-based project, often designing as they go. Mention is made in passing of bricklaying, carpentry, thatching and stonemasonry. An important historical point is that organization and management was very much simpler prior to industrialization because there were few interfaces between trades and skills. The general contractor is described as someone "employing all the necessary skills, providing all of the materials, plant and equipment and undertaking to build what the client had had designed". Trade contractors are referred to implicitly as those who do site work under the management and co-ordination of general contractors. Designers are discussed in terms of the relationships between those with overall responsibility and the specialist designers that they co-ordinate. Quantity surveyors are said to have emerged as a response to the need for cost planning and for measurement and valuation of work in progress. The professions of structural and services engineering are seen as a response to the increasing need for specialized knowledge and project managers as a response to the need for overall management of the increasing numbers of specialists. The involvement of "regulators" is seen as ensuring that structures do not arbitrarily disrupt the lives of the people who come into contact with them, through the roles of the local planning authority, the building inspectorate and the health and safety executive. Finally purchasers and users are distinguished from each other, as their involvements are very different.

An alternative account (Ndekugri and Rycroft 2000) identifies and describes roles for employer, employer's representative, contractor, architect, quantity surveyor, planning supervisor, principal contractor, designers, person-in-charge, clerk of works, suppliers and sub-contractors. Also mentioned, but not defined, are funder, civil or structural engineers, mechanical or electrical engineers, nominated supplier, nominated sub-contractor and sub-sub-contractor. These authors usefully point out that such labels refer those who possess certain duties, rather than to types of professional or business organization. The purpose of these descriptions is to show how the roles of the participants are described in terms of contractual or statutory duties. As such, it does not contain any analysis of roles or how they relate to each other. However, the approach is typical in that structured, comparative analyses of roles are simply not present in the construction literature.

Since there is little in the construction management literature that contributes an analysis of the roles in projects, it is worth examining the literature on the design and construction process.

2.2 Process descriptions in the construction literature

In early work about design method, several writers attempted to map out the processes inherent in design. A general model emerged, initially from a

conference on design method (Jones and Thornley 1963) at which a consensus emerged showing that the complexity of design could be understood as comprising a three-stage process analysis, synthesis and evaluation. Several maps of the design process have been proposed, presenting broad similarities among each other, in such diverse fields as engineering design (Asimow 1962), town planning (Levin 1966) and industrial design (Jones 1963, Archer 1969). The aim was to apply rational models of decision-making and systems engineering methodologies to the process of design.

Asimow (1962) and Jones (1963) provided the basis for the ideas that emerged as the RIBA's plan of work in 1963. The design model divides the design process in four phases:

1. *Assimilation*: gather information about a problem,
2. *General study*: study the problem,
3. *Development*: produce and draw a solution or solutions,
4. *Communication*: communicate solutions to people.

It was pointed out that these phases were not necessarily sequential, because of the likelihood of unpredictable jumps between them, though the importance of completing each phase before starting the next was emphasized.

Subsequently, more detailed frameworks of the architectural design process were produced. For example, Markus (1969) and Maver (1970) proposed both decision sequences and a design process or morphology, in order to go through the decision sequence of analysis, synthesis, appraisal and decision at increasingly detailed levels in the design process. In this way, the cyclical model seems to apply at every step in the production of increasingly detailed outputs. Descriptions of the design process are fairly consistent in this respect. For example, Akin (1986) and Lawson (1990) produce interesting and useful descriptions of what designers do and how they do it. But such analyses of the thought processes involved in design do not provide a useful basis for managing the process.

It is interesting that the cyclical process, described by the RIBA as the phases of design, is not directly reflected in the plan of work they subsequently published. In most maps and schemes of the design process that have since been published, the steps relate to output, rather than to what designers do. Presumably, this is because the practice of management relates to outputs rather than to thought processes. The importance of focusing on output is underlined by views represented in legal literature, where the focus is on the consequences of design. Thus, design is generally recognized as the exercise of informed choice. Interestingly, this definition is simply a means of attributing liability and, as such, does not provide assistance in understanding what designers do, or how to manage their work.

By focusing on the output of designers, sequential models predominate. For example, the original RIBA plan of work had twelve sequential stages. The plan of work presupposed that the architect would lead the process,

outlining the activities of other members of the design team, such as the quantity surveyors and engineers and how they related to the architect.

Rather than focusing on the steps in the process, Carpenter (1981), in considering what was wrong with the UK construction procurement process, identified a large number of "unannounced participants", particularly connected with utilities and statutory bodies, but also with the fact that participating organizations involve several of their staff in a project. Indeed, case studies described by Hughes (1989) revealed that up to 200 people would routinely be involved in the design process of even relatively small projects. This is in stark contrast to the habit of many writers and analysts, who characterize the construction process by identifying half a dozen or so organizations, rather than the true number of people involved in a typical project. Thus there are two dimensions to the problem of organizing the process: tasks and participants.

Gray *et al.* (1994) examined in detail the processes involved in managing design in construction. Among other things, the separation of *doing* from *managing* is quite clearly applicable to certain types of construction project. This notion fits well with the drafting policy of the JCT. This book contains a very clear exposition of the processes involved in managing the design process, and, as such, is the only example available. A glossary in a new version of the book (Gray and Hughes 2001) provides definitions for various roles: architect, client, concept architect, construction manager, cost consultant, designer, design professionals, design manager, design team, design team leader, planning supervisor, principal contractor, project manager, specialist contractor, trade contractor, works contractor. The sequence of activities and ideas for managing the process are presented.

Numerous reports deal with the processes of project management. Many are written from the point of view of one or other of the parties. For example, the British Property Federation (1983) developed a manual for the procurement of buildings in an effort to overcome many of the problems that private sector clients routinely experienced on projects. This provides a thorough description of the stages through which projects proceed, as well as indications of the responsibilities of the major participants. More recently, the Construction Industry Board has produced guidance on the key factors for success in projects (Construction Industry Board 1997a). While giving comprehensive advice about policy, there is little detail here about how individual responsibilities develop and change through a typical project. There are some much more detailed descriptions of construction design processes, and these may yield more useful analyses (Newton 1995, Reich *et al.* 1996, Sonnenwald 1996).

A recent review of the processes involved in design and construction (Kagioglou *et al.* 1998) involved the development of a device called the Process Protocol Map. Since it offers a fresh approach to the modelling of the design and construction process, it is analysed in detail in Section 4.13 (page 97).

Generally, commentators have tended to focus on strictly operational issues, apart from the exceptions noted above. In order to understand the significance of this tendency, it is worth considering the literature on the theory of organizations, which is dealt with below (see page 17).

2.3 Role descriptions in legal literature

Perusal of the main texts on construction contract law serves to illustrate the wide range of terms that has been used to describe persons carrying out similar functions and to emphasize the lack of any universally accepted role descriptions. In fairness, those texts seek neither to draft watertight definitions of the responsibilities that exist within construction projects, nor to consider whether the word normally used to identify any particular role is the most suitable for that purpose. They merely attempt to provide the reader with a broad idea of the functions commonly associated with major participants in the construction process such as architects, engineers and quantity surveyors.

May (1995) quotes the definition of "architect" adopted by the tribunal set up under the Architects' Registration Act 1938, noting that this was cited with apparent approval in the Divisional Court in *R v Architects' Registration Tribunal, ex p Jaggar* [1945] 2 All ER 131:

> *An 'architect' is one who possesses, with due regard to aesthetic as well as practical considerations, adequate skill and knowledge to enable him (i) to originate, (ii) to design and plan, (iii) to arrange for and supervise the erection of such buildings or other works calling for skill in design and planning as he might in the course of his business reasonably be asked to carry out or in respect of which he offers his services as a specialist.*

Although this may serve as an abstract definition, it offers little in functional terms. The same source goes on to note that the contract administration functions frequently carried out by an architect may be given to an engineer (in an engineering contract) or to a person described in the contract as a surveyor, contract administrator, clerk of works, supervising officer, director of works or whatever else the parties choose to call him. Bartlett *et. al* (1998) observe similar vagueness in relation to the term "engineer".

Wallace (1995) provides the most extensive descriptions of the activities commonly carried out by various persons in a construction project. He also quotes the definition of "architect" mentioned above, but notes that modern construction techniques and specialized building products and processes frequently demand expertise and skills beyond that of a single person. In such circumstances some design functions may be assigned to outside consultants, to specialist sub-contractors or to suppliers but, Wallace

asserts, the architect remains the "captain of the ship". (It is by no means clear what this slick phrase is intended to signify, since it does not reflect the way that consultants' services are now provided.)

Wallace also notes that a definition of "quantity surveyor" which was judicially approved in the 19th century was that of a person "whose business consists in taking out in detail the measurements and quantities from plans prepared by an architect for the purpose of enabling builders to calculate the amounts for which they would execute the plans".

Finally, Wallace acknowledges the difficulties of definition in relation to "project managers", whom he appears to equate with management contractors or construction managers. He says of project managers that their services, qualifications and experience vary considerably, and that no universally accepted or recognized groups of services, or contracts for their performance, appear to have evolved (at the time of his writing).

One area of legal writing that offers significant comment on roles is the area of dispute resolution. Many terms are introduced and defined in a variety of source texts. Statute provides substantial descriptions of the roles of adjudicators and arbitrators, but no formal definitions are given. Other dispute resolution roles have been examined by Murdoch and Hughes (2000), revealing definitions of two further roles: conciliator and mediator. While it is not intended to go into detail here, these terms will be incorporated into the terminology.

In summary, the existing construction law texts offer little assistance in suggesting the most appropriate terminology, but texts on dispute resolution describe and define various specific terms relating to the roles involved with the resolution of disputes.

3 MAPPING ROLES, RESPONSIBILITIES AND RELATIONSHIPS

In analysing work, the focus is inevitably operational – on the work that is being done by each person. This means that little account is taken of the way in which each person fits into a complex and sophisticated organization. Most importantly, the central task for developing a more comprehensive view of roles in the design and construction process is to de-construct what is meant by "management" and identify clearly how the various aspects of management might be brought to bear in this context. As shown in the previous chapter, the construction and legal literature has tended to focus on operational issues. To avoid re-inventing the wheel, this section discusses the approaches to organizational analysis, particularly de-constructing the management task, in the mainstream literature on organizational theory.

An organization can be defined as a formal group of people with individual or collective objectives (Dawson 1996). Clearly, construction project organizations fall into this category. Defining construction organizations as purposeful highlights the need to distinguish *doing* work from *managing* work (Beer 1972). This is because the purpose of the work is usually defined by someone in higher authority than the person doing the work. The decision to do *something* is the step that gives purpose to activity; without decisions, activity has no purpose. The theories of organizational analysis (contingency theories, systems theories, etc.) provide a basic vocabulary of concepts for thinking about the structures of organizations in practice.

3.1 Basic organizational theory

Objectives for an organization must be translated into objectives for each of the parts so that work can be planned, output measured and corrective action taken. Thus detailed plans are formed against which the progress of each part can be measured. The notion of "feedback" refers to the measures taken to make adjustments either to the plan or to the activity; and performance is continuously evaluated. Therefore, "control" requires observation, evaluation and correction. These concepts, and the relationships between them, are developed by Cleland and King (1975) and Checkland (1981)

In order for these controlling functions to take place, responsibilities must be defined so that job descriptions can be developed, not just for doing the work, but also for controlling and managing it. While this has been part of

the remit of construction plans of work in the past, they focus almost exclusively on operational issues of who does the work, rather than allocating responsibility for monitoring, controlling, directing, supervising and so on. The need to allocate responsibility for the management of work requires a careful analysis of the roles and relationships involved in management, as well as an analysis of the operational work.

3.2 Modelling organizational structures

The organizational structure of projects can be modelled using theoretical principles developed from organizational and systems theory (Hughes 1989). This approach produces a robust technique for modelling the work that is undertaken on construction projects. Such an approach enables systematic comparisons of different construction project management structures. In the past, this approach has been used to analyse projects after they have finished, based upon what actually took place. Until now, this has not been applied to published plans of work.

The relevant principles from organizational theory are based upon ideas of specialization, co-ordination, horizontal and vertical boundaries between participants, interfaces and control of work.

Organizations that operate in complex, unstable environments need to be more complex than those that operate in simple, stable environments. Emerging technology adds to complexity by creating demands for new skills and techniques. To avoid wasted effort, or an inadequate range of skills, the diversity of skills brought to a project ought to be matched to the complexity of the project. Plans of work, by their nature, make assumptions about the complexity of projects by defining the range of skills that will be needed for all projects envisaged by their authors. Interactions between participants at the operational level occur in two ways. First, the person doing the work may consult others for advice. Each of these consultations creates a communication link, between people with different skills (see Figure 1). Second, when working in a team, each member of the team interacts with all the others, creating a network of communication links between people with different skills. Each additional team member creates extra links to all existing team members (see Figure 2). To account for the number of interfaces, and hence the degree of integration and co-ordination that will be needed, a clear understanding of the numbers of links is needed. The number of links is related to the number of people, as shown in Table 1.

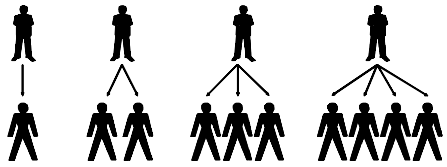

Figure 1: Links with consultations

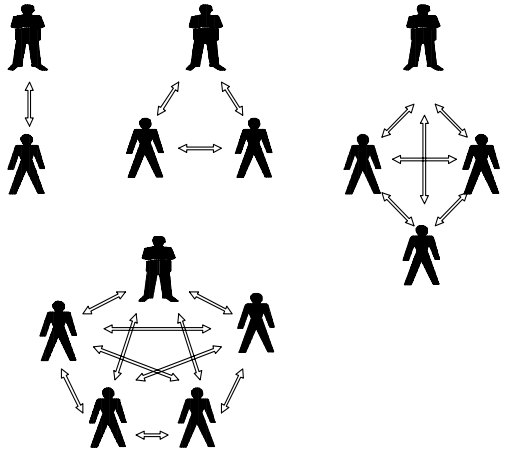

Figure 2: Links in teamwork

Table 1: Communication links in different patterns of interaction

	Consultations (*Figure 1*)	**Team work (*Figure 2*)**
No. of people	**No. of links**	**No. of links**
2	1	1
3	2	3
4	3	6
5	4	10
6	5	15
7	6	21
8	7	28

3.3 Elements of the mapping technique

It is important to deconstruct the various parts of a project organization so that each can be identified and defined. The general framework offered here separates objectives, decisions, control, activity, operations and roles so that each can be separately identified in any analysis of a particular project. This framework will also enable analyses of descriptions of how projects should be managed, such as the RIBA Plan of Work.

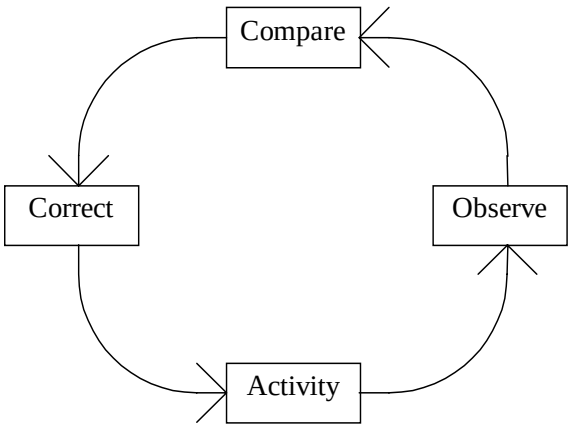

Figure 3: Control System

3.3.1 Objectives

The general view of objectives in construction is that clients want a building on time, within budget, to a specific quality (Chartered Institute of Building 1982, Draper 1984, Finn 1984). However, most participants in the construction process focus on their own responsibilities, rather than on the realization of client objectives (Bengtsson 1984, Dawson 1996: 43). This is a result of traditional organization structures of projects and the orientation they impose on the individual. The project objectives are the major determining factor for the objectives for each sub-system. Each sub-system must have its own objectives, orientated to the overall project objective.

3.3.2 Decisions

In order for a project to progress meaningfully, its objectives, and their achievement, must be closely allied to the decision structure. Decisions give purpose to activity; a project begins and ends with decision points. The trigger decision for a project would be the client's decision to explore the extent to which its objectives can be met by the procurement of a building. Similarly, the completion of the building project is a decision that rests with the client. These two decisions concern matters of client policy, and thus they are termed "Policy Decisions". Although the client's policy will probably vary during the project, this will be a gradual evolution rather than a series of discrete events. Thus, there are only two Policy Decisions for the purposes of this analysis. Between these, other decisions are taken, based upon information generated by the project team, which incrementally commit the client to further expenditure and resources, while offering opportunities to reject work or even abort the project. These decisions, which punctuate stages in the project, are termed "Strategic Decision".

3.3.3 Control

The purpose of a Control System is to regulate the work in relation to its (perhaps changing) context. The Control System (see Figure 3) involves comparing progress to targets and taking some sort of corrective action

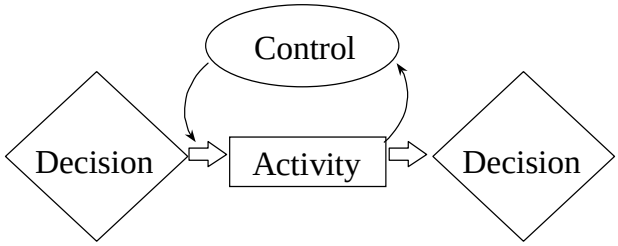

Figure 4: The context of project activity

(Kast and Rosenweig 1985). The corrective action may take two forms: taking steps to change the performance of the activity to bring it closer to what was planned, or changing the plan so that it more closely reflects the changed situation brought about by the departure from the plan. The Control System requires decisions to be taken at a level more senior than that doing the work. Such decisions are termed "Tactical Decisions".

Control Systems are required for several reasons: cost, quality, time, etc. All plans of work reveal that different types of Control System need to be exerted over a building project. A certain amount of control will be needed irrespective of project variables. But the need for control will vary from one project to another, just as project contexts vary. On large and complex projects any of the control aspects could form a separate activity for some person or organizational unit. On smaller jobs it may simply be one aspect among many for the project manager or management team.

As Litterer (1973) states,

> *control is concerned not only with the events directly related to the accomplishment of major purposes, but also with maintaining the organization in a condition in which it can function adequately to achieve these major purposes.*

This distinction is important, but not often drawn. Burns and Stalker (1966) refer to the maintenance of the organization as the Managing System, and Walker (1980) follows this idea. This convention will be followed here. In addition, Control Systems refer to the matching of performances with objectives. The Control System acts as an interface between the Operating System and the Managing System. The Managing System sets the policies and objectives for the project, and the Operating System undertakes work in order to achieve them. The Control System matches activity to objectives in order to ensure that output is orientated towards objectives.

Figure 4 shows how activity, decisions and control are related to each other in the context of project management. The initial decision is termed the "trigger" decision. It is here that the objectives for this particular sub-system are set. The end point is called the "terminal" decision, and this will usually form a trigger for a subsequent subsystem. This pattern occurs in all of the plans of work and is the embodiment of the basic systems model

in which the Managing System is triggering, regulating and terminating packages of work.

3.3.4 Activity

The basic stages of work identified in published plans of work constitute the activities generally found on construction projects. These patterns form the basic frame of reference for what people do in construction projects. Although the separation of work into stages may imply sequential progress, it is not usually intended that stages are absolutely sequential because information may be generated in different ways for different projects. Indeed, stages often take place in parallel. But in strictly organizational terms, stages may begin prematurely on the assumption that a decision will be taken. Such an action is part of the risk taken by consultants and other participants in construction projects. Stages of work are merely generalizations and, as such, much of the detail within a stage may change from one project to another.

Each stage of work can be broken down into a group of Operations that have to be undertaken with a realistic relationship to each other. Further to this, each stage should have its own uniquely identifiable objective. Some activities identified within plans of work, such as briefing and cost control, take place more or less throughout the life of the project. This is because they form part of the Control Process and are in fact components of the management information system for the project.

3.3.5 Operations

Operations are the components of activity. An Operation is defined as a package of work that can be undertaken by one organizational unit without interruption by decision points (adapted from British Standards Institution 1979). Scott (1981) points out the inevitability that those who participate in organizations do so only partially, as they belong, at any point, to more than one kind of organization. Moreover, the involvement of participants is temporary (Cherns and Bryant 1984).

In the “Operating System”, Operations may be linked reciprocally or sequentially (Thompson 1967), that is, they may take place in parallel, each feeding information to the other, or they may take place one after the other. Additionally, within an Operation, different participants may be providing input or receiving output. Thus the work to be done in an Operation consists of combining a variety of information inputs, some from previous or concurrent Operations, and some from participants giving advice and information. These inputs are transformed into information outputs by the exercise of technical skill. The outputs will be made to other participants in other Operations, thus forming the inputs of subsequent Operations. Aspects of control may be so significant as to form discrete Operations in their own right on complex projects; but on simple projects they may be reduced to consultation or management functions within Operations.

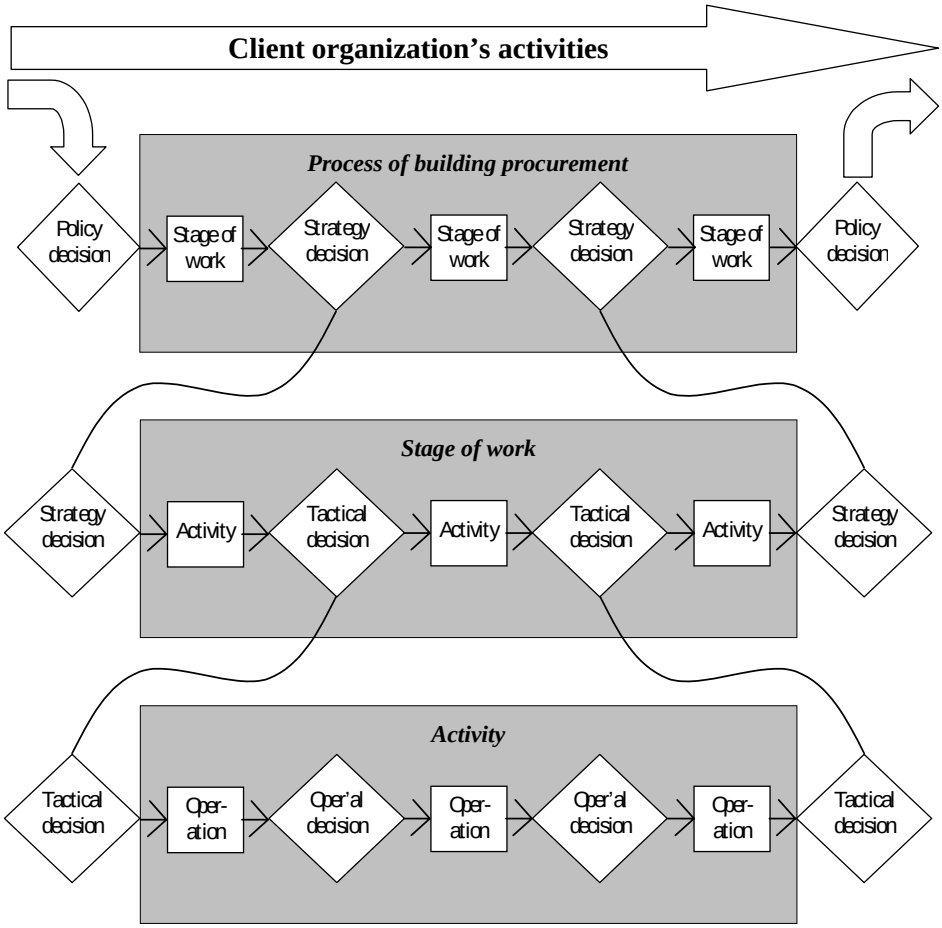

Figure 5: Decisions, stages of work, activities & operations

3.3.6 Hierarchies of decisions

Decision points form the major boundaries to activities. They can be classed as Policy, Strategic, Tactical and Operational Decisions. The structure of decision points is shown in Figure 5, and the definitions are as follows.

Policy Decisions are the major constraint on any project and determine the framework within which the project takes place. The trigger Policy Decision sets the objectives for the project, and the terminal Policy Decision terminates the project. Premature termination would be a result of major change in the client's policy toward the project. Policy Decisions are the highest-ranking decisions. They define the beginning and end of the "Process of Building Procurement". As such they are at the interface between the macro-environment and the project. In this sense the project exists as a response to the environment, and with the aim of effecting some sort of changes to the environment. This definition results in the Managing System, which regulates, maintains and adjusts the process of building procurement in terms of the project's environment.

Within the "Process of Building Procurement", Strategic Decisions deal with matters impinging on the project, e.g. the decision to apply for planning permission, or negotiation of terms for site acquisition. Strategy will be mainly concerned with the implementation of client's policy, but will also cover implementation of other policies such as planning approvals. Thus, Strategic Decisions are not always in the hands of the client or even the project team. Strategic Decisions define the beginnings and ends of stages of work. The sub-systems created by Strategic Decisions determine the detailed constraints of the project. Between Strategic Decisions is the Control System, which is concerned with regulating and adjusting the work taking place in terms of the objectives set by the Strategic Decisions.

Each Strategic Decision results in a new management structure, different from what led to the Decision. Such decisions are not always taken at the Strategy level; they may be delegated. Also, the Decision may not be explicit, in which case, work continues on the assumption (and risk) that it has been taken. However, since the nature of the work alters at these mile-stones, even if they are not explicit, the work progresses as if they had been.

Tactical Decisions are concerned with the deployment of resources and the management of the project on a day-to-day basis. They will be within the purview of the project leader, or project manager. Examples of these are the decision to appoint nominated sub-contractors for parts of the work, or the decision to adopt certain forms of contract. Tactical Decisions form the boundaries to sub-systems of activity, and constrain the Control Systems.

Operational Decisions are directly related to Operations as previously defined. By definition, decision points trigger Operations and mark their completion. Therefore, in the absence of a higher rank of decision there will be an Operational Decision. These occur where decentralization of authority is high, and where there is autonomy at the Operational level; thus they may not be explicitly present on many projects. Activity is the term used to describe the groups of Operations between Tactical Decisions. The Operating System is the term used to signify groups of Operations interacting to progress the project incrementally towards the objectives of the stage of work.

In this way, Operations are sub-systems of activity. Activities are sub-systems of stages of work, and stages of work are sub-systems of the process of building procurement.

The key point about this analysis is that a participant in the process may be exercising responsibility at any or all of these different levels. It is important to distinguish operational contributions from management contributions. Moreover, it is important to distinguish responsibilities concerned with controlling operational output from responsibilities concerned with maintaining the project organization. Thus, work is separated into Operational, Control and Managing Systems.

Table 2: Definitions of roles

Role	Definition
Operating System	
Operating	Carrying out work (i.e. performing an operation) on some aspect of the project, and having overall responsibility for its output.
Co-operating	Carrying out work as part of a team or committee with partial responsibility for output.
Advising	The provision of technical or other information when asked for it. Typically undertaken in the construction industry by professional consultants.
Receiving	Receipt of information about the project for purposes outside the management of the project: for example the accounts department of a client organization.
Control system	
Monitoring	Recording and filtering information about an operation and communicating it to those who may take action.
Supervising	Comparing progress with a predetermined plan and bringing about some sort of response to the situation.
Resourcing	Ensuring that those who carry out operations have sufficient resources (in terms of both skill and economic resources)
Managing system	
Co-ordinating	Ensuring that information flows successfully between organizational links and assembling diverse outputs.
Directing	The executive responsibility for ensuring that the output of activities is orientated towards the objectives of the project.
Recommending	Passing information or the results of an activity to someone who must take a decision on it.
Approving	The executive function of taking decisions about the output of activities. This decision will usually form the input of a subsequent activity.

3.3.7 Roles and responsibilities

The relationship between a participant and an Operation is known as a role. There is a variety of such roles, and they may be combined for each participant. They will be determined primarily by the purpose of each contribution as well as the participant's skill and ability.

The degree of detail and the classification of roles are dependent on the depth of the analysis and the purpose of the investigation (Cleland and King 1975). Three types of system have been introduced, the Operating System, the Control system and the Managing System. These systems are exercised through various combinations of roles, and these are summarized in Table 2 and grouped in Figure 6.

Recommendations may arise at any level in the hierarchy, and will be subject to Approval by the next level in authority. This Approval may become a Recommendation to someone in a higher managing function again, so the chain of Recommendation and Approval passes up the

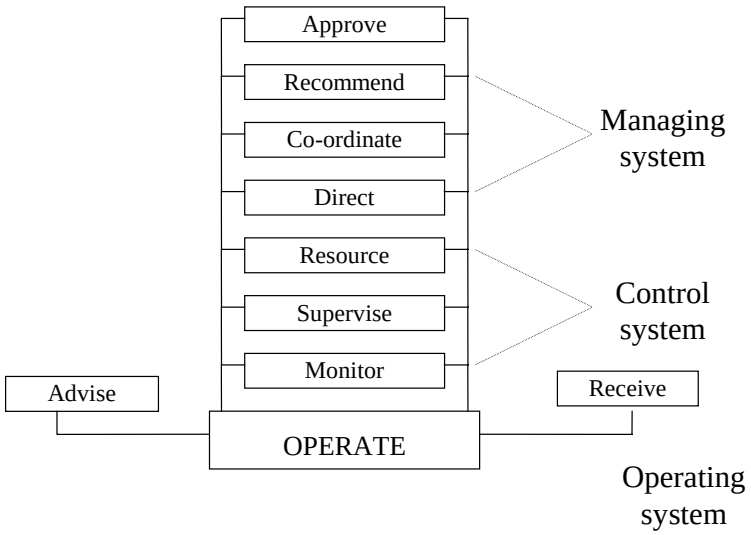

Figure 6: Hierarchy of roles related to systems

management hierarchy until it reaches the person who has the ultimate authority for the particular decision being taken. The ultimate authority in the project management system is the client, so the final Approval may end up as a client's Policy Decision.

Any analysis of a construction project's organization ought to be capable of exposing the situation where integration is achieved through meetings and teamwork. Thus the role of "Co-operating" is defined as membership of a team or committee. This can occur at any level in the system, and has to be shown separately because in such a case, even though there may not be an individual whose responsibility is to co-ordinate, it may take place by teamwork and meetings.

These role definitions help to define the contribution that each participant makes to a project, and they relate to the different type of system. Each level of decision-making constitutes a different level of detail for analysis. In strict systems terms, the Control System described in Figure 3 (page 21) should be applied at all levels. The practical manifestation of this is the communication patterns that are observed at each of the levels. These form the "glue" which binds the different roles at each level and produce the characteristic pattern shown in Figure 7. This demonstrates the dynamics of communication between the participants, and shows how the control cycle (from Figure 3) is implemented at all the levels of the management hierarchy. At the Operational level, control is achieved through the exercise of three roles. The process of observing is achieved via the role of Monitoring. This gathering of information must include a certain amount of filtering, to make it effective. Thus the Monitor undertakes some comparison of information to objectives. Information is passed to more senior people in the organization and they also undertake a comparison to the objectives before determining the course of action to take. Control will be achieved by the exercise of supervisory powers, either to change the level of resources available to the Operator, or by changing the plan so that

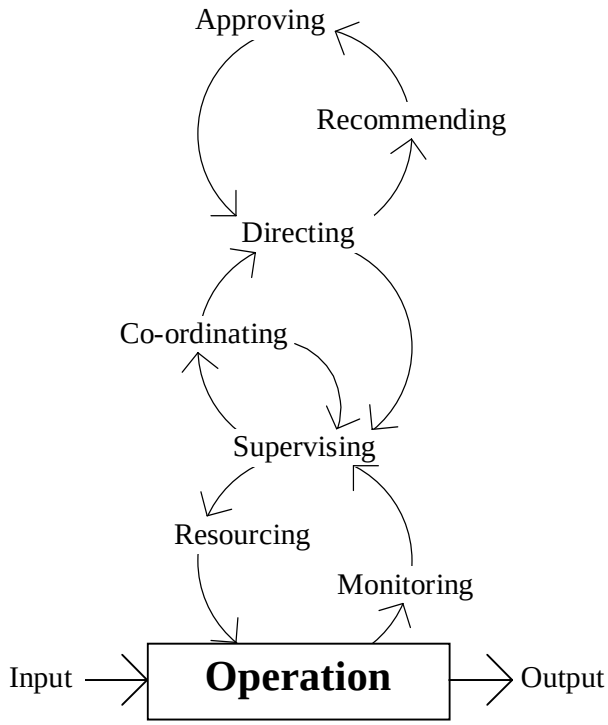

Figure 7: The relationships between roles

the departure from the plan is removed. This will involve referral to the Managing System for a Strategic Decision. The Control System, then, at the Operational level is achieved through the roles of Monitoring, Supervising and Resourcing.

At Strategic Decision points, the control process becomes the responsibility of a higher level of the hierarchy, and is manifested through the roles of Directing, Recommending and Approving. This is a higher level of control, which involves the client in the decision-making process.

Figure 7 also shows why decisions from policy makers sometimes take a long time to filter down to those who implement them at the Operating System level. Problems may be circulating for a considerable time in the upper portion of the figure before finally working their way back down to the Operating System. This may be beyond the perception of those on the Operating System who often only perceive the enormous time lag in decision-making, with no appreciation of the structure of the system that produces the decision. It is important to note that, for practical reasons, people at an operational level will frequently predict the decision that will be taken and continue to work assuming that the final decision, when it comes, is merely a confirmation that work is progressing satisfactorily. This may result in abortive work if the decision is not what was expected and is a commercial risk on the part of those at the operational level.

3.3.8 Organizational mapping

These principles provide a comprehensive framework of organizational concepts to be used in mapping various organizational approaches published in the literature. The approach to mapping has been used in

various industries in the past, including the construction industry, where, for example, it was used for mapping in great detail the processes observed in four detailed case studies of public sector building projects (Hughes 1989).

4 EXAMINATION OF PUBLISHED PLANS OF WORK

Various bodies (governmental, professional and inter-disciplinary) have attempted to describe the construction project process in a plan of work or similar document. Given that there are techniques for analysing organizational structures, it is clearly desirable to examine and compare these documents, in order to determine the extent to which they support or contradict the idea of a commonly accepted terminology for the descriptions of the roles of participants in the construction process and the activities in which they participate. However, the task of comparison is made more difficult by the fact that, while some of the plans of work are constructed in tabular form (enabling a swift check for correlation between participant and activity), others consist entirely of textual descriptions of the process.

4.1 Technique

The technique adopted for this part of the research project is that of reducing each plan of work to a matrix or grid. The first column of each matrix provides a sequential list of the stages of work, and of every operation within each stage, which is separately identified by the plan of work in question. The remaining columns list every person or organization that is separately identified (either individually or as a member of a group) as contributing in any way to the project. The matrix is then completed by the insertion of code letters to indicate the precise role of a particular person or organization in relation to a particular activity. The codes used for this purpose reflect the definitions of roles explained in Table 2, page 27. This reduction of what are often large passages of text to skeleton form (activity/participant/role) is the best way to create a common currency on which meaningful comparisons can be based.

The technique has been applied to nine plans of work and schemes of the construction process. They are:

- JCT Draft Schedule of Services: The unpublished September 1998 Consultation Draft (TCO.98.107) has been used for this analysis (Joint Contracts Tribunal 1998).
- British Property Federation System (British Property Federation 1983).
- BS 7000: 1997, Part 4. Management of design in construction (British Standards Institution 1997).

- RIBA Plan of Work: Original version 1964, with minor amendments up to 1997 (Royal Institution of British Architects 1997).
- RIBA Plan of Work: New version (Phillips and Lupton 2000).
- Construction Industry Council Inter-Disciplinary Design Management (Construction Industry Council 1998).
- Construction Industry Board (Construction Industry Board 1997a, 1997b).
- GC/Works/5: Documentation produced by the Property Advisors to the Civil Estate (PACE), intended primarily for use in government projects, but designed to be used more widely (Property Advisors to the Civil Estate 1998).
- Generic guide to the design and construction process protocol (Process Protocol Map), produced by a research team at the University of Salford, in conjunction with industrial partners (Kagioglou *et al.* 1998).

Two further documents were examined. The first of these was the ACE conditions of engagement with schedule of services. This was not sufficiently detailed for the purposes of developing a detailed matrix, primarily because it does not describe management roles, only operational roles. Second, the NHS Building Procedures were considered for analysis. However, it was felt that, since the NHS documentation was intended for a very specific client and for a specific type of project, it was extremely unlikely that its analysis would alter the basic finding: that there was simply no consistency of terminology between different schemes. Indeed, the cross-tabulations beginning on page 108 reveal a wide diversity of terms.

In the following pages the nine analysed schemes are presented, followed by direct quotations of any definitions supplied in the text of the source document, and then by observations on the scheme arising from the compilation of each matrix.

4.2 Basis of the organizational matrices

In approaching the resulting matrices, the following points should be borne in mind:

- The intention in every case is to show what the base document actually says. Where there are possible omissions or ambiguities, no attempt has been made to correct these on the basis of the researchers' own ideas of what really happens.

- It follows that readers may occasionally be surprised by what appears to be an erroneous view of the role of a particular participant. Unless this results from a misreading of the text by the researchers, the

proper conclusion is that the base document has failed to give an accurate portrayal of the process.

- In places, completion of the matrices has required the researchers to tease out a participant's precise role by inference from the text; for example where a particular responsibility is allocated in general terms for an entire work stage. There are undoubtedly occasions on which the text might be interpreted differently; however, the primary objective has been to reflect what is felt to be the most natural meaning of the words used.

- Where a base document provides terse definitions of particular stages, activities or responsibilities (for example by means of a glossary), these are reproduced for information at the end of the relevant matrix. However, where any such definitions would have to be teased out of the text itself, no attempt has been made to do so. This is because much of the text is context-dependent, so that brief definitions would inevitably be open to question and would require qualification. In any event, the purpose of this exercise is to get behind the text and thus to reveal the key elements which can be used as a valid basis of comparison.

4.3 How to read the matrices

For an example of how to read these matrices, refer to the row labelled *6 Develop outline proposals* on page 37. This shows that the Lead Designer is responsible for doing this work (Operating) and for Co-ordinating other inputs to this task as well as Directing the work. It also shows the Consultant Team Manager with responsibility for Monitoring, Co-ordinating and Directing. (This overlap arises because the source document, at Part 3a, defines part of the basic design roles for the Lead Designer as *responsibility and authority for Direction and Co-ordination of the design process*, whereas the detailed description of the work in Stage C describes part of the role of the Consultant Team Manager as *Co-ordinate and Direct the work of the Consultant Team and monitor compliance with the Project and Work Stage Programmes*.) Further along the row, a series of Bs shows that the Architectural Designer, the Building Services Designer and the Structural Designer are Co-operating, meaning that they are providing output that contributes to the outline proposals. Finally, the Building Services Designer and the Planning Supervisor are providing advice. (The Building Services Designer is obliged to advise on energy strategies in relation to the relevant design, in addition to the obligation to contribute design output.) In summary, this particular row shows that there is some confusion over who is co-ordinating the output of the various designers and that the Services Designer is advising on one aspect of the design while contributing output related to the design. No one is allocated explicit responsibility for Supervising (i.e. choosing what corrective action

should be taken in the event that the work departs from what was planned) or for Resourcing (i.e. ensuring that those who are undertaking the work have the resources to do it). The fact that no one is making recommendations at this point is not a problem, since recommendations would arise towards the end of a stage of work for client approval. Indeed, looking further down this chart to tasks 22 and 23, it is clear that the need for recommendations and approval of output is dealt with explicitly.

This example shows how each row of a chart describes in some detail what work has to be done, the information and reporting system as well as the management of the work. By looking at the changing patterns of management roles from one task to another, discontinuities can be checked for. By examining the contents of a column of a chart, the precise obligations of each participant can be elicited, including the way that his or her involvement changes during the project.

4.4 Analysis

In order to examine the matrices for any systematic differences, a few measures can usefully be calculated. These are based on the theoretical background to the analysis of organizational structure delineated earlier in this document (Section 3).

- **Operations:** The number of operations indicates the scale of a project, in the perception of those who drafted the documentation. For example, Stage C of the JCT draft schedule contains 23 operations, whereas the concomitant stage in BS 7000 contains only 9. Such a difference is interesting, highlighting as it does serious differences of approach to the task of defining and describing the design and construction process.

- **Complexity:** A good indicator of organizational complexity is the number of people involved in each operation. The simplest operations can be accomplished by one person undertaking operational work, without being managed by others. Clearly, more complex tasks require larger numbers of skills divided between different people operating in diverse capacities. A simple count of complexity can be derived by counting the number of role codes entered into each row of the matrix. For example, Stage B of the JCT draft schedule contains only 4 entries, signifying very low complexity, whereas stage C contains 144, signifying a much more complex stage.

- **Load:** Role codes can be combined within individuals, and the extent to which individual job titles are called upon to undertake multiple roles is referred to as the "load". This can be calculated as an average for each stage of work, and for the project as a whole. A load of 1.0 indicates that each participant has only one role code in the matrix. Larger numbers indicate that participants are being called upon to act in a

variety of capacities. For example, in stages A and B of the JCT draft schedule, the load averages to 1.0, because each person is involved in only one capacity. This measure is useful because it gives an indication of the extent to which the management task had been de-constructed with differing roles allocated to different people. Higher numbers for load indicate that participants are called upon to act in several different capacities at the same time. Again, such numbers are interesting for drawing comparisons between plans of work, rather than for their absolute value.

- **Decentralization:** The involvement of people other than the client comes about not only because the client engages staff, consultants and contractors, but also because of the involvement of external agencies (e.g. planning authority). Some participants are closer than others to the client. A weighting has been applied subjectively, but consistently, to the various role occupants on the basis that the consultants are closer than contractors, who are, in turn, closer to the client than sub-contractors. This weighting is a number that indicates a subjective view of the relative "distance" from the client in order for the "amount" of decentralization to be calculated. Thus, the client has a "decentralization weighting" of 1, a project manager would be 2, and other consultants, 3. Statutorily defined roles, such as Planning Officer, are furthest from the client, and are given a weighting of 7. These weightings enable an indication of the level of decentralization (distance from the client) to be calculated, simply by multiplying the number of role codes (r) for a participant by the weighting (w), and dividing by the number of role codes in the row (n). This can be expressed for each row of the matrix as:

$$\frac{\sum r \times w}{n}$$

  Higher values indicate higher levels of decentralization (greater distance from the client). To calculate the extent of decentralization for a stage of work, the values for all the operations within a stage can be averaged. This provides an indication of the extent to which the client is called to delegate authority and responsibility in a project, and an easy means for comparison between schemes.

- **Interfaces:** One very important aspect of organizing project work is the number of interfaces between participants. This can be difficult to quantify, as there are many ways in which people interact. For the purposes of analysis, the method involves counting the number of participants acting in an operational capacity (role codes "A" or "B") and finding the number of links between them, as illustrated in Figure 2 (Page 19). To these the numbers of consultations have to be added, calculated by multiplying the number of participants with role code "A" by those with role code "C". The number of interfaces is a good indicator of the demand for information flow in the project, as every interface would require the exchange of information. In complex

situations, it would be expected that the number of interfaces would be higher than in simple situations.

- **Control:** Control is exercised when work is monitored, supervised and resourced. According to the framework presented in section 3, this combination of roles ought to be present in each operation. Therefore, assessing the amount of control is simply a matter of counting how many of these three roles are present in each operation, and representing this as a percentage. A scheme which designated clear control mechanisms at every step would score 100%.

- **Co-ordination:** Co-ordination is the corollary of skill diversity. To provide a simple measure, the matrices can be examined to count the number of operations in which the role code "H" is present. This is a simplification because work may be co-ordinated because of the use of standards or procedures, because of familiarity of the participants with each other's ways of working and other reasons. However, for the purposes of comparing plans of work, the key variable is the presence or absence of co-ordination as a role specifically allocated to someone in a management capacity. This can be presented as the number of operations including someone in role code "H", expressed as a percentage of all the operations in a stage or project.

These measures have been applied to all of the plans of work analysed and are used in Section 5.1, page 105 to ascertain the differences between the plans of work.

4.5 JCT draft schedule of services

It is expected that feasibility studies will be completed prior to the appointment of consultants under this scheme, thus stages A and B do not form a part of the scheme.

Key: A – Does the work; B – Co-operates; C – Advises; D – Receives; E – Monitors; F – Supervises; G – Resources; H – Co-ordinates; I – Directs; J – Recommends; K – Approves	Client	Feasibility consultant	Consultant team manager	Lead designer	Architectural designer	Building services designer	Structural designer	Lead cost advisor	Cost advisor	Planning supervisor	Tendering contractors	Contractor	Principal contractor	Sub-contractors	Development Control Authority	Statutory and other utilities	Health and Safety Executive
(Decentralization weighting)[1]	*1*	*2*	*2*	*3*	*4*	*4*	*4*	*3*	*4*	*3*	*5*	*5*	*5*	*6*	*7*	*7*	*7*
Feasibility:																	
A – Appraisal																	
Identify requirements and constraints	*A*	*C*															
Feasibility studies	*A*	*C*															
Decision to proceed with project	*A*	*C*															
B – Strategic briefing																	
Preparation of strategic brief	*A*	*C*															
Appoint planning supervisor	A									C							
C – Outline proposals																	
1. Appoint consultant team	A																
2. Notify project to Health and Safety Exec										A							D
3. Programme of work for Stage C[2]	C		A		C	C	C		C								
4. Develop the strategic brief to project brief	A		BH	HI	BC	BC	BC		BC	C							
5. Develop management procedures	B		A	HI	B	B	B	B		B							
6. Develop outline proposals			EHI	AHI	B	BC	B			C							
7. Assess need for outline devpmt cont appro.	IJK		AJ	B											K		
8. Apply for outline development cont appro.[3]																	
9. Develop mgnt procedures (pre-constn)		A															
10. Review and advise on prog., procurement, contract and contingency plan strategies	K		AEJHI	HI	B	B	B		B	C							
11. Review the need for additional specialists, consultants or additional services	K		AJ		C	C	C			C							
13. Develop conceptual design strategy			EHI	AHI	B	B	B										
14. Consider and assess constraints and options for the relevant design			EHI	HI	A	A	A		C								

[1] This number is used in subsequent analysis. It indicates a subjective view of the relative "distance" from the client in order for the "amount" of decentralization to be calculated at a later stage in the report.
[2] From Part 3, page 5, standard management procedures – general work stage procedures (applies to all stages)
[3] This activity is implied, but not stated; hence no one appears to be responsible for it.

Key: A – Does the work; B – Co-operates; C – Advises; D – Receives; E – Monitors; F – Supervises; G – Resources; H – Co-ordinates; I – Directs; J – Recommends; K – Approves	Client	Feasibility consultant	Consultant team manager	Lead designer	Architectural designer	Building services designer	Structural designer	Lead cost advisor	Cost advisor	Planning supervisor	Tendering contractors	Contractor	Principal contractor	Sub-contractors	Development Control Authority	Statutory and other utilities	Health and Safety Executive
15. Preliminary consultations for statutory and other approvals			EHI	HI	A	A	A									C[1]	
16. Investigate utility and services connections			EHI	HI	A	A	A									C	
17. Cost planning and estimates (outline)			HI					A									
18. Preliminary cash flow projection			HI					A									
19. Cost control			HI		C	C	C	A		C							
20. Open health and safety file			HI							A							
21. Establish format for health and safety plan			HI							A							
22. Periodic progress reports	K		AHIJ		C	C	C		C								
23. Work stage report	K		AHIJ		C	C	C		C								
D – Detailed proposals																	
1. Programme of work for Stage D	C		A		C	C	C		C								
2. Finalize and prepare project brief	A		HI		B	B	B		BC	C							
3. Review programme, procurement, contract and contingency plan strategies	K		AHI		B	B	B		B	C							
4. Review advice on any need for additional specialists, consultants or additional services	K		AHI		C	C	C			C							
5. Consider and assess constraints and options for developing authorized proposals			EHI	HI	A	A	A		C								
6. Develop detailed design proposals			EHI	AHI	A	AC	A		C	C							
7. Construction method statements[2]			EHI			C											
8. Review cost planning and estimates			EHI						A								
9. Review cash flow projections			EHI						A								
10. Cost control			EHI						A								
11. Review health and safety file			EHI							A							
12. Pre-tender health and safety plan			EHI							A							
13. Full development control approval	JK		EHI	AHI	B	B	B								K		
14. Statutory and other approvals			EHI	HI	A	A	A									C	
15. Periodic progress reports	K		AHIJ		C	C	C		C								
16. Work stage report	K		AHIJ		C	C	C		C								
E – Final proposals																	
1. Programme of work for Stage E	C		A		C	C	C		C								
2. Develop final proposals			EHI	AHI	B	BC	B	E	CE	C						C	
3. Review programme, procurement, contract and contingency plan strategies	K		AHI		B	B	B		B	C							
4. Review advice on any need for additional specialists, consultants or additional services	K		AHI		C	C	C			C							
5. Consider and assess constraints on possible finalized design options			EHI	HI	A	A	A		C								

[1] Implied

[2] This item reveals what may be an anomaly in that only the building services engineers advise about construction method, and it raises the question, "to whom is this advice given?"

Key: A – Does the work; B – Co-operates; C – Advises; D – Receives; E – Monitors; F – Supervises; G – Resources; H – Co-ordinates; I – Directs; J – Recommends; K – Approves	Client	Feasibility consultant	Consultant team manager	Lead designer	Architectural designer	Building services designer	Structural designer	Lead cost advisor	Cost advisor	Planning supervisor	Tendering contractors	Contractor	Principal contractor	Sub-contractors	Development Control Authority	Statutory and other utilities	Health and Safety Executive
6. Construction method statements[1]			EHI	HI		A											
7. Statutory and other approvals[2]			HI														
8. Review cost planning and estimates			EHI	HI				A	C								
9. Review cash flow projections			EHI	HI				A									
10. Cost control			EHI														
11. Review health and safety file[3]			EHI							A							
12. Pre-tender health and safety plan			EHI							A							
13. Periodic progress reports	K		AHIJ		C	C	C		C								
14. Work stage report	K		AHIJ		C	C	C		C								
F(i) – Production information																	
1. Programme of work for Stage F(i)	C		A		C	C	C		C								
2. Define distinction between F(i) and F(ii)	K		AC		C	C	C										
3. Review programme, procurement, contract and contingency plan strategies	K		AEHI		B	B	B		B	C							
4. Review advice on any need for additional specialists, consultants or additional services	K		AEHI		C	C	C			C							
5. Prepare production information			EHI	AHI	B	B	B	CE	C	C							
6. Statutory and other approvals			EHHI	A													
7. Review contractual requirements			CEHI					AC[4]									
8. Review estimates and cost plan			EHI					A									
9. Review cash flow projection			EHI					A									
10. Review health and safety file			EHI							A							
11. Periodic progress reports	K		AEHIJ		C	C	C		C								
12. Work stage report	K		AEHIJ		C	C	C		C								
13. Authorize commencement of Stage F(ii)	A																
14. Programme of work for Stage F(ii)	C		ACJ		C	C	C		C								
F(ii) – Production information																	
1. Programme of work for Stage F(ii)	C		A		C	C	C		C								
2. Completion of production information	K		EHI	AHI	B	B	B	CE	C	C							
3. Periodic progress reports	K		AEHIJ		C	C	C		C								
4. Work stage report	K		AEHIJ		C	C	C		C								
G - Tender documentation																	
1. Programme of work for Stage G	C		A		C	C	C		C								
2. Review programme, procurement, contract and contingency plan strategies	K		AEHI		B	B	B		B	C							
3. Identify preferred contractors and subs.	B		AHI		B	B	B		B	C							

[1] See previous footnote.
[2] No one seems to be allocated responsibility for this.
[3] During Stage E, the Planning Supervisor must "Review and update advice on Health and Safety implications of the Project brief", although no other mention is made of the project brief during this stage.
[4] Seems to be advising himself!

Key: A – Does the work; B – Co-operates; C – Advises; D – Receives; E – Monitors; F – Supervises; G – Resources; H – Co-ordinates; I – Directs; J – Recommends; K – Approves	Client	Feasibility consultant	Consultant team manager	Lead designer	Architectural designer	Building services designer	Structural designer	Lead cost advisor	Cost advisor	Planning supervisor	Tendering contractors	Contractor	Principal contractor	Sub-contractors	Development Control Authority	Statutory and other utilities	Health and Safety Executive
4. Prepare tender documentation			AEHI	AHI	B	B	B	BCE	BCE	C							
5. Pre-tender estimate			HI					A									
6. Review cash flow projection			EHI					A									
7. Pre-tender health and safety plan			HI							A							
8. Review health and safety file			EHI							A							
9. Periodic progress reports	K		AEHIJ		C	C	C		C								
10. Work stage report	K		AEHIJ		C	C	C		C								
H - Tender action																	
1. Programme of work for Stage H	C		A		C	C	C		C								
2. Review programme, procurement, contract and contingency plan strategies	K		AEHI		B	B	B		B	C							
3. Identify preferred contractors and subs.	B		HI		B	B	B		B	C							
4. Assemble and despatch invitations to tender			AHI		B	B	B		B		D						
5. Resolve tender queries			EHI	A	C	C	C	A	C	CE	B						
6. Appraisal of bids	B		EHI		B	B	B	AE	BC	C							
7. Review cash flow projection			EHI					A									
8. Review health and safety file			EHI							A							
9. Periodic progress reports	K		AEHIJ		C	C	C		C								
10. Work stage report	K		AEHIJ		C	C	C		C								
Construction:																	
J – Mobilization																	
1. Programme of work for Stage J	C		A		C	C	C		C								
2. Prepare and collate contract documents	K		AHI	H	B	B	B	C									
3. Appoint contractor and principal contractor	A		H														
4. Arrange appointment of pre-selected subs	K		HI														
5. Develop management procedures	B		AHI		B	B	B		B	C							
6. Prepare production information			HI	HI	B	B	B			C							
7. Prepare pricing documentation			HI					H	A								
8. Carry out functions under building contract	A		AHI					A									
9. Possession of site to contractor	K		AHI														
10. Health and safety plan			HI							K		A					D
11. Review health and safety file			EHI							A							
12. Periodic progress reports	K		AEHIJ		C	C	C		C								
13. Work stage report	K		AEHIJ		C	C	C		C								
K – Construction to practical comp.																	
1. Programme of work for Stage K	C		A		C	C	C		C								
2. Carry out functions under building contract	A		AEHI		C	C	C	A									
3. Construction operations	K		EHI		C	C	C					A					
4. Review cash flow projection			EHI					A									
5. Production information			EHI	EHI	B	B	B	H	C	C							
6. Contractor's design information			EHI	EHI	C	C	C	H	C	C		A					
7. Site inspections			EHI		A	A	A										

Key: A – Does the work; B – Co-operates; C – Advises; D – Receives; E – Monitors; F – Supervises; G – Resources; H – Co-ordinates; I – Directs; J – Recommends; K – Approves	Client	Feasibility consultant	Consultant team manager	Lead designer	Architectural designer	Building services designer	Structural designer	Lead cost advisor	Cost advisor	Planning supervisor	Tendering contractors	Contractor	Principal contractor	Sub-contractors	Development Control Authority	Statutory and other utilities	Health and Safety Executive
8. Interim valuations			EHI					A	C								
9. Contract claims administration	K		CEHI	C								B					
10. Testing and commissioning			EHI			AC						B					
11. Practical completion	K		EHI							JK		A					
12. Review health and safety file[1]			EHI							A							
13. Review final costs			EHI					A									
14. Periodic progress reports	K		AEHIJ		C	C	C		C								
15. Work stage report	K		AEHIJ		C	C	C		C								
L - After practical completion																	
1. Programme of work for Stage L	C		A		C	C	C		C								
2. Carry out functions under building contract	A		AEHI		C	C	C	A	A			A					
3. Provision of information to contractor			HIE	AHI	B	B	B	H	C								
4. Inspection of contract work			EHI														
5. Interim valuations			EHI					A	C								
6. Review cash flow projection			EHI					A									
7. Defects resolution action	K		EHI									A					
8. Final inspection			EHI														
9. Final account			EHI					A	C			B					
10. Contract claims administration	K		CEHI	C								B					
11. Periodic progress reports	K		AEHIJ		C	C	C		C								
12. Work stage report	K		AEHIJ		C	C	C	B	C								

[1] Dealing with contractor's information after practical completion for passing to client.

4.5.1 Further role definitions for JCT Schedule of services

In addition to the detailed breakdown of who does what, the documentation includes definitions of responsibility, as follows:

Consultant Team Manager	Responsibility and authority for: • Direction, co-ordination, programming and monitoring of the performance of the members of the Consultant Team; • Development and review of programmes, resources and Work Stage procedures; • Making and/or obtaining from the Client decisions necessary for cost control; • Communications between the Client and the members of the Consultant Team; • (If appointed for the construction period Work Stages) exercising the powers and duties of and associated with the role of the Contract Administrator under the Building Contract and direction, co-ordination and monitoring of any site inspectors.
Planning Supervisor	Responsibility and authority for: • Exercising the powers and duties of and associated with the statutory role of the planning supervisor under the CDM regulations; • Advice on health and safety implications of Information prepared for the Project; • Preparation of Health and Safety File and the pre-tender Health and Safety Plan.
Lead Designer	Responsibility and authority for: • Direction and co-ordination of the design process; • Establishing the form that design Information is to take (including interfaces) and devising a verification strategy; • Initiation of an overall design concept for the Project; • Co-ordination and integration of design Information provided by members of the Consultant into an overall design solution for the Project; • Provision of designs, specifications, advice and Information concerning the design for the Project other than where to be provided under the other design roles.
Designer	Responsibility and authority for: • Provision of designs, specifications, advice and Information concerning the Relevant Design with due regard to aesthetics, environmental performance, weather and water resistance, buildability, operation and maintenance; • (Where engaged to provide Site Inspection) inspection of the Relevant Design; • Determination of materials, elements and components, standards of workmanship, type of construction and performance in use for the Relevant Design; • Integration into the Relevant Design of design

	Information provided by others; • Preparation of drawings, sketches, schedules, specifications, calculations and tender and production Information for the Relevant Design as appropriate.
Architectural Designer	Responsibility and authority for: • Siting, spatial arrangement, amenity and appearance of buildings, and/or their components and elements with respect to the Work Groups allocated to this role in the Schedule of Services but including the provision of advice on questions of appearance concerning Work Groups allocated to other Design roles.
Building Services Designer	Responsibility and authority for: • Building services (including mechanical, electrical, public health, transport and/or communications systems) with respect to the Work Groups allocated to this role in the Schedule of Services.
Structural Designer	Responsibility and authority for: • Structural stability of building sub-structures, super-structures and external works elements with respect to the Work Groups allocated to this role in the Schedule of Services but including the provision of advice on questions of structural stability concerning Work Groups allocated to other Design roles.
Lead Cost Advisor	Responsibility and authority for: • Co-ordination and integration of estimates, advice and Information provided by Cost Advisors and the provision of overall cost Information for the Project; • (If appointed for the Construction Period Work Stages) exercising the powers and duties of and associated with the role of the Quantity Surveyor under the building contract.
Cost advisor	Responsibility and authority for: • Provision of estimates, advice and Information concerning the cost of constructing the Relevant Design.

4.5.2 General comments on JCT scheme

The management procedures tend to be dealt with in general paragraphs describing responsibilities that apply to all work. This means that management procedures tend to be general rather than specific. For example, the Consultant Team Manager is responsible for Co-ordinating and Directing throughout every activity. In places where these roles are specifically allocated to someone else, for good reason, there will be overlaps, which may result in complex patterns of responsibility.

One role that is not dealt with in the scheme is Resourcing. The authors of this scheme do not envisage that this document should deal with this issue, on the grounds that each participating organization has an obligation to ensure that its participants are adequately Resourced. Thus, Resourcing can be seen as an implicit obligation in a document of this nature, dealing as it

does with inter-organizational issues. Apart from this, the scheme is indeed comprehensive and is equally detailed from the beginning to the end of the project. Given this finding, this work raises an interesting question for analysts seeking to apply principles from mainstream organizational theory to the study of project-based organizations. The issues of inter-firm organization clearly demand principles and assumptions that differ from those developed for analysing organizational structures within firms.

Although the role codes used in the analysis distinguish the executive role of Directing from Co-ordinating, the detail of the source document seems to be a little less clear on this distinction. While the phrase "responsibility and authority for…direction and co-ordination" identifies the two tasks of first, ensuring that diverse outputs are integrated (co-ordination) and second, ensuring that the project is progressing in a way that will satisfy the client's needs (direction), the fact that they always appear together suggests that they might be synonymous.

Unlike some schemes, the JCT scheme makes explicit the fundamental distinction between cost advice and design. In many places, the Cost Advisor has the same relationship to the work as a designer (B or C matching) but there are several tasks where the Cost Advisor is Advising while the Designers are Co-operating or Operating. The Lead Cost Advisor has somewhat ambiguous responsibilities, sometimes Operating, sometimes merely echoing the involvement of the Cost Advisor, and sometimes Co-ordinating the work of other Cost Advisors. When the Lead Cost Advisor is Monitoring, this is in parallel with Monitoring by the Consultant Team Manager. If the work of cost advising is to be clearly distinguished from the work of designers there may be a case for developing extra activities (similar to what has been done with the work of the Planning Supervisor, for example). This would provide scope for a more detailed breakdown of how this work is managed, without adding to role duplication, a phenomenon best avoided.

The executive decision making process involves recommendations from the operating system, through the control system, to the managing system. This is not clearly articulated in the scheme, since recommendations for approval by the client seem to be introduced at arbitrary points in stages of work, rather than in the lead up to the end of one stage and the beginning of the next. There may be scope for considering the pattern of client involvement during the stages of work.

The text definitions given in the source document are robust and consistent throughout the documentation. However, it may be worthwhile considering the allocation of "authority" to every responsibility definition, simply clarifying what is meant by this and how it interacts with the delegated patterns of authority within a project.

The JCT Draft Schedule of Services provides a comprehensive and internally consistent description of the operational and management responsibilities usually required in a construction project. However, the

scheme tends to deal with management responsibilities by defining them generally, for application throughout the project. It takes no account of the need to ensure that participants are adequately resourced, and some of the distinctions between levels of management function are not clear, simply because they are bracketed together every time that they are referred to. Cost advice is (unusually) clearly separated from design. The draft schedule goes to great lengths to identify how the patterns of involvement change and develop throughout the various stages of a project. There is a tendency in this documentation to identify blanket responsibilities for certain participants. This approach conceals the essentially dynamic nature of the project management process. Although there are some anomalies in the details, this scheme is highly developed and very detailed.

4.5.3 Analysis of JCT draft schedule

The early stages of the project are explicitly beyond the scope of this document. The patterns of responsibility are the same in Stages A and B, the only separation between them being a decision point. The transition from Stage B to C does not seem to be marked by a decision, but there is an explicit statement that before Stage C commences, the Planning Supervisor should be appointed.

Once the project enters Outline Proposals (Stage C), the Consultant Team Manager is largely responsible for managing the project, while the Lead Designer co-ordinates various design inputs. Decisions with resource implications are subject to the approval of the client, as are decisions about the adequacy of progress. This pattern remains the same throughout the project. The stages in the project are marked by Work Stage Reports, which give the client the opportunity to review progress and decide on whether and how to continue with the project.

Within the JCT documentation, the description of the way that the project will be managed is provided in general terms for all stages. This makes it difficult to discern detailed differences in the way that stages are managed.

As already stated, the first two stages of the JCT draft schedule are explicitly beyond the scope of the documentation. Even so, appraisal and strategic briefing are mentioned, and the pattern of responsibilities, though minimal, is the same in both.

Table 3: Analysis of JCT draft schedule

Stage	Operations	Complexity	Load	Decentralization	Interfaces	Control (%)	Co-ordination (%)
A	3	4	1.0	1.5	3	0	0
B	2	4	1.0	1.8	2	0	0
C	22	144	1.5	2.9	106	9	68
D	16	116	1.5	3.1	76	21	94
E	14	97	1.6	2.9	45	19	93
F1	14	97	1.6	2.8	49	24	71
F2	4	40	1.5	3.2	22	25	75
G	10	77	1.6	2.9	67	20	90
H	10	85	1.4	3.2	74	23	90
J	13	79	1.4	2.7	42	8	92
K	15	111	1.6	3.1	42	31	93
L	12	83	1.6	3.0	49	31	92
Total	135	937			577		
Average			1.4	2.8	48	18	72
Max		144		3.2	106		

The number of stages and number of operations in each stage are among the highest of the plans of work analysed here, indicating a higher level of detail in the documentation than that found in the others. Such detail would indicate that this organizational structure is intended for situations of high complexity.

The analysis in Table 3 shows the extent to which stages differ from each other in organizational terms. The organizational complexity of the stages varies a lot. However, as the first two stages were never intended to be part of the schedule, they should be disregarded here. Despite this, organizational complexity continues to vary somewhat, peaking significantly during stage C. The low measure for complexity in stage F2 can be accounted for since F2 is a parallel stage, duplicating some of F1, acknowledging that stage G often proceeds before stage F is complete.

Generally, the level of decentralization is consistent. The number of interfaces peaks at stage C (Outline proposals) and varies significantly between stages. Control is patchy but co-ordination is generally present in most stages. On its own, this table enables a few conclusions to be drawn about the draft schedule, but the most useful information will be gleaned in comparing this to the other plans of work analysed.

4.6 BPF System

The manual of the British Property Federation System for the procurement of buildings was published by private sector property developers as a response to what they saw as inherent inefficiencies and problems with the traditional means of procurement (British Property Federation 1983). It was based upon a series of principles, such as the need to re-appoint consultants at the beginning of each stage, the desire to include design responsibility with the main building contract and the programming of the production of design information.

Key: A – Does the work; B – Co-operates; C – Advises; D – Receives; E – Monitors; F – Supervises; G – Resources; H – Co-ordinates; I – Directs; J – Recommends; K – Approves	Client	Client's Representative	Design Leader	Architect	Structural Engineer	Building Services Engineer	Supervisor	Client's direct contractors	Site investigation contractor	Specialist contractors	Contractor	Planning authority	Statutory authorities
Decentralization weighting	*1*	*2*	*2*	*3*	*3*	*3*	*4*	*5*	*5*	*6*	*5*	*7*	*7*
Stage 1- Concept													
Prepare initial viability studies	A												
Investigate Development Land Tax liability	A												
Negotiate with funding insts., letting and publicity agents	A												
Obtain legal advice and assistance on leasing arrangements, restrictive covenants and all other matters associated with ownership and letting	A												
Negotiate with ground landlord	A												
Deal with future tenants	A												
Appoint Client's Representative	A	C											
Appoint Design Leader	A	CE											
Appoint Consultants	A	CE											
Prepare feasibility studies		E	A										
Prepare budget costs and present feasibility studies	K	AEFH		BC	B	B							
Prepare concept design proposals		E	A										
Establish site boundaries, levels and other survey data		E	A										
Brief development	BK	AEJ		C									
Site and soil investigations, surveys and models		AE			B								
Develop the concept	AK	AEH	B	B	B	B				C			
Prepare outline design brief for Stage 2	AK	AEHJ	B	B	B	B							
Outline cost plan	A	AEH	B	B	B	B							
Conduct planning negotiations		AE		C									
Consultant's and Contractor's applications for payments	K	EJ	A	A	A								
Stage 2 - Preparation of brief													
Appoint Design Leader	A	CE											
Appoint consultants	A	CE	C										
Negotiate with funding insts., letting and publicity agents	A												
Negotiate with ground landlord	A												
Deal with future tenants	A												

Key: A – Does the work; B – Co-operates; C – Advises; D – Receives; E – Monitors; F – Supervises; G – Resources; H – Co-ordinates; I – Directs; J – Recommends; K – Approves	Client	Client's Representative	Design Leader	Architect	Structural Engineer	Building Services Engineer	Supervisor	Client's direct contractors	Site investigation contractor	Specialist contractors	Contractor	Planning authority	Statutory authorities
Define split of design responsibilities		A	CH	D	D	D							
Brief development	BK	AEJ	CH										
Consultant's and Contractor's applications for payments	K	AEJ	CA	A	A	A							
Soil investigations, surveys and models		AEH	C		B								
Establish site boundaries, levels and other survey data		E	A		B								
Organize and programme production of information		E	AH	D	D	D							
Sketch proposals	K	AJE	EH	A	B	B				C			
Schedule of areas		E		A		B							
Determine requirements of statutory authorities		E	A			C							C
Submit planning applications		AEJ	B	C								K	
Conduct planning negotiations		AE	C	C									
Prepare and maintain master programme		AE	CH			C							
Prepare cost plan	K	EJ	AH	B		C							
Issue brief and amendments to Design Leader		AE	DEH										
Check professional indemnity insurances of consultants		AE											
Construction feasibility studies		E	AH			C							
Life cycle analysis and costs-in-use plan		E	AH			C							
Stage 3 - Design development													
Appoint Design Leader	A	CE											
Appoint consultants	A	CE	C										
Negotiate with funding insts., letting and publicity agents	A												
Obtain legal advice and assistance on leasing arrangements, restrictive covenants, etc.	A												
Negotiate with ground landlord	A												
Deal with future tenants and tenants' queries and reqmts	A												
Statutory approvals		E	A	B	B	B							K
Submit planning application		A	C	C	C								
Conduct planning negotiations		AE	C	C	C	C							
Define split of design responsibilities		A	CH	D	D	D							
Develop architectural design		E		A		C							
Priced design programmes		EK	AH	B	B	B							
Investigations, surveys and models		AE	C	A	B	B							
Brief development	BK	AEJ	CEH										
Consultant's and Contractor's applications for payments	K	AEJ	CA	A	A	A							
Prepare and maintain master programme		AE	ECH	C	C	C							
Prepare and maintain cost plan	K	AEJ	EH	B	B	B							
Issue brief and amendments to Design Leader		AE	DEH										
Check professional indemnity insurances of consultants		AE											
Approve proposed named subcontractors		EK		C	C	C				C			
Arrange appointment of Adjudicators and bring in their services where necessary		AE											
Authorize amendment of priced design programmes and activity schedules		EK	EH										

Key: A – Does the work; B – Co-operates; C – Advises; D – Receives; E – Monitors; F – Supervises; G – Resources; H – Co-ordinates; I – Directs; J – Recommends; K – Approves	Client	Client's Representative	Design Leader	Architect	Structural Engineer	Building Services Engineer	Supervisor	Client's direct contractors	Site investigation contractor	Specialist contractors	Contractor	Planning authority	Statutory authorities
Determine overall space planning of the building and derive net/gross ratios		E	AH			C							
Provide forecast tender price		E	A			C							
Provide drawings and specifications	K	E	AEH			B				B			
Establish agreements in principle with relevant authorities on means of escape		E	A										
Develop commissioning plan		E	AE			C							
Stage 4 – Tendering													
Negotiate with funding insts., letting and publicity agents	A												
Obtain legal advice and assistance on leasing arrangements, restrictive covenants, etc.	A												
Negotiate with ground landlord	A												
Deal with future tenants	A												
Define split of design responsibilities		A	CH	D	D	D							
Appoint specialist consultants	A	E	C			C							
Priced design programmes		EK	A	B	B	B				B			
Soil investigations, surveys and models		AE	C	B									
Brief development	BK	AEJ	C										
Arrange client's direct contractors	A	CE	C	C	C	C							
Consultant's and Contractor's applications for payments	K	AEJ	CA	A	A	A							
Prepare and maintain master programme		AE	CE										
Prepare and maintain cost plan	K	AEJ	E			C							
Produce design information for tendering		E	AEH	B	B	B				B			
Issue brief and amendments to Design Leader		AE	DE										
Third party approvals		E	A	B									
Check professional indemnity insurances of consultants		AE											
Arrange appointment of Adjudicators and bring in their services where necessary		AE											
Approve preferred components		EK	E			C							
Submit final design proposals and revised cost plan		EJ	EH							B			
Draw up list of qualified tenderers		AE	C		C								
Send out tender documents		AE											
Receive tenders and obtain clarification as required		AE				C							
Prepare tender award recommendation to Client	K	EJK	AJ			C							
Assemble contract docs, raise bonds and obtain Client and Contractor's signatures to building agreement		AEH	C			C							
Arrange orders for long delivery components		AE	C		C								
Choose adjudicator		AE											
Develop commissioning plan		E	A										
Stage 5 - Construction													
Negotiate with funding insts., letting and publicity agents	A												
Obtain legal advice and assistance on leasing arrangements, restrictive covenants etc.	A												

Key: A – Does the work; B – Co-operates; C – Advises; D – Receives; E – Monitors; F – Supervises; G – Resources; H – Co-ordinates; I – Directs; J – Recommends; K – Approves	Client	Client's Representative	Design Leader	Architect	Structural Engineer	Building Services Engineer	Supervisor	Client's direct contractors	Site investigation contractor	Specialist contractors	Contractor	Planning authority	Statutory authorities
Negotiate with ground landlord	A												
Deal with future tenants	A												
Appoint supervisor	A	CE					C						
Brief development	BK	AEJ	H	H			C						
Arrange client's direct contractors	A	CE	H			C	C						
Consultant's and Contractor's applications for payments	K	AEJ	CA	A	A	A	A						
Prepare and maintain master programme		AE		C	C	C	C						
Prepare and maintain cost plan	K	AEJ		C	C	C	C						
Develop commissioning plan		E	A			C	C						
Issue brief and amendments to Design Leader		AE	D				C						
Check professional indemnity insurances of consultants		AE		B	B	B							
Arrange appointment of Adjudicators and bring in their services where necessary		AE											
Authorize amendment of priced design programmes and activity schedules		EK	H	H	C	C	C						
Provide Supervisor with drawings and specifications			AH	H			D						
Contractor's design work		E	HK	BHJ	BJ	C	CF				A		
Obtain Contractor's insurance certificate		AE					C						
Client's direct contractors' construction work			H	C		C	F	A					
Construction work				C	C	C	F				A		
Prepare valuations and prepare final account		AE		BC	C	C	C						
Issue variation orders and instructions	K	AEJ	B	C	C	C	C						
Deal with insurance claims		AE					C						
Receive occupation certificates and clearance from health and safety and fire officers		AE					C						
Issue certificates of extensions of time		AE				C	C						
Issue taking over and final certificates		AE		C		C	C						
Ensure that defects are remedied		AE				C	C						
Consolidate consultants' drawings		E	A	B	B	B							
Maintenance and management manual		E	A				C						
Prepare Client's commissioning and equipping progr-amme; obtain maintenance manuals, as-built drawings		AE		B	B		C						

4.6.1 Further role definitions for BPF system

In addition to the schedules of what each participant should be doing, there are useful definitions of responsibilities, as follows:

Client	The person or firm responsible for commissioning and paying for the design and construction of the building. The Client is usually referred to as the Employer in building contracts.
Client's representative	The person or firm responsible for managing the project on behalf

	of and in the interests of the Client. He may be an architect, chartered surveyor, engineer or project manager. He may be an employee of the Client or a consultant. Some of the duties of the Client's Representative may be undertaken by the Design Leader.
Design leader	The person or firm with overall responsibility for the pre-tender design and for sanctioning the Contractor's design. The work may be carried out by an individual, by a multi-disciplinary firm or by a consultant with specialist consultants contracted to him. Where the Client wishes to have separate contracts with specialist Consultants, one of those Consultants is appointed Design Leader, with responsibility for co-ordinating the work of the consultants to produce the pre-tender design and to sanction the contractor's design. The Design Leader is likely to be an architect or an engineer. Some of the responsibilities of the Design Leader may be undertaken by the Client's Representative.
Consultant	Person or firm contracted by the Client to produce design and cost services additional to those provided by the Design Leader. Consultants may be architects, structural engineers, civil engineers, building services engineers, quantity surveyors, building surveyors, acoustic engineers, geotechnical engineers, landscape architects, etc.
Contractor	A firm appointed to carry out post-tender design and to construct the works using a combination of its own resources and those of sub-contractors. The Contractor may employ consultants to develop the design.
Supervisor	The person or firm responsible, with his staff, for monitoring that the works are built in accordance with the contract documents. The Supervisor may be an architect, engineer, building surveyor, or possibly a resident engineer, or clerk of works. Some or all of the responsibilities of the Supervisor may be allocated to the Design Leader or another Consultant.
Adjudicator	The person who is appointed to decide impartially disputes which may arise in the implementation of the agreements. A decision by the Adjudicator may be referred to arbitration at the end of the contract. The Adjudicator appointed for the pre-tender stages may require different skills from one appointed for the building agreement.

4.6.2 General comments on the BPF System

This system was developed in the early 1980s, before the current trend of separating managing work from doing work. Thus, it offers little guidance on the current efforts toward developing a comprehensive picture of the management responsibilities within projects.

The source document provides a number of very useful checklists. But these are compiled from the point of view of the property developer and, as such, provide a model that applies only to certain types of project. The responsibilities identified in the source document tend to be operational, rather than managerial and therefore this document offers little guidance on how the construction project process should be managed. This is confirmed by the fact the client's representative has both an operational and managerial role throughout the process, even though the managerial responsibility is merely Monitoring.

Table 4: Analysis of BPF System

Stage	Operations	Complexity	Load	Decentralization	Interfaces	Control (%)	Co-ordination (%)
1	20	75	1.4	1.8	64	23	20
2	22	100	1.4	2.2	45	27	45
3	27	122	1.4	2.2	65	26	33
4	28	114	1.4	2.1	58	27	14
5	30	145	1.3	2.6	86	29	20
Total	127	556			318		
Average			1.4	2.2	64	27	27
Max		145		2.6	86		

The responsibilities of designers and cost advisors are wrapped up in the generic term “consultants”. Other than the checklists of things that must be done, there is very little articulation of project management requirements.

The British Property Federation System is more a checklist than a plan of work in that management responsibilities are implicit, rather than explicit. Also, the target market is much narrower than that of, for example, the JCT scheme or the RIBA plan of work, and therefore there are many sector-specific tasks in the lists of things to be done. The document is clear and easy to understand.

4.6.3 Analysis of BPF system

The BPF System identifies only five stages of work. This document is written from the point of view of clients who engage frequently with the construction industry. As a result there is quite a lot of detail about the work that takes place prior to the appointment of consultants.

The BPF System contains only five stages of work, and a large number of operations in each stage. The numerical analysis of the matrix is given in Table 4.

Interestingly, the BPF System contains a similar number of operations to the JCT draft schedule, although in fewer stages (see page 46 for the analysis of the JCT scheme). There is some consistency in the extent of detail to which these two plans go, although the stages are very differently defined. The overall organizational complexity of the matrix is also very similar, as is the load. But in the BPF System, the load is extremely consistent throughout. There is a smaller value for decentralization, indicating a closer involvement of the client with the day-to-day management of the project. The number of interfaces also seems smaller in the BPF system, demonstrating less interaction envisaged between the participants. Control and co-ordination are both low, indicating a focus on the operational rather than management aspects of a project. In a way, this is to be expected for a plan of work published in 1983, as the prevailing view at the time was different to the contemporary trend of identifying management processes explicitly.

4.7 BS 7000: 1997 – Part 4

The British Standard on the management of design in construction (British Standards Institution 1997) complements standards on the design process in manufacturing. It has been produced to help the management and planning of the design process.

Key: A – Does the work; B – Co-operates; C – Advises; D – Receives; E – Monitors; F – Supervises; G – Resources; H – Co-ordinates; I – Directs; J – Recommends; K – Approves	Client	Advisory group	Design team leader	Design unit leader	Design facility manager	Designer	Planning supervisor	Specialist advisor	Contractor	Sub-contractor	Planning authorities	Local utilities
Decentralization weighting	*1*	*2*	*2*	*3*	*3*	*4*	*3*	*3*	*5*	*6*	*7*	*7*
Inception and initial brief												
Appoint design team leader	A		C									
Prepare initial brief[1]	A	C	B								C	C
Establish advisory group	A	C										
Select design procurement process	A	B										
Initial estimate of design cost and time												
Feasibility study and brief development												
Develop project plan			B									
Create management structure				B								
Appoint design team	K		AJ	B								
Develop project communications plan			BH	B								
Investigate client's requirements			A									
Cost planning			H	B								
Outline design programme	C		AH	B								
Programme for each design unit			H	A								
Technical and economic feasibility study			H									
Need evaluation												
Prototype or model evaluation												
Preliminary design				ABE								
Site surveys												
Environmental impact assessments												
Planning submissions				A	G							
Develop project brief			AH	BCE							C	C
Progress reports	D		A	B								
Cost control			H	E	G	B						
Design development	K		HJK	ABEJK	G	B						
Proceed to conceptual design[2]	K		JK	B								
Conceptual design												
Develop design brief	K		AH	B	G	C					C	C

[1] Many of the activities here are only discernible from the list of definitions at section 1.3 of the standard. Generally, the document is silent as to the steps through which a project must progress, although much is implied in the text. Moreover, there is very little *direct* guidance on who should do what at each point.

[2] In section 2.5 of the standard, it is stated "completion of a stage is conditional on co-ordination between all team members and the approval of the design team leader and possibly the client."

Key: A – Does the work; B – Co-operates; C – Advises; D – Receives; E – Monitors; F – Supervises; G – Resources; H – Co-ordinates; I – Directs; J – Recommends; K – Approves	Client	Advisory group	Design team leader	Design unit leader	Design facility manager	Designer	Planning supervisor	Specialist advisor	Contractor	Sub-contractor	Planning authorities	Local utilities
Establish consolidated programme	K		AH	B	G	C						
Construction cost planning			H	E	G	A						
Obtain necessary approvals			H	AE	G	B					K	K
Design development	K		HJK	ABEJK	G	B						
Monitor/control progress of design			AH	AB	G	C	C	B				
Cost control			H	BE	G	B						
Progress reports	D		AH	B	G	C						
Design review			AH	BE	G	C	C					
Scheme Design												
Progress reports	D		AH	B								
Cost control			H	B								
Design development	K		HJK	ABEJK			C					
Present consolidated brief[1]	K		H									
Design review			AH	BE	G	C	C					
Detail design												
Develop detail design			H	A								
Develop health and safety plan			B				A					
Design development	K		HJK	ABEJK								
Appraise designs				AE			C	B	B	B		
Design review			AH	BE	G	C	C					
Progress reports	D		A	B								
Cost control			H	B								
Information for construction												
Progress reports	D		A	B								
Cost control			H	E	G	B						
Design development	K		HJK	ABEJK	G	B	C					
Design information				BE	G	B						
Design review			AH	BE	G	C	C					
Construction												
Progress reports	D		AH	E	G	B						
Cost control			H	B	G							
Provision of construction information			AH	B	G		C					
Construction operations							C		A	A		
Contractors' design work				EHJ			C		A	A		
Site visits			AH	E	G	A						
Completion of record drawings			AH	E	G	B	C					
Heath and safety file			BH				A					
Operating instructions and maintenance schedules			AH	E	G	B	C					
Design management appraisal												
Appraisal of design process				A	D							
Appraisal of design management				A	D							

[1] Although details are articulated at 4.5.4, no indication is given as to who presents this document.

4.7.1 Further role definitions for BS 7000

There are definitions of responsibilities, amplified and augmented throughout the document, some more explicit than others, as shown below.

Client	The guidance … covers the management of design activities throughout the life cycle of a construction project, from the point when the client initiates a project. It does not include any actions taken by a client in reaching a decision to initiate the project, or the factors considered by the client when selecting the most appropriate form of construction procurement.[1]
Advisory group	The client should set up an advisory group to assist in determining the most appropriate design procurement process and in preparing an initial brief. This advisory group, or a similarly constituted group, should then form a project management team to execute the project (2.1)
Project management team	Mentioned, but not defined
Project team	A group responsible for executing a project, including both design and construction personnel (1.3)
Designer	Mentioned, but not defined
Design team	The total capability required to undertake a design, comprising an appropriate mix of design units and specialists under the direction of a design team leader (1.3).
Design team leader	A person responsible for overseeing and co-ordinating the work of the design team (1.3). … the most significant management function undertaken within a construction project is that of the design team leader (2.1). Part of the project management structure and provides the primary link between project management and design management. Responsible for co-ordinating the work of a design team that consists of one or more design units with the capacity to cover the scope of the project. Should contribute to the overall planning of the project and be directly responsible for planning, programming, controlling and delivering its design content. Should co-operate with the planning supervisor, liase with other design units and ensure that effective communications and decision-making systems are applied (2.2.1). Normally include the following aspects of management: (a) establishing the design-related client requirements and defining them in a project brief; (b) advising on and possibly undertaking design procurement; (c) participating in the overall development and monitoring of the design-related elements of the project plan; (d) preparing the design-related aspects of the plan of work; (e) formulating overall targets for the design team that are consistent with the project plan; (f) collating cost and time data from design units and establishing a consolidated programme; (g) collating contributions from the design units and establishing a

[1] These initial stages *are* covered in section 2.1 of the standard, despite this explicit statement that they are not.

	consolidated brief; (h) co-operating with the planning supervisor; (i) co-ordinating the activities of the design team; (j) monitoring and controlling progress; (k) assisting in the development of the health and safety plan; (l) establishing compatible design information interfaces and a verification strategy; (m) determining the form and content of design output. The design team leader, as part of the project management team is responsible for managing all design work for a particular project. The design team leader's main objectives should be to see that the design work is properly co-ordinated between the design units and that it is completed within the time, cost and technical constraints imposed by the client … appointed for the duration of a commission or other defined task ... (4.1)
Design unit	An individual or group of designers from one design facility appointed to fulfil some part, or the whole, of the design requirements of a particular project (1.3) Should be formed from the resources under the control of the design facility manager.
Design facility	The resources, equipment, procedures, management, infrastructure and accommodation providing the capability to undertake design commissions (1.3).
Design facility manager	… includes an assessment of the merits of all new work to ensure that it is within the scope and resources of the design facility and otherwise acceptable. The design facility manager is responsible for appointing a design unit leader and assigning suitable design and support staff. The design facility manager is responsible for accepting commissions … a permanent managerial position … (4.1)
Design unit leader	A person responsible for leading a design unit in producing such elements of design as are the responsibility of that unit (1.3). A design unit leader is responsible for managing that part of a design commission assigned to a particular organization under the direction of a design team leader. A design unit leader's main objective should be to complete a design commission in collaboration with other design units within the time, cost and technical parameters agreed with the client … appointed for the duration of a commission or other defined task ... (4.1). A design unit should be supervised by a design unit leader. Normally appointed on commencement of a commission to undertake the management of resources and produce a cost-effective design within the parameters of cost and programme, in keeping with the design brief and good practice … should report to the client through a design team leader unless there is a specific requirement for direct communication … (4.4).
Design leader	Mentioned, but not defined
Planning supervisor	As defined in Clause 2(1) of the *Construction (Design and Management) Regulations* 1994.
Specialists and advisors	Mentioned, but not defined

Table 5: Analysis of BS 7000

Stage	Operations	Complexity	Load	Decentralization	Interfaces	Control (%)	Co-ordination (%)
1	5	11	1.0	1.7	7	0	0
2	20	53	1.4	2.0	13	12	40
3	9	62	1.3	3.1	26	52	100
4	5	25	1.6	2.3	6	20	100
5	7	31	1.4	2.6	13	19	57
6	5	30	1.4	2.8	9	53	60
7	9	43	1.2	3.2	15	41	89
8	2	4	1.0	3.0	0	0	0
Total	62	259			89		
Average			1.3	2.6	11	25	56
Max		62		3.2	26		

4.7.2 General comments on BS7000 Part 4

Overall, the definitions given in the standard are not as useful as they could have been, because different phrases are introduced throughout the text to deal with similar ideas. Words are not used in the way that they have been defined and the identification of who does what is not clear in the text. These problems eclipse the useful separation of Design Unit Leader, Design Facility Manager and Designer; three aspects of design practice which are usually wrapped into one. A lot of the detailed description of the tasks to be done is dealt with by blanket definitions that identify things which have to be done at all stages of work, hence the repeated patterns of tasks in the matrix. Interestingly, a lot is made of Resourcing, probably as a result of identifying a responsibility of Design Facility Manager. Another positive aspect is the separation of Co-ordination from Monitoring, a feature not commonly found in other documents.

The document contains little detail about the responsibilities of the main members of the project team. Moreover, it only applies to the design of a project and, as such, does not provide guidance on such matters as contract administration. Moreover, it contains inconsistencies. For example, tasks are identified for which no one is allocated responsibility. Some responsibilities are defined, but not used, whereas others that are used are not defined. There are many policy statements in the document that explain a basic principle, without attributing responsibility. For example, in section 2.3.2 of the standard; *the initial brief should be analysed and resolved into a clear statement from which a more specific project brief is developed.*

The structure and approach of BS 7000 Part 4 results in a glossary that seems independent of the rest of the document and does not provide explicit guidance about the responsibilities of the members of the project team.

4.7.3 Analysis of BS 7000

BS 7000 (see Table 5) contains fewer stages than the JCT draft schedule and a much smaller number of operations, by about half. The measure of

organizational complexity is also much smaller than those for JCT and BPF, as is the load. There is a high degree of decentralization, and the measure for interfaces is at a similar level to those in BPF, indicating much less interaction between participants than the JCT draft schedule envisages. Interestingly, Stage 8 contains no interfaces at all. Although control is very low, there is a higher level of co-ordination than in the previous two plans.

4.8 RIBA Plan of work 1964

The RIBA plan of work was published in 1964 and has remained largely unchanged, although it has been through a few slight revisions. The revised version (Royal Institution of British Architects 1997) is the basis for the Architect's Job Book (Cox and Hamilton 1995). Both have been correlated and summarized in this section. The outline plan of work begins with a warning that it has changed little since it was first published, that it uses outdated terminology, that it has not been revised in line with recent events and that it may need to be adapted to suit prevailing circumstances.

Key: A – Does the work; B – Co-operates; C – Advises; D – Receives; E – Monitors; F – Supervises; G – Resources; H – Co-ordinates; I – Directs; J – Recommends; K – Approves	Client	Architect (management function)	Architect (design function)	Quantity surveyor	Engineer Civil and Structural	Engineer Mechanical and Electrical	Contractor	Specialist contractors	Specialist suppliers	Planning supervisor	Planning Officer	Statutory bodies	Demolition contractor	Site Inspectorate	Clerk of works
Decentralization weighting	*1*	*2*	*3*	*4*	*4*	*4*	*5*	*6*	*6*	*3*	*7*	*7*	*5*	*4*	*4*
A Inception															
1. Consider the need to build	A														
2. Organizational set-up	A														
3. Appoint architect	A	CG													
Project quality plan[1]		A													
4. Client's requirements	A	D													
Initial brief		B													
5. Appointment of consultants	A	C		C		C				C					
6. General directive		A	D												
B Feasibility															
1. Organize nucleus design team	B	A	B	B	B	B									
Programme meetings and Stages	K	AHIJ		C	C	C									
2. Feasibility information	C	AHI													
2. Site studies		HI	A							C					
2. Outline planning consent	A	HI	B							K					
2. Initial cost information		HI		A											
2. Site investigation (ground)		HI			A					C					
2. Site investigation (services)		HI				A				C					
3. Project feasibility		AHI	B	B	B	B				C					
4. Design work		HI	A	B	B	B				C					
5. Prepare feasibility report		AHI	B	B	B	B				C					

[1] Various (unnumbered) activities are discussed in the Job Book, but not mentioned in the Plan of Work. Similarly, the clear distinction in the Plan of Work between management and design functions of the architect is not made in the Job Book. Therefore, for items identified in the Job Book alone, the managing function is usually assumed, unless design function is obviously intended.

Key: A – Does the work; B – Co-operates; C – Advises; D – Receives; E – Monitors; F – Supervises; G – Resources; H – Co-ordinates; I – Directs; J – Recommends; K – Approves	Client	Architect (management function)	Architect (design function)	Quantity surveyor	Engineer Civil and Structural	Engineer Mechanical and Electrical	Contractor	Specialist contractors	Specialist suppliers	Planning supervisor	Planning Officer	Statutory bodies	Demolition contractor	Site Inspectorate	Clerk of works
6-8. Feasibility decision	A	BC	BC												
8. Confirm appointments	A	C													
9. Prepare Stage C Directive		AHI	B	B	B	B									
Project brief		A		C		C				C					
Health and Safety Plan										A					
Project quality plan		A													
C Outline proposals															
1. Organize design team	B	AHIG	B	B	B	B	(B)								
Project quality plan		AHI													
1. Programme Stage C	B	AHI	B	B	B	B	(B)			C					
2. Elicit relevant information	BC	AHI													
Discussions with statutory and other bodies	C	AHI									C	C			
Site visits/inspections		AHI													
2. Outline design studies	BC	HI	A					C	C	C					
Construction contour or block models		AHI													
2. Outline cost studies	BD	BHI		A						C					
Prepare master cost plan		HI	C	A	C	C	(C)								
Health and Safety risk assessments		HI	C	C	C	C	(C)			A					
Health and Safety File		HI	C	C	C	C	(C)			A					
Pre-tender Health and Safety Plan		HI	C	C	C	C	(C)			A					
2. Outline engineering studies	B	HI			A					C					
2. Outline services studies	B	HI				A				C					
(2. Outline construction studies)	B	HI					(A)			C					
3. Assimilate and analyse information		HI	A	B	B	B	(B)			C					
4. Choose and prepare outline scheme		HI	A	B	B	B	(B)			C					
5. Outline cost plan		HI	B	A	C	C	(C)			C					
6. Compile design dossiers		AHI	B	B	B	B	(B)			C					
Design brief	B	AHI	C	C	C	C	(C)			C					
7. Report of outline proposals	DK	AHIJ	B	B	B	B	(B)			C					
D Scheme design															
1. Organize design team	B	AHIG	B	B	B	B	(B)								
2. Complete design studies	BC	HI	A					C	C	C					
Construction contour or block models		AHI													
Check Health and Safety requirements		AHI								C					
Cost appraisal for Stage D		AHI													
2. Complete cost studies	BD	BHI		A						C					
Prepare master cost plan		HI	C	A	C	C	(C)								
Health and Safety File		HI	C	C	C	C	(C)			A					
Pre-tender Health and Safety Plan		HI	C	C	C	C	(C)			A					
Submit planning application		AJ									K				
2. Complete engineering studies	B	HI			A					C					

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2. Complete services studies	B	HI				A				C					
(2. Complete construction studies)	B	HI					(A)			C					
3. Assimilate information		HI	A	C	C	C	(C)			C					
4. Full scheme design		HI	A	C	C	C	(C)			C					
Preliminary specialist tender action		AHI						C	C						
4. Preliminary construction programme		HI					(A)			C					
5. Draft cost plan		HI	C	A	C	C	(BC)								
5. Engineering scheme design		HI			A					C					
5. Services scheme design		HI				A				C					
6. Review scheme design		HI	A							C					
7. Finalize cost plan		HI	B	A	B	B	(B)								
8. Review scheme design and prepare presentation drawings		HI	A												
9. Report scheme design	CK	AHIJ													
Consolidated brief	C	AHI		C	C	C	(C)								
12. Freeze brief	K														
12. Obtain all approvals		AHIJ									K	K			
E Detail design															
1. Organize design team	B	AHIG	B	B	B	B	(B)								
2. Complete user studies	BC	HI	A					C	C	C					
2. Review cost plan	BD	BHI		A						C					
Prepare master cost plan		HI	C	A	C	C	(C)								
Health and Safety File		HI	C	C	C	C	(C)			A					
Pre-tender Health and Safety Plan		HI	C	C	C	C	(C)			A					
Submit planning application		AJ									K				
3. Detail design		HI	A	C	C	C	(B)			C					
3. Engineering detail design		HI	C	C	A	C	(B)			C					
3. Services detail design		HI	C	C	C	A	(B)			C					
Specialist tender action		AHI						C	C						
5-6. Cost studies and cost checks		HI	C	A	C	C	(BC)			C					
7-8. Review and confirm completed design		AHI	BC	BC	BC	BC	(BC)			C					
Specification notes		AHI	C	C	C	C	(C)			C					
F Production information															
1. Organize design team	B	AHIG	B	B	B	B	(B)								
2. Production information		HI	A	B	B	B									
3. Obtain final approvals		AHIJ									K	K			
3. Specification for structure, roads, etc.		HI			A										
3. M&E tender list		HI	B	B		AJ	(B)								
4. Initial demolition contract		HI		B			(B)						A		
4. Programme specialist work		HI	B			A	(B)								
5. Advance ordering		AHI													
5. Finalize services specification notes		HI	B	B		A									

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5. Commence supply procurement		HI					(A)								
6. Contract preliminaries		HI	A	B	C	C									
7. Specialist quotations or PC sums[1]		HI		B											
7. Review form of site administration		HI		B	A	A									
Check Health and Safety requirements		AHI								C					
Review cost plan	BD	AHI								C					
Review quality management of potential suppliers and sub-contractors		AHI						C	C	D					
G Bills of quantity															
1. Organize design team	B	AHIG	B	B	B	B	(B)								
2. Information to QS		HI	A	D											
2. Go through tender list		HI	B	B	A										
2. Design temporary works		HI					(A)								
3. Draw up tender list	K	HIJ	A	B	C										
3. Information to QS		HI		D	A										
4. Interview site staff		AHI													
4. Prepare bills of quantity		HI		A											
5. Prepare contract drawings		HI	A												
6. Obtain quotations for PC items		HI	A	B				C	C						
6. M&E tender list		HI		K		AJ									
7. Assemble drawings		HI	A												
7. Adjudicate tenders		HI		B		A									
Advance ordering	C	HI	A												
Arrange direct works	C	HI	A												
Pre-tender Health and Safety Plan		HI	C							A					
Building regulations approval		HI	AJ									K			
H Tender action															
1. Organize design team[2]	B	AHIG	B	B	B	B	(B)								
Check documentation		AHI	C	C	C	C	C								
Tendering contractors' site inspections		HI					A								
Pre-tender health and safety plan		HI								A					
Nominated sub-contractors' tender docs.		AGHI	C	C	C	C		B	B						
Cost appraisal		HI		A											
List potential contractors		HI	A				C								
Decide procedure		HI	A												
Preliminary enquiries		HI	A												
Invite tenders		HI	A												
Select contractor		HI	A												

[1] Presumably, the reference to obtaining PC sums "from consultants" is intended to refer to provisional sums.
[2] Implied, since it begins every other stage.

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J Project planning															
1. Fulfil financial arrangements	A	CHI													
1. Agree responsibilities	K	AHIJ													
2. Check documents	A	HI		B	B	B	B								
Appoint clerk of works	A	CHI													C
2. Arrange insurance	A	EHI													
3. Programme critical dates		AHI													
4. Brief site staff		AHI												D	
5. Project meeting	B	AHI		B	B	B	B							B	
6. Hand over site to contractor	A	HI					D								
6. Pre-contract checking of information		AGHI													
6. Agree site details		HI			A		C								
6. Review sub-contractors' programmes		BHI				A	C	C							
6. Briefing, liaison and setting out		HI					C							A	
6. Pre-contract planning and programme		HI					A	B	C						
Health and Safety Notice		HI								A					
Construction Health and Safety Plan		HI					A								
Obtain performance bonds		AGHI					B	B	B						
7. Project meeting		AGHI		B	B	B	B	B	B					B	B
K Operations on site															
1. Hand over site	A	HI					D								
2. Site meetings		AGHI		B	B	B	B							B	B
3. Soil conditions and construction method		HI			A		BC							B	E
3. Setting out		HI					B							A	E
4. Contractor's production meetings		BHI					A							B	
5. Construction operations[1]	D	FGHI			F	F	A	B	B					F	E
5. Contract administration	BD	AFGHI					B							B	C
5. Interim valuations	D	FGHI		A			B							B	
'As-built' records		AGHI								D					
5. Claims management	BD	AFGHI					B							B	
6. Quality control	D	AGHI			B	B	C								
6. Cost control	D	BHI		A			C	C	C						
7-8. Commissioning and testing	DK	HI				B	H	A						B	E
9. Appoint maintenance staff	A	HI				C									
10. Maintenance manual		AGHI				B		B	B						
L Completion															
1. Instruct sub-contract inspection		B				A	B	B						B	
2. Inspection of C & S work					A		B	B						B	
2. Inspection of M & E work		E				A	B	B						B	
2. Continue training client's staff							B	A							

[1] Construction operations, as such, are not identified, but supervision of them is.

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3. Instruct main contract inspection		AGHI					D							B	
3. Inspect building							A							B	
4. Arrange insurance	A	C													
5. Inspect building		AGHI					B							B	
6. Hand-over meeting	B	AGHI					B							B	
7. Certificate of practical completion	B	AGHI													
7, 10. Final account		BCD		AE	C	C	B	B							
8. Complete outstanding work	C	FHI					A	B							
9. Feedback reviews	B	AHI		B	B	B	B	B						B	
11. Inspect building	B	AGHI			B	B	B								
11-12. Programme remedial work	K	CE					A								
13. Final inspection	B	AGHI					B								
14. Certificate of making good defects	B	A					D								
15. Complete final account	D	D		A			BD								
16. Final certificate	B	A													

4.8.1 Defined stages in RIBA Job Book

Client's requirements	…will first need to be evaluated to determine whether they provide an adequate statement. They should set out the objectives that the client wishes to achieve in the project, and will probably refer to functional requirements, environmental standard, levels of quality, life span and maintenance. After evaluation and discussion these requirements may need to be adapted or modified to form the initial brief
Initial brief	…may be anything from a broad preliminary statement of interest to a comprehensive set of technical requirements. It will rarely be sufficiently clear or detailed for design work, but it should be seen as the basis for feasibility studies. Considerable further investigation and development work may be necessary to bring it to the level of a project brief by the end of stage A-B. However, it should be seen as an important part of developing the brief, and as such should be a formalized document to be agreed with the client.
Project brief	…should be a document that covers the technical, managerial and design intentions as set out in the initial brief, and shows how these requirements are to be met. It is likely to be the result of research and development involving all of the design team, with additional expertise and advice from commissioned specialists. It will be the outcome of activities such as: • Feasibility studies; • Site or building survey and studies; • Research into functional needs; • Environmental impact considerations; • Statutory constraints; • Cost appraisal studies. The project brief should be seen as the starting point for the development of the design brief and should be formalized by the end of stage A-B.
Design brief	…developed from the project brief, should define all design requirements. It should be prepared by the architect in collaboration with the client, and with co-ordinated contributions from all consultants and specialists, and the health and safety planning supervisor. Development of the design brief will probably require: • assembly of all relevant information; • design studies and investigations; • preparation of an outline design proposal; • preparation of a cost plan. The design brief is the foundation on which the design will develop, and serves as a yardstick against which further design development can be measured. As such it is a factual record, and a document of importance.
Consolidated brief	… is the last stage in the briefing process and may be equated with the end of Plan of Work Stage D. It will be the basis for further detailed design work, and should take the form of a report to the client containing the following; • introduction, purpose, résumé of brief development; • summary of research undertaken; • discussion of design options and conclusions;

- description of proposed scheme design;
- cost plan and programme.

The consolidated brief should be "signed off" by the client after approval.

In the Job Book, it is stated that the terminology, for items relating to the development of the brief, is intended to accord with BS 7000 part 4. For items relating to work stages, it is that used in the Plan of Work. For those relating to quality management, it is that of *RIBA Quality Management: Guidance for an Office Manual* and BS 5750. It is presumed that the authors of the Job Book have checked that the glossaries of these documents are consistent.

4.8.2 General comments on RIBA Plan of Work

The RIBA Plan of Work is the most well established of the documents analysed. Its tabular format was useful in conveying the spread of responsibilities. The contents of the associated document, the Job Book, are mainly discursive and include an enormous amount of detail for the architect. Together, these documents contain a lot of detail, but the steps within each stage are neither clearly defined nor distinguished from each other. Responsibilities are widely spread throughout the team. Stages tend to begin with allocating the managing architect responsibility for "organizing", interpreted in the matrix as the role of Directing (I). Also, some obligations are all encompassing and vague, such as the client's duty to provide "all information required by architect" and "assist as required". It is particularly interesting to note the intention of clearly separating the architect's role into a management role and a design role, but this distinction disappears at stage J. Worse, the managing architect is sometimes allocated operational roles and the design architect is sometimes allocated managing roles.

The detailed plan of work includes neither stage H nor stage M. The numbering is not systematic, with the same number used to denote different activities within a stage of work.

In line with the BPF system, the RIBA Plan of Work makes little contribution to the separation of doing from managing. Nearly all the work is described in operational terms, with the architect (management function) taking on responsibility for Co-ordinating and Directing throughout the process. The notion of preparing information for client approval at the end of each stage in order to get commitment for subsequent stages is not articulated in the plan of work. In fact the only responsibility for Approval is allocated to external bodies such as the planning officer and statutory bodies. Some parts of this plan of work contain extraordinary levels of detail, such as the tasks to be undertaken at completion.

The RIBA Plan of Work is the most well known, and the usual benchmark against which all others are measured. There is an enormous amount of detail in terms of the operational work that has to be done, as would be

Table 6: Analysis of RIBA 1964

Stage	Operations	Complexity	Load	Decentralization	Interfaces	Control (%)	Co-ordination (%)
A	8	16	1.1	1.8	5	4	0
B	17	81	1.3	2.7	71	0	1
C	22	156	1.3	3.1	147	2	1
D	27	153	1.4	3.1	86	1	1
E	14	112	1.3	3.6	92	2	1
F	16	83	1.5	3.3	52	2	1
G	17	77	1.4	3.0	32	2	1
H	11	53	1.4	3.0	32	6	1
J	18	93	1.6	3.0	71	7	1
K	15	111	1.5	3.4	60	36	1
L	19	97	1.4	3.3	92	18	0
Total	184	1032			740		
Average			1.4	3.0	67	7	1
Max		156	1.6	3.6	147		

expected in a checklist for architects when managing projects. Although there is an explicit attempt to separate responsibility for managing design from responsibility for doing it, this is not well implemented. Also, parts of the plan of work are simply not present (operations on site, evaluation). Although the Plan of Work has clearly been of enormous use in the past, it is well past its useful life and would not form a useful model for contemporary projects. The economic and legal environments have changed markedly since the date of original publication.

4.8.3 Analysis of the RIBA plan of work

The RIBA plan of work is analysed in Table 6. The number of stages is comparable to the JCT draft schedule, although there are more operations. It is also much more complex than any of the other plans analysed. The load is slightly less than that for the JCT draft, peaking at 1.6 during only one stage, whereas the JCT draft schedule reaches 1.6 in five different stages. Decentralization has a higher peak, and seems a little higher overall than the JCT draft. The number and pattern of interfaces is similar. Control and co-ordination are facets of the management structure that seem barely present in the RIBA plan of work. However, this documentation is very old and, as in the BPF system, the contemporary emphasis on separately identifying the management system should not be expected in documents prepared when the focus was on operational work.

4.9 RIBA Plan of work 2000

This new Architect's Plan of Work (Phillips and Lupton 2000) was used as the basis for the analysis reported here. The new plan of work is published in various versions, for different procurement methods. The version used here is that for a "fully designed building project".

Key: A – Does the work; B – Co-operates; C – Advises; D – Receives; E – Monitors; F – Supervises; G – Resources; H – Co-ordinates; I – Directs; J – Recommends; K – Approves	Client	Architect as lead consultant/cont. admin.	Architect as designer and design leader	Quantity surveyor	Structural engineer	Building services engineer	Planning supervisor	Site inspectorate	Statutory undertakings	Tendering contractors	Contractor	Principal contractor	Sub-contractors	Development Control Authority	Statutory and other utilities	Health and Safety Executive
Decentralization weighting	*1*	*2*	*3*	*4*	*4*	*4*	*3*	*4*	*7*	*5*	*6*	*5*	*6*	*7*	*7*	*7*
Feasibility:																
A – Appraisal																
Authorize commencement of work stage	A	D	D	D	D	D	D									
Initial statement of requirements	A	D	D	D	D	D	D									
Site appraisal	A	B	C	C	C	C	C									
Site surveys	K	J	AH	C	AC	AC	C									
Design studies	K	H	AHIJ	C	BC	BC	C							C	C	
Cost studies		H	A	A	C	C										
Assess risks			A	A	A	A										
Appraisal of options	CK	AH	C	C	C	C	C									
Value management/cost benefit studies	K	AH	C	C	C	C										
Develop preferred solution		H	AIH	C	C	C	C									
Outline development control submission	B	H	A	C	C	C								K		
Prepare outline business case	A	H	C	C	C	C										
B – Strategic briefing																
Preparation of strategic brief	A	C	C	C	C	C										
Pre-construction period:																
C – Outline proposals																
Authorize commencement of work stage	A	D	D	D	D	D	D									
Strategic brief	A	D	D	D	D	D	D									
Identify client's agent or another client	A															
Site information	A	D	D	D	D	D	D									
Health and Safety file			H				A									
Evaluate strategic brief	K	AJ	AI	A	A	A										
Consider sustainable development	A		C		C	C										
Site surveys and investigations	K	HJ	A		A	A	A									

Key: A – Does the work; B – Co-operates; C – Advises; D – Receives; E – Monitors; F – Supervises; G – Resources; H – Co-ordinates; I – Directs; J – Recommends; K – Approves	Client	Architect as lead consultant/cont. admin.	Architect as designer and design leader	Quantity surveyor	Structural engineer	Building services engineer	Planning supervisor	Site inspectorate	Statutory undertakings	Tendering contractors	Contractor	Principal contractor	Sub-contractors	Development Control Authority	Statutory and other utilities	Health and Safety Executive
Appoint additional consultants	AK	AJ					C									
Establish design management procedures			AH													
Project programme	K	A	C	C	C	C	C									
Establish work stage procs. and programme	B	A	B	B	B	B	B									
Initial design studies	K		AHIJ		C	C	C									
Develop project brief	B	B	B	B	B	B	B									
Energy targets and fuel policy	K	AJ	C	C		C										
Preliminary consultations with stat. authorities			AI		A	A									C	
Establish format for pre-tender H&S plan			H				A									
Review risk assessments		C	C	C	C	C	A									
Outline proposals			AI		A	A										
Initial cost studies			C	A	C	C										
Procurement options			C	C	C	C	C									
Work stage report	K	AJ	B	B	B	B	B									
Establish basis of post-project evaluation																
Amend outline proposals		A	AI	A	A	A	C									
Outline development control submission	K	H	A	C	C	C										
Decision to proceed to next Work Stage	K	J	D	D	D	D	D									
D – Detailed proposals																
Authorize commencement of work stage	A	D	D	D	D	D	D									
Implement work stage procs. and programme	A	A	A	A	A	A	A									
Evaluate outline proposals against brief		A	A	A	A	A	A									
Complete user studies		H	AI													
Complete cost studies		H		A												
Complete structural engineering studies		H	H		A											
Complete services engineering studies	K	HJ	H			A										
Develop detailed design solution			AHI	C	C	C										
Completion of project brief	B	B	B	B	B	B	B									
Identify need for additional consultants	K	AJ	AI		A	A	A									
Prepare and obtain specialist tenders		A														
Requirements for equipment selection tenders	K	AJ														
Detail fixed furniture and equipment	A															
Detailed proposals and outline spec.			AHI		A	A										
Update elemental cost plan				A	C	C										
Establish compliance with stat requirements			A	C	A	A										
Review design co-ordination		A	BHI	B	B	B	B									
Additional risk assessments			A	A	A	A	C									
Draft pre-tender H & S plan			CH	C	C	C	A									
Sign off project brief	A	B	BI	B	B	B	B									

Key: A – Does the work; B – Co-operates; C – Advises; D – Receives; E – Monitors; F – Supervises; G – Resources; H – Co-ordinates; I – Directs; J – Recommends; K – Approves	Client	Architect as lead consultant/cont. admin.	Architect as designer and design leader	Quantity surveyor	Structural engineer	Building services engineer	Planning supervisor	Site inspectorate	Statutory undertakings	Tendering contractors	Contractor	Principal contractor	Sub-contractors	Development Control Authority	Statutory and other utilities	Health and Safety Executive
Consolidate and update detailed proposals			AHI	B	B	B										
Negotiate incoming services						A			C							
Review procurement advice			A	B	B	B	B									
Work stage report	K	AJ	C	C	C	C	C									
Development control submission	K	H	A	C	C	C										
Amend detailed proposals		A	AHI	A	A	A	C									
Decision to proceed to next Work Stage	K	AJ	D	D	D	D	D									
E – Final proposals																
Authorize commencement of work stage	A	D	D	D	D	D	D									
Implement work stage procs. and programme	A	A	A	A	A	A	A									
Final layouts	K	J	AHI		A	A									C	
Integrate design inputs			AHI		B	B										
Cost control		HI	C	A	C	C										
Final proposals			AHI		A	A										
Review design co-ordination		B	BHI	B	B	B	A									
Risk assessments			B	B	B	B	A									
Health and Safety plan			CH	C	C	C	A									
Health and Safety file			H				A									
Review and update cost plan			B	A	B	B										
Review procurement method and contingency		A	A	A	A	A	A									
Work stage report	K	AJ	C	C	C	C										
Statutory and other submissions	K	AJ	B	B	B	B										
Amend final proposals		A	AHI	A	A	A	C									
Decision to proceed to next Work Stage	K	AJ	D	D	D	D	D									
F – Production information																
Authorize commencement of work stage	A	D	D	D	D	D	D									
Implement work stage procs. and programme	A	A	A	A	A	A	A									
F1: Review design co-ordination		A	BHI	B	B	B	B									
F1: Prepare co-ordinated production info.			AHI		A	A										
F2: Agree programme for completion		A	A		A	A										
Identify info for H & S file			H				A									
Cost control		HI	C	A	C	C										
Complete statutory and other submissions		H	A		A	A										
Review H & S principles and time			H				A									
Work stage report	K	AJ	C	C	C	C	C									
Amend production info. and cost plan		A	AHI	A	A	A	C									
Decision to proceed to next Work Stage	K	AJ	D	D	D	D	D									
F2: Complete outstanding production info		HI	A	A	A	A										

Key: A – Does the work; B – Co-operates; C – Advises; D – Receives; E – Monitors; F – Supervises; G – Resources; H – Co-ordinates; I – Directs; J – Recommends; K – Approves	Client	Architect as lead consultant/cont. admin.	Architect as designer and design leader	Quantity surveyor	Structural engineer	Building services engineer	Planning supervisor	Site inspectorate	Statutory undertakings	Tendering contractors	Contractor	Principal contractor	Sub-contractors	Development Control Authority	Statutory and other utilities	Health and Safety Executive
G – Tender documentation																
Authorize commencement of work stage	A	D	D	D	D	D	D									
Implement work stage procs. and programme	A	A	A	A	A	A	A									
Pre-tender H & S plan		H	CDH	C	C	C	A									
Finalize statutory submissions			A		A	A										
Ascertain contract conditions		A	C	C	C	C	C									
Implement document control		A	H													
Prepare tender pricing documents			B	A	B	B										
Archive data for tender pricing docs.				A												
Edit production information			AHI		A	A										
Prepare information release schedules		H	AH		A	A										
Review procurement method		A														
Review completed production information			AHI	A	A	A										
Pre-tender estimate and cash flow			C	A	C	C										
Work stage report	K	AJ	C	C	C	C	C									
Amend tender documentation		A	AHI	A	A	A	C									
Decision to proceed to next Work Stage	K	AJ	D	D	D	D	D									
H – Tender action																
Authorize commencement of work stage	A	D	D	D	D	D	D									
Implement work stage procs. and programme	A	A	A	A	A	A	A									
Identify procedural requirements	A															
Pre-tender enquiries		AH	BI	B	B	B										
EC or other advertisement		A	B	B	B	B										
Financial & technical contractors' check		AH	B	B	B	B	C			C						
Prepare short list of tenderers	K	AJ	B	B	B	B	C			C						
Tender documentation		H	AHI	A	A	A										
Main contract tendering	D	H		A						C						
Sub-contract tendering	D	H	A		A	A				C						
Answer tenderers' queries		A	B	B	B	B	B									
Appraisal of tenders		H	B	B	B	B										
Appraise response to H & S plan		A	H				C									
Negotiations with tenderers	K	AJ	B	B	B	B										
Tender (work stage) report	K	AJ	C	C	C	C	C									
Amend production and pricing info.		A	AI	A	A	A	C									
Decision to proceed to next Work Stage	K	AJ	D	D	D	D	D									
Construction:																
J – Mobilisation																
Authorize commencement of work stage	A	D	D	D	D	D	D									
Implement work stage procs. and programme	A	A	A	A	A	A	A									

Key: A – Does the work; B – Co-operates; C – Advises; D – Receives; E – Monitors; F – Supervises; G – Resources; H – Co-ordinates; I – Directs; J – Recommends; K – Approves	Client	Architect as lead consultant/cont. admin.	Architect as designer and design leader	Quantity surveyor	Structural engineer	Building services engineer	Planning supervisor	Site inspectorate	Statutory undertakings	Tendering contractors	Contractor	Principal contractor	Sub-contractors	Development Control Authority	Statutory and other utilities	Health and Safety Executive
Develop H & S plan	K	J	H				E					A				
Letter of acceptance of tender	A											D				
Contract documents	B	AH	BHI	B	B	B					BD		B			
Notify project to HSE			H				A									D
Production information		H	AHI	A	A	A					D	D	D			
Issue priced tender documents				A												
Brief site inspectorate		A	A	A	A	A		D								
Administrative arrangements		A	B	B	B	B					B	B	B			
Nominate or name sub-contractors		A	B	B	B	B										
Review design co-ordination		B	HI				A				B	B	B			
Decision to proceed to next Work Stage	K	AJ	D	D	D	D	D									
K – Construction to practical comp.																
Authorize commencement of work stage	A	D	D	D	D	D	D									
Implement work stage procs. and programme	A	A	A	A	A	A	A									
Take possession of site											A					
Perform obligations under building cont.											A					
Administer the building contract	K	AJ		C												
Provide additional information			AHI		A	A	C				D					
Variations	K	AJ	CI	C	C	C	C									
Contractor's design information			CHI		C	C	C				A					
Site visits		D	A		A	A		A								
Interim certificates	K	AJ	C	B	C	C					B					
Assemble data for H & S file			H								A					
Contractor's claims	K	DJ	C	C	C	C					A					
Progress reports		DJ									A					
Cost reports				A												
Progress and performance review meetings		A	B	B	B	B					B					
Contractor's meetings		B	B	B	B	B					A					
Monthly progress and financial reports	K	AJ														
Testing and commissioning	K	K				H					B					
Arrange training of client's personnel	B					A										
Completed info. For H & S file		H	H								B					
Building Owner's manual		H	AH		A	A	BH				B					
Inspection of the works		H	A		A	A										
List outstanding items			A					B			D					
Handover	D	H	BH		B	B	B				A					
Defects reporting procedure	B	A	B													
Arrange insurance	A	C														
Interim certificates	K	A		C												

Key: A – Does the work; B – Co-operates; C – Advises; D – Receives; E – Monitors; F – Supervises; G – Resources; H – Co-ordinates; I – Directs; J – Recommends; K – Approves	Client	Architect as lead consultant/cont. admin.	Architect as designer and design leader	Quantity surveyor	Structural engineer	Building services engineer	Planning supervisor	Site inspectorate	Statutory undertakings	Tendering contractors	Contractor	Principal contractor	Sub-contractors	Development Control Authority	Statutory and other utilities	Health and Safety Executive
Updated cost report				A												
Updated status report		A														
Decision to proceed to next Work Stage	K	AJ	D	D	D	D										
L – Construction after practical comp.																
Authorize commencement of work stage	A	D	D	D	D	D										
Implement work stage procs. and programme	A	A	A	A	A	A										
Correction of defects	K	DH	C		C	C					A					
Final account			A								B					
Review decisions affecting completion date		A	C		C	C										
Regular reports to client	D	A														
Interim certificates	K	A		C												
Pre-final inspections	B	H	AI		A	A					B					
Schedule of defects		A									D					
Programme for remedial work	K	H									A					
Appoint Planning Supervisor if necessary	A	C	H				C									
Final inspection	B	AH	AI		A	A					B					
Certificate of making good defects		A									D					
Complete final account				A							K					
Issue final certificate	K	A														
Completion of consultant services	D	A	A	A	A	A										

4.9.1 Further definitions in RIBA 2000

In the introduction to the plan of work, various statements allocate or discuss responsibilities. Some roles, (the client's and the lead consultant's) are summarized in very general terms. Project management is mentioned as something that the client might like to utilize, but for the purposes of the plan of work, these are client functions. The text about the lead consultant makes clear that this person (among other things) directs the design process, co-ordinates the design in relation to the Health and Safety Plan and co-ordinates the design-related aspects of the work. This adds role codes throughout the matrix that are not apparent from the detailed plan of work. In many cases, it produces a duplication of co-ordination roles, as the Lead Consultant is specifically allocated co-ordination functions. Control, as defined in this research, does not occur. No one is allocated to the elemental functions of control, although some aspects are mentioned in

Table 7: Analysis of RIBA 2000

Stage	Operations	Complexity	Load	Decentralization	Interfaces	Control (%)	Co-ordination (%)
A	12	91	1.2	3.2	63	0	67
B	1	6	1.0	3.0	5	0	0
C	25	139	1.1	3.0	125	0	26
D	27	141	1.2	3.1	171	0	41
E	16	99	1.2	3.3	115	0	50
F	13	75	1.2	3.2	77	0	62
G	16	83	1.2	3.3	74	0	38
H	17	105	1.1	3.1	130	0	41
J	13	81	1.1	3.6	113	3	38
K	30	134	1.1	3.4	113	0	30
L	16	66	1.1	3.1	60	0	31
Total	186	1020			1046		
Average			1.1	3.2	95	0	38
Max		141		3.6	171		

general terms in the introduction. Finally, specialist designers are mentioned in the introduction, but nothing is made of their involvement in the plan of work.

4.9.2 General comments on RIBA 2000

It is interesting that much of the general information in the introduction does not appear in the detailed plan, where it refers to the roles of participants, whereas the introductory notes about work stage procedures are clearly echoed throughout the detailed plan.

Although the original RIBA plan of work has been recognized for many years throughout the industry as the standard against which others are judged, this new plan has been produced to reflect changes in practice and legislation and to fit better with the recommendations of the Co-ordinated Production Information Committee and other influential reports that have been published in the last few years.

4.9.3 Analysis of RIBA 2000

Table 7 shows that the work represented by RIBA 2000 is most intense during the early design and the construction stages, i.e. there are more operations in these stages than in others. The inclusion of a stage for strategic briefing (B) seems odd in terms of this analysis, which highlights the extent to which the work during this stage is outwith the remit of the project team. Apart from this stage, the numbers for load, decentralization and interfaces are fairly consistent between stages, as is the absence of control. The inconsistency in the values achieved for co-ordination is interesting, varying as it does between zero and 67%. In most of the stages, co-ordination is present in less than half of the operations, and the matrix shows that when co-ordination is present, more than one person is exercising this function.

Comparing this plan of work to its predecessor (Table 6, page 69), it is interesting to see that the number of operations and the organizational complexity measure produce very similar pictures in both plans of work. The new plan has a smaller load for participants, probably reflecting the largely operational approach to this new plan of work, i.e. the high incidence of participants in operating, co-operating and advising roles, with no additional management responsibility. The decentralization produces a higher figure in the new plan, reflecting the involvement of participants more distant from the client. The number of interfaces is much larger in the new plan, showing that the plan envisages much higher levels of interaction than used to be the case. Control was very low in the previous version of the plan of work, but is now all but absent, whereas co-ordination now appears throughout the plan, somewhat erratically, and in many cases this is duplicated, a feature which may cause difficulties in practice, unless care is taken to ensure consistency and integration between the different facets of the project being co-ordinated.

Another interesting direct comparison is with the JCT draft schedule of services (see Table 3, page 46), since this new plan of work is intended to complement it. Here it is interesting to see that RIBA 2000 has many more operations, as well as a higher organizational complexity than the JCT scheme. The load is lower in RIBA 2000 than in JCT and decentralization is slightly higher. The number of interfaces is higher in RIBA 2000 and the figures for control and co-ordination are completely different. These features seem to indicate that there are fundamental differences of approach between the two schemes, with a generally higher level of detail in RIBA 2000 than in the JCT scheme.

4.10 Construction Industry Council

The Construction Industry Council, in conjunction with the Association of Consulting Engineers, has been engaged in mapping responsibilities throughout the design process (Construction Industry Council 1998). This information was only available in draft form at the time of writing, and some of the supporting documentation was unavailable, although it was made clear that the missing documents only reiterated what was in the flowcharts and schedules made available. The matrix here represents the current position in regard to the emerging Construction Industry Council documentation on inter-disciplinary design management.

Key: A – Does the work; B – Co-operates; C – Advises; D – Receives; E – Monitors; F – Supervises; G – Resources; H – Co-ordinates; I – Directs; J – Recommends; K – Approves	Client	Team management	Cost consultant	Architect (design)	Structural engineer	Services engineer	Planning supervisor	Tendering contractors	Contract administrator	Contractor	Steelwork sub-contractor	M & E services sub-contractor	Specialist sub-contractors
Decentralization weighting	*1*	*2*	*4*	*3*	*4*	*4*	*3*	*5*	*3*	*5*	*6*	*6*	*6*
A & B Appraisal and strategic briefing													
Appoint consultants	A												
Establish scope of feasibility study	K	A	B	B	B	B							
Establish information and consultants' proposals	CK	AGH	B	C	C	C							
Assess client's functional needs	B			AE	A	A							
Dimensional surveys	B			AE									
Geotechnical and exploratory holes	B			E	A								
Special investigations (services)	B			E		A							
Establish legal, contractual etc constraints	B			AE									
Identify site constraints and advise on structural form	B			E	A								
Assess availability of utility supplies	B			E		A							
Sketches of ideas		H	C	AJ	C	C							
Decision: Are proposals satisfactory?				K[1]									
Prepare feasibility report		HJ	B	B	B	B							
Decision: Proceed to Strategic Brief	K												
Prepare strategic brief	A	B	B	B	B	B							
C Outline Proposals													
Appoint consultants and allocate functions and elements	A												
Issue strategic brief	A	D	D	D	D	D							
Consider design brief[2]		H	B	A	B	B							
Review scope of work for outline proposals	BK	H	B	A									
Decision: agree revised design brief	K			J									

[1] It is the architect who decides whether proposals are satisfactory and, if not, the return line on the flowchart bypasses Team Management.

[2] The strategic brief immediately becomes the design brief

Key: A – Does the work; B – Co-operates; C – Advises; D – Receives; E – Monitors; F – Supervises; G – Resources; H – Co-ordinates; I – Directs; J – Recommends; K – Approves	Client	Team management	Cost consultant	Architect (design)	Structural engineer	Services engineer	Planning supervisor	Tendering contractors	Contract administrator	Contractor	Steelwork sub-contractor	M & E services sub-contractor	Specialist sub-contractors
Design programme	K	AJH	B	B	B	B							
Initial sketch proposal drawings	C	H		AE									
Assess structural implications	C	H		E	A								
Assess services implications	C	H		E		A							
Consider Health and Safety aspects	C	H		E			A						
Comment on cost of proposals		H	A	B									
Prepare preliminary proposals	B	BH		A									
Assimilate client's comments and criticisms	C	H	B	A	B	B							
Consider alternative arrangements		H	B	A	B	B							
Prepare outline proposals	B	H	B	A	B	B							
Prepare outline cost plan		H	A	C	C	C							
Prepare Outline Proposal Report	C	H	B	A	B	B							
Propose procurement method	K	HJK	AJ										
Advise on need to appoint Planning Supervisor	K	AHJ											
Decision: Approval of outline proposal report	K	AHJ											
D Detailed proposals													
Instruct design team and planning supervisor	A	CD	CD	CD	CD	CD	CD						
Consider when information required from team		H	A										
Review scope of architectural work		H		A									
Review scope of structural work		H			A								
Review scope of M&E work		H				A							
Assess competence of designers		H					A						
Review scope of H&S planning work		H					A						
Prepare co-ordinated design programme	D	AH	D	D	D	D	D						
Review outline proposals				A									
Prepare location drawings and risk analysis			D	A	C	C	D						
Consider scope of project and initial risk analysis							A						
Cost checks and prepare project cost plan		D	A										
Prepare project brief report	K	AJ											
Decision: Approve and freeze project brief and cost plan	A												
E Final proposals													
Instruct structural and services engineers		A			D	D							
Prepare final M&E design				CH	C	A							
Prepare final design and 1:100 GA drawings					A								
Decision: are SE and M&E drawings acceptable?				AK	C	C							
Decision: are SE and M&E proposals acceptable?			AK	C	C	C							
Confirm 1:100 GAs … information as frozen		A											
Confirm instruction to proceed to production information	A	B		BC	BC	BC							
F1 Production information													
Prepare 1:50 and 1:20 detail drawings		E		A	D	D							
Prepare co-ordinated 1:50 and 1:20 detail drawings		E				A							

Key: A – Does the work; B – Co-operates; C – Advises; D – Receives; E – Monitors; F – Supervises; G – Resources; H – Co-ordinates; I – Directs; J – Recommends; K – Approves	Client	Team management	Cost consultant	Architect (design)	Structural engineer	Services engineer	Planning supervisor	Tendering contractors	Contract administrator	Contractor	Steelwork sub-contractor	M & E services sub-contractor	Specialist sub-contractors
Revise 1:50 and 1:20 detail drawings		E	D	A	C	C							
Cost check against cost plan		E	A										
Consider implications of specifications		E	A				D						
Prepare specifications, production information etc		E		A			D						
Prepare specifications, production information etc		E			A		D						
Prepare specifications, production information etc		E				A	D						
Prepare health and safety plan		E	C	C	C	C	A						
Decision: confirm details are frozen		AEK	D		D	D							
G Tender documents													
Bills of quantity take-off for location drawings		E	A										
Bills of quantity take-off for details		E	A										
Prepare detail drawings		EH			A								
Prepare detail drawings, specifications and BQs		EH				A							
Decision: Proceed with remainder of production info.	K	E		J									
Bills of quantity		DE	A	CD	CD	CD	CD						
Adjust and revise drawings and specifications		DE		A									
Adjust and revise drawings and specifications		DE			A								
Adjust and revise drawings and specifications		DE				A							
Compile health and safety plan		E	D				A						
Compile tender documents		E	A										
Prepare cost estimate		E	A										
Considers BQ cost report	A												
F2 Production information													
Agree drawing production for F2			A										
Prepare const. drawings required at start of contract				A									
Prepare const. drawings required at start of contract					A								
H Tender action													
Decision: Is EC advertisement required?	AK	D											
Compile tender list	D	A	C	C	C	C							
Pre-qualification of tenderers	K	AJ					C	C					
Approve going to tender	A												
Issue tender documents		A	C				C	D					
Post-tender design details			A										
Reinforcement drawings for details				A									
Submit priced tenders	D							A					
Review priced tenders	K	JK	AJ	B	B	B	B		B				
Decision: Appoint contractor and principal contractor	A									D			

Key: A – Does the work; B – Co-operates; C – Advises; D – Receives; E – Monitors; F – Supervises; G – Resources; H – Co-ordinates; I – Directs; J – Recommends; K – Approves	Client	Team management	Cost consultant	Architect (design)	Structural engineer	Services engineer	Planning supervisor	Tendering contractors	Contract administrator	Contractor	Steelwork sub-contractor	M & E services sub-contractor	Specialist sub-contractors
J, F2 & K Mobilization, post-production information and construction[1]													
Execute contract documents	A		B							A			
Issue contract drawings			D	A	A	A							
Cost check			A										
Issue all available construction drawings and information		A							D				
Issue all available construction drawings and information									A	D			
Issue "information required schedule" (IRS)									D	A			
Schedule production information		H		A	A					C			
Prepare production information		H	E	A	A				E?	C			
Issue construction status drawings		A							DB	D			
Steelwork production information			E		CD		D		H	F	A		
M & E services production information			E			CD	D		H	F		A	
M & E builders' work production information			E	CD	CD	CD	D		H	F		A	
Specialist sub-contractors' production information			E	CD	CD	CD	D		H	F			A
Variation control	K	AHJ	AC	AC	AC	AC	AC			AC			
…[2]													

[1] There seems to be no attempt to separate these procedures in the flowcharts

[2] There is no clear ending to any procedures, perhaps because of the exclusive focus on design processes.

Table 8: Analysis of CIC scheme

Stage	Operations	Complexity	Load	Decentralization	Interfaces	Control (%)	Co-ordination (%)
A&B	15	61	1.2	2.6	46	18	20
C	20	93	1.2	2.5	40	7	1
D	14	46	1.2	2.7	28	0	1
E	7	26	1.3	3.3	14	0	0
F1	10	37	1.1	3.1	20	33	0
G	14	42	1.4	2.6	26	31	0
F2	3	3	1.0	3.7	6	0	0
H	10	35	1.1	2.7	20	0	0
J,F2&K	14	81	1.3	3.7	212	21	1
Total	107	424			412		
Average			1.2	3.0	46	12	2
Max		93		3.7	212		

4.10.1 General comments on CIC Scheme

There were no glossaries or other descriptions associated with the documentation, other than lists of things to be provided at each stage. The documents upon which this matrix is based consisted almost solely of flowcharts. As such, they provided an excellent picture of information flows, which is why there are so many instances in the matrix of Receiving (D). The scheme is almost entirely operational, with very little information about managing the process. There are many instances of information being passed formally from one person to another with little (apparent) addition of information. In some of the stages of work, the responsibility for Co-ordination is allocated to Team Management, but not in all cases. Also, there are opportunities for the client to approve output towards the end of stages of work. No other attempt is made to deal with management functions. The final stage of work becomes quite cyclical with no obvious end. No mention is made of completion.

Generally, this scheme is very useful for conveying the interdependencies between tasks, but not very useful for identifying the management structure for the design process in construction projects.

The Construction Industry Council's draft scheme for the management of building design information is understood to be based on the new Architet's Plan of Work (see page 71), which is intended to be consistent with the JCT Draft Schedule of Services, but, apart from the labelling of the main stages of work, the CIC scheme does not seem consistent with either of them. The flowcharts convey much about operational interdependencies between participants during the design process, but little about the management of the process.

4.10.2 Analysis of CIC scheme

The CIC documentation is analysed in Table 8. Although there are many operations, and a number of stages comparable to the JCT draft schedule,

the stages are not clearly delineated from each other. The number of operations is lower than those found in JCT and RIBA documents, and the organizational complexity is much lower. The load is generally much lower, meaning that very few job positions are carrying out multiple roles. Decentralization is not very different from the other plans examined, whereas the number of interfaces is generally very low, until the last stage (incorporating three stages) where more than half of the interfaces for the entire scheme occur. Control is occasionally present and co-ordination is almost completely absent.

The analysis reveals that the scheme does not provide clear guidance for the purposes of defining operational and management responsibilities.

4.11 Construction Industry Board

Constructing Success emerged as a response to the Latham report (1994). It provides guidance on how to organize the construction process (Construction Industry Board 1997a), in conjunction with the complementary document, *Selecting consultants for the team* (Construction Industry Board 1997b)

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Key: A – Does the work; B – Co-operates; C – Advises; D – Receives; E – Monitors; F – Supervises; G – Resources; H – Co-ordinates; I – Directs; J – Recommends; K – Approves	Client	Project sponsor	Client advisor	Client project manager	Consultant	Contractor	Designer	Lead contractor	Lead designer	Adjudicator (p14)	Mediator (p14)	Planning supervisor	Principal contractor	Specialist contractor	Sub-contractor	Stakeholders
Decentralization weighting	*1*	*2*	*2*	*2*	*3*	*5*	*4*	*5*	*3*	*3*	*3*	*3*	*5*	*6*	*6*	*7*
Getting started																
Nominate and appoint the project sponsor	A	C														
Appoint client advisor	A		C													
Appraise options	K	AIJ	B													
Confirm the business case	K	AIJ	B													
Develop a project strategy		A	B													
Decision: Confirm construction project needed and agree strategy for execution	K	J														
Select and appoint client's project manager	K	AIJ	B	C												
Defining the project																
Develop strategic brief	K	HJK		AEFGJ												C
Develop project execution plan	K	JK		AEFGJ												
Assembling the team																
Decide contracts		K		AEFGJ												
Select the project team[1]		K		AEFGJ												
Appoint the project team	A			EFG												
Designing and constructing																
Develop the project brief	BIK	HI		AEFG	B	B	B	B	B			B	B	B	B	C
Develop the concept design	IK			EFGG												
Develop the detailed design	IK	CJ		EFGH		C								C	C	
Start construction	I			EFG		A?										
Payments to contractor	A			EFG												
Manage and resolve problems	I			EFG						A	A					
Review progress and quality	I	K		EFGJ				A								
Completion and evaluation																
Ensure work is ready for use				EFG												
Complete the project	K	HJ		EFGJK				A						B	B	
Evaluate feedback	B	A		BEFG												C

[1] Further details of what to consider and how to decide are given in *Selecting consultants for the team.*

4.11.1 Defined responsibilities in CIB documents

In addition to the schedules of what each participant should be doing, there are several useful definitions of responsibilities, as follows:

Client	The customer for construction
Client advisor	The independent advisor, with a knowledge of construction and able to understand the client's business needs and objective, including any special needs of the users. Engaged very early in the project to give impartial guidance on the best way to proceed.
Client project manager	The individual or organization supplying the technical expertise to assess, procure, monitor and control the resources needed to complete the project. The client project manager should act in the client's interests and report directly to the project sponsor.
Consultant	An individual or organization producing design, cost, management or other advisory services.
Contractor	An individual or organization that contracts to undertake or manage construction work.
Designer	An architect, engineer, specialist consultant or contractor responsible for the design of part or all of a project.
Lead contractor	The organization that contracts with the client to construct (and sometimes design) the project. The lead contractor will usually engage sub-contractors to construct (and sometimes design) specific parts of the project.
Lead designer	The senior designer, usually an architect or engineer, responsible for co-ordinating the work of all other designers.
Planning supervisor	A competent individual or organization appointed by the client under the CDM regulations to co-ordinate health and safety issues during the planning and design phases of a project and to co-ordinate the production of the health and safety file.
Principal contractor	A competent contractor (usually the lead contractor) appointed by the client under the *Construction (Design and Management) Regulations 1994* (CDM regulations) to co-ordinate health and safety issue during the construction phase of the project.
Project sponsor	The senior executive from the client organization who is responsible for developing and delivering the project to meet the client's needs. The project sponsor manages the client's input to the project, co-ordinates the client's functional and administrative needs, works with stakeholders and users, resolves conflicts on the client side, and acts as the formal point of contact for the project team.
Project team	All the consultants, contractors, specialists and others who come together to design, manage and construct a project.
Specialist contractor	An individual or organization which specializes in the construction (and frequently design) of a particular element of a project, and which may be employed either as a sub-contractor or directly by the client.
Sub-contractor	An individual or organization employed by the lead contractor to construct (and sometimes design) part of a project.
Stakeholders	The key interested parties, such as investors and end-users, whose views must be taken into account during the development of a project.

In addition to the definitions of various responsibilities, there are further definitions of certain processes, stages and documents:

Concept design	The outline architectural and engineering design for the project, based on an early statement of client needs.
Construction	The process of constructing a building, a civil engineering project, or engineering construction work, including new structures, maintenance, repair and refurbishment.
Construction project	A series of activities to define, design, construct and put to use construction work.
Detailed design	The design which defines and details every component of the construction work.
In-project evaluation	A procedure for assessing the successes and failures of processes and participants when a project is in progress. The aim is to help to avoid poor performance, and rectify it quickly if it occurs.
Partnering	A relationship between parties to a project in which they work openly and jointly to achieve common objectives, with defined performance targets. Partnering may be entered into for a single project or a series of projects.
Post-project evaluation	A procedure following the completion and/or occupation of a project, which examines the successes, and failures of all aspects of project performance.
Procurement system	A method of obtaining and organizing the external resources needed to complete a project.
Project brief	The full statement of the client's functional and operational requirements for the completed project.
Project execution plan	The statement of policies and procedures designed to ensure that every aspect of the design and construction of the project is properly undertaken, within the clients constraints, and to achieve the stated objectives.
Qualification	The process of assessing potential contractors as suitable and competent to undertake certain types and values of construction work against general, rather than project specific, criteria.
Risk management	A systematic procedure to identify, assess, control and manage risk on a project in order to minimize potential damage or loss.
Selection	The whole process of identifying the best tenderer from the available field, through qualification, compiling the tender list, tendering and assessment.
Signing off	A process of formally recording the client's approval of briefing statements or design proposals.
Strategic brief	The statement of the broad scope and purpose of the project and its key parameters including overall budget and programme, agreed at an early stage of the project.
Value management	A structured approach to the identification and evaluation of project objectives and of the means by which these may be achieved in order to obtain value for money, using a specialist facilitator and workshop techniques.
Whole-life costs	The total cost of an asset over its lifetime, including initial capital costs, replacement costs, maintenance and repair costs.

Finally, *Selecting Consultants for the Team*, a document intended for use in conjunction with *Construction Success*, has its own glossary. This has only two terms in common with *Constructing Success* (project brief and qualification), both of which are provided with different definitions:

Client's brief	The document prepared by the client and/or consultants which details the client's requirements for the project.
Consultant's brief	Definition of what is required from the consultants in terms of work content and programme.
Feasibility study	An initial or outline study to ascertain the overall viability of the project or options prior to commencing major studies and cost commitment.
Project brief	Definition of the requirements of the client in terms of what, why and when.
Procurement	The whole process of selecting, tendering and appointing a consultant.
Pre-qualification or selection	The process of selecting consultants with the right qualifications to tender for the aspect of the project in question.
Qualification	The process of validating the technical and managerial competence, financial standing and resource capability of companies wishing to be considered for invitation to tender.
Quality	The degree of excellence that is required to meet the performance criteria established for the project.
Quality assurance	A system of demonstrating the attainment of quality standards in a project.
Quality threshold	The overall minimum safe level of quality, measured through weighted scoring, that is required from a consultant organization to fulfil its role on the project adequately.

4.11.2 General comments on CIB Scheme

The scheme in the *Selecting* consultants document has been produced to be used alongside *Constructing success*, but certain activities appear in a different sequence there. For example, the client's advisor is appointed after the strategic brief is developed, rather than at the beginning. Similarly, the client is urged to appoint a tender board "at the outset" in the *Selecting Consultants* document

This scheme contains the least detail of any. There are many definitions given, but each of the two documents considered had their own glossary, some of the entries giving contradictory definitions. There is some useful guidance on management of the design process, with clear identification of responsibility for Directing and for Approving work. In fact, the client is involved at every point in the scheme. The client project manager is responsible for most of the project management functions, but there is very little evidence of the need for Co-ordination in the documentation.

The definition of consultant encompasses the definition of designer, so both seem to apply to those with design responsibility. However, the distinction between consultant and designer seems not to be followed in the source documentation.

While the document raises valid questions and usefully considers the client's processes prior to design and construction commencing, there is little detail about the operational or managing systems to be adopted for a

Table 9: Analysis of CIB scheme

Stage	Operations	Complexity	Load	Decentralization	Interfaces	Control (%)	Co-ordination (%)
1	7	24	1.3	1.7	7	0	0
2	2	18	2.6	1.5	0	100	50
3	3	16	2.7	1.8	0	100	0
4	7	59	1.7	2.5	67	100	29
5	3	21	1.9	2.3	9	100	33
Total	22	138			83		
Average			2.0	2.0	17	80	22
Max		59		2.5	67		

project. Thus, this source document is not very useful for the purposes of the present study, being insufficiently detailed to provide guidance on managing the project management process. Terms are defined differently in each of the documents studied. Responsibility for management is not distinguished from operational responsibility.

4.11.3 Analysis of CIB scheme

The CIB scheme is analysed in Table 9, where comparison with other schemes reveals that this that documentation is not particularly detailed. There are only five stages, as in the BPF system, but only 22 operations and an organizational complexity of 138 in total, much less than any of the other schemes. The average load is 2.0, a higher figure than any other scheme, indicating that, on average, people are undertaking 2 different roles throughout the period of their involvement. Decentralization is at a level similar to the other plans. Interfaces are very few in number, with some stages containing no interfaces between participants at all. Control is very high indeed, running at 100% for all but the first stage. Co-ordination is patchy, as it is on most schemes.

4.12 PACE GC/Works/5

The Property Advisors to the Civil Estate (PACE) have developed an integrated package of documentation for use in government projects. The main form of building contract is GC/Works/1, and the consultants' agreement that has been produced for use in conjunction with this building contract is GC/Works/5 (Property Advisors to the Civil Estate 1998). This is published alongside guidance notes and model forms. GC/Works/5 is flexible in terms of the constitution of the project team. For example, the overall design function may be carried out by an architect or a building surveyor. Moreover, the lead consultant may be from any of the professional disciplines, so the functions shown for the lead consultant can be added to those for the relevant consultant.

Key: A – Does the work; B – Co-operates; C – Advises; D – Receives; E – Monitors; F – Supervises; G – Resources; H – Co-ordinates; I – Directs; J – Recommends; K – Approves	Employer	Project Manager	Lead consultant	Architect/Building surveyor	Quantity Surveyor	Structural engineer	Building services engineer	Civil engineer	Landscape architect	Sub-consultants	Contractor	Building services contractor	Sub-contractors	Suppliers	Site inspection staff	Geotechnical investigator	Local authority	Statutory authorities
Decentralization weighting	*1*	*2*	*3*	*3*	*3*	*3*	*3*	*3*	*3*	*4*	*4*	*5*	*5*	*5*	*3*	*5*	*6*	*6*
Stage 1 (RIBA: A to C)																		
Client's initial brief	A	D	D	D														
Identify options and expenditure limits	A	B	B															
Project procurement strategy	K	AJ	B															
Site selection and acquisition	A	BC	B															
Appointment of consultants	K	CJK	AJ															
Scope of the works	K	JK	AHJ	C	C	C	C	C	C									
Project programme	K	JK	AHJ	C	C	C	C	C	C									
Anticipated project costs	K	JK	AHJ	C	C	C	C	C	C									
Arrange site surveys	K	JK	AJ	C	C	C	C	C	C									
Survey of inspection	D		H	A														
Inspection of the property	D		H		A													
Structural survey	D		H			A												
Building services survey	D		H				A											
Civil engineer's survey	D		H					A										
Landscape architect's survey	D		H						A									
Building surveyor's inspection	D		H															
Client's initial brief				D	D	D	D	D	D									
Site inspection			H	A													C	
Site investigation	K		H	AJ														
Organize consultant team	K	AJ	H		C	C	C	C	C									
Surveys	K	AJ	H															

Key: A – Does the work; B – Co-operates; C – Advises; D – Receives; E – Monitors; F – Supervises; G – Resources; H – Co-ordinates; I – Directs; J – Recommends; K – Approves	Employer	Project Manager	Lead consultant	Architect/Building surveyor	Quantity Surveyor	Structural engineer	Building services engineer	Civil engineer	Landscape architect	Sub-consultants	Contractor	Building services contractor	Sub-contractors	Suppliers	Site inspection staff	Geotechnical investigator	Local authority	Statutory authorities
Cost advice	C		E	A														
Cost planning			E		A	B	B	B	B									
Preliminary feasibility studies	K	AJ	E	B	C													
Project proposals	K		E	AJ	C	BJ												
Geotechnical investigations	K		E			BJ			BJ							A		
Statutory approvals			E	A		B											K	
Confirmed brief	K	AJ	D															
Confirmed programme	K	AJ	D															
Confirmed cost limits	K	AJ	D															
Distribute confirmed brief			A	D	D	D	D	D	D									
Interaction with neighbouring properties	K	BJ	AJ															
Risk assessments		A	E	A	A	A			A									
Value management exercise		A	E	A	A	A			A									
Approval to proceed to Stage 2	K	JK	D	D	D	D			D									
Stage 2 (RIBA: D to G)																		
Project cost plan		H	BDH	BD	AD	BD	BD	BD	BD	D								
Project cash flow	K	JK	AJ															
Programme production of design info.		K	AJ	B	BCE	B	B	B	B									
Design development	K	H	EH		CDE	AJ	H	H	AJ									
Scheme design	K	HJ	EH	A	BCE	BEJ	BEJ	BEJ	BEJ									
Building services design	K	EH	EH				AHJ	H										
Investigate plant and equipment							A											
Civil engineering design	K	EH	EH	B	B	B	BH	AH										
Project team meetings		A	AEH	B	BCE	B	B	B	B									
Specify plant and equipment		EH	EH				AH											
Pre-tender quotations for plant and equipment	CK	EH	EH				AJ							C				
Specify specialist contractors and suppliers	K	AHJ	EHJ	B	BCE	ABJ	ABJ	ABJ	BJ	C			C	C				
Statutory requirements		EFH	BEHJ	A													K	
Cost and programme changes to brief	K	EH	EH	A	ACE	ACJ	ACJ	ACJ	ACJ									
Monthly progress reports	K	FJ	AEH				BC											
Material and construction specifications	D	AH	BEH	BE	BCE	B	B	B	B									
Completion of structural design		EH	EH			A	EH	EH										
Completion of building services design	K	EH	EH				AEH	EH										
Completion of civil engineering design	K	EH	EH				EH	AEH										
Complete landscape design	K	EH	EH				EH	EH	A									
Completion of design	K	HJ	EH	A	BCE	B	BEH	BEH	B									
Establish need for site inspection	CK		H	A	DE													
Statutory approvals	B	EFH	BHJ	B	BCE	BJ	B	BJ	BJ								K	K
Payment	AK	DJ	H	D	CE	D	D	D	D									
EC notices	AK	EHJ	B															

Key: A – Does the work; B – Co-operates; C – Advises; D – Receives; E – Monitors; F – Supervises; G – Resources; H – Co-ordinates; I – Directs; J – Recommends; K – Approves	Employer	Project Manager	Lead consultant	Architect/Building surveyor	Quantity Surveyor	Structural engineer	Building services engineer	Civil engineer	Landscape architect	Sub-consultants	Contractor	Building services contractor	Sub-contractors	Suppliers	Site inspection staff	Geotechnical investigator	Local authority	Statutory authorities
Life cycle costing	K	AEHJ	EHJ	B	BCE	B	BE	BE	B									
Environmental assessment	K	AEHJ	EHJ	B	BCE	B	BE	BE	B									
Identify procurement approach	K	AJK	BJ	BJ	BCEJ	B	BJ	BJ	B									
Design documentation	K	EHJ	AEH	BC	BCE	BC	BCE	BCE	BCE									
Bills of quantity, schedules, etc.		EH	EH	BC	A	BC	BCE	BCE	BCE									
Establish tendering arrangements	K	AJ		B	BE													
List tendering contractors	K	AJ	BH	B	BCE	AJ	BJ	BJ	BJ									
Pre-tender cost check	D		H	AH	CE	AH	AH	AH	AH									
Pre-tender estimate	K	EHJ	H		CE													
Risk assessments		A	H	A	CE	A	A	A	A									
Value management exercise		A	H	A	CE	A	A	A	A									
Approval to proceed to Stage 3	K	JK	HJ	D		D	D	D	D									
Stage 3 (RIBA: H & J)																		
Establish need for site inspection	CK					AD	AD	AD	AD									
Establish tendering arrangements	K	C	A			AJ	AJ	AJ	AJ									
List tendering contractors	K	JK	AJ	B	B	B	B	B	B									
Tender documentation			E															
Further design documentation						A	A	A	A									
Invite tenders	D	FH		A	A	A	A	A	A		C		C	C				
Calculate consultants' fees	A				C													
Site visits		E																
Tender queries	D	EH																
Appoint site inspection staff		EH																
Tender appraisals	K	HJ	C	A	C	AC	AC	AC	AC									
Arithmetical and technical check of tender		EFH		E	A													
Tender report	D			B	A	B	B	B	B									
Tender decision	K	J		D		D	D	D	D									
Contract documentation	D	H		A	B	B	B	B										
Anticipated cash-flow report	D				A													
Notify unsuccessful tenderers		A																
Arrange site possession		A																
Risk assessments		A		A	A	A	A	A	A									
Value management exercise		A		A	A	A	A	A	A									
Approval to proceed to Stage 4	K	HJ		AE	D	D	D	D	D									
Stage 4 (RIBA: K)																		
Administer the contract		A	B	B	B	B	B	B	B									
Contractor's programme		BK	B								C							
Agree date for starting site work	B	A	E								B							
Building services contractor's programme			E				A					C						
Project meetings	D	AD	BD	BD	BD	BD	BD	BD	BD	BD	BD	BD	BD	BD	BD			

Key: A – Does the work; B – Co-operates; C – Advises; D – Receives; E – Monitors; F – Supervises; G – Resources; H – Co-ordinates; I – Directs; J – Recommends; K – Approves	Employer	Project Manager	Lead consultant	Architect/Building surveyor	Quantity Surveyor	Structural engineer	Building services engineer	Civil engineer	Landscape architect	Sub-consultants	Contractor	Building services contractor	Sub-contractors	Suppliers	Site inspection staff	Geotechnical investigator	Local authority	Statutory authorities
Consultants' meetings		D	A	BD	BD	BD	BD	BD		BD	D	D	D	D	D			
Monthly progress reports	K	AJ	BE	B														
Safety policies		H	EH	E		E	E	E	E		A		B					
Health and safety statutory requirements				EH		E	E	E	E		A		A					
Quality management procedures		H	EH	E		E	E	E	E									
Adjudication of disputes	B	AF	A	B	B	B	B	B	B		B							
Identify needs for special inspections		D				A	A	A	A									
Tests and inspections	D	AHK	AE			AE	AEJ	AEJ	AEJ									
Claims administration	DK	AJ	BE		ACJ						C		C					
Construction work	D	E	E	E	E						A		A					
Identify contractual difficulties		DI	E	A		A	A	A	A									
Establish post contract control procedures		B	B	A	AB	AB	AB	AB	AB									
Variations to the works	A	A	A	A	C	A	A	A	A		C		C					
Updates to cash flow forecasts	D		E		A													
Construction records and photographs		H	EH															
Payment records		A	BE		C						C		C					
Cost control procedures			AE	B	B	B	B	B	B									
Consultants' financial statements	K	DJK	DEJ															
Certification		HK	EJ	A			A	A			D	D	D					
Site visits		H	EH	A	A	A	A	A	A		C		C					
Financial statements	D	D	D	D	A	D	D	D	D		C		C					
Monthly valuations of work in progress	K	K	E		AJ						C		C					
Arrange spare equipment	D	EH	E															
As-built' drawings	D	EH	E															
Maintenance manuals	D	EH	E															
General operational guidance	D	EH	E															
Notification of imminent completion	D	AD	A	A		A	A	A	A									
Commissioning tests							EHI	EHI			A	B						
Rectifying defects in commissioning							H	H			A							
Certification of completion		H	EH					A										
List of defects		EH	EH															
Stage 5 (RIBA: L)																		
Appoint operational and maintenance staff	A	C					C	C										
Record drawings and operational guidance	D	B	B	A	B	AB	AB	AB	AB									
Issue list of defects				A		A	A	A	A		D							
Rectification of all defects		E	E	E		E	E	E			A							
Cleaning, testing and commissioning		E	E															
Statutory certificates and approvals	D	DE	E															
Certificate making good of defects		E		A		A	A	A			D							
Claims administration	K	AJ																

Key: A – Does the work; B – Co-operates; C – Advises; D – Receives; E – Monitors; F – Supervises; G – Resources; H – Co-ordinates; I – Directs; J – Recommends; K – Approves	Employer	Project Manager	Lead consultant	Architect/Building surveyor	Quantity Surveyor	Structural engineer	Building services engineer	Civil engineer	Landscape architect	Sub-consultants	Contractor	Building services contractor	Sub-contractors	Suppliers	Site inspection staff	Geotechnical investigator	Local authority	Statutory authorities
Final valuation of the works	D		B	A	B	B	B	B	B									
Statement of final cost	D	D			A													
Report final cost of the works	D					A	A	A	A									
Final accounts and final certificates	K	HJ	H		AJ	A			A		D	D	D					
Completion report	D	A	B															
Insurance claims	A	B	B															
Documentation for arbitration or litigation	I	A	B	A	A	A	A	A										

4.12.1 Defined responsibilities in PACE scheme

The general conditions for the appointment of consultants contain the usual clause of definitions, in which certain terms are defined for the purposes of the contract. As such, although there is a specific definition for consultant, contractor, department, employer, project team, sole consultant and sub-consultant, the definitions tend to identify who each person is, by reference to other sections of the document into which names have been entered. As such there is no guidance about what is expected from each of these participants.

4.12.2 General comments on GC/Works/5

The systematic approach to the checklists in the appendices produces a very clear picture of responsibilities and interactions. There is clearly an intention for flexibility in the application of these conditions. For example, the architect and building surveyor have identical lists of duties, the intention obviously being that one or the other will carry these out, but not both. The documentation makes clear that one of the consultants will act as lead consultant, and in this case, the responsibilities will be added together. However, there are very few responsibilities for the lead consultant, other than to act as an assistant to the project manager, who seems to be in the key management position for the project.

Another interesting feature of this scheme is the absence of roles such as Planning Supervisor and Principal Contractor, for the purposes of Health and Safety legislation. The scheme was published after the legislation, so it is not clear why these roles are omitted.

Table 10: Analysis of PACE GC/Works/5

Stage	Operations	Complexity	Load	Decentralization	Interfaces	Control (%)	Co-ordination (%)
1	35	191	1.2	2.5	79	8	40
2	37	485	1.9	2.7	454	32	84
3	21	125	1.2	2.5	193	13	33
4	36	286	1.3	2.8	421	24	42
5	15	85	1.1	2.5	147	9	7
Total	144	1172			1294		
Average			1.3	2.6	259	17	41
Max		485		2.8	454		

Activities such as *undertake risk assessments* and *value management exercises* appear for most participants, in most stages of work, although sometimes in different sequences. Apparently, these items are a response to the government's "best practice" programme for the construction industry, but the arbitrary nature of their inclusion indicates that they are not activities that are well connected with the rest of the project work. Indeed, the general application of control to the project occurs at an operational level, with much repetition. In several cases, every consultant has the obligation to co-ordinate something or to ensure that something takes place. While this may have some contractual significance, it makes the issue of co-ordination very confused as there is not a clear, overall pattern of co-ordination that is obvious from the disposition of tasks and responsibilities.

4.12.3 Analysis of GC/Works/5

The results of the analysis of the matrix are shown in Table 10. In common with the BPF System and the CIB Scheme, there are only five stages, but the number of operations indicates a high level of detail in the documentation, and this is reinforced by a very high overall measure for organizational complexity. However, comparing the measure of complexity for each stage, a somewhat inconsistent pattern is evident. The load is very high in stage 2, but otherwise is broadly consistent between stages. Decentralization provides a consistent picture between stages and is not extreme. The number of interfaces between participants is very high, indicating that those who prepared this plan envisaged a large amount of interaction between participants, particularly at Stages 2 and 4. Control is patchy, as seems to be usual in such plans, and co-ordination is present in less than half the places where it might be. Both control and co-ordination seem at their lowest during Stage 5.

4.13 Process protocol map

The Process Protocol Map (PPM) has been produced by a research team at the University of Salford, in conjunction with industrial collaboration from the construction industry (Kagioglou *et al.* 1998). The purpose of this work is to increase co-ordination and decrease fragmentation, by applying organizational principles from manufacturing industries (Kagioglou *et al.* 2000).

Key: A – Does the work; B – Co-operates; C – Advises; D – Receives; E – Monitors; F – Supervises; G – Resources; H – Co-ordinates; I – Directs; J – Recommends; K – Approves	Client	Development management	Project management	Resource management	Design management	Production management	Facilities management	H & S, statutory and legal management	Process management	Change management
Decentralization weighting	*1*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*
Phase 0 – Demonstrating the need										
Client's strategic master plan	A									
Establish need for a project		A	B	B	C	C	B	C	A	C
Stakeholder list		B	B	B	C	C	B	C	B	C
Statement of need		B	B	B	C	C	B	C	B	C
Outline business case		A	B	B	C	C	B	C	A	C
Outline project execution plan		B	A	B	C	C	B	C	B	C
Outline process execution plan		B	B	B	C	C	B	C	A	C
Phase review report	K	B	B	B	C	C	B	C	B	C
Phase 1 – Conception of need										
Approval for funding	A									
Final stakeholder list		B	B	B	B	C	B	C	B	C
Final statement of need		B	B	B	B	C	B	C	B	C
Initial project brief		A	B	B	B	C	B	C	A	C
Updated business case		B	B	B	B	C	B	C	A	C
Design brief		B	B	B	A	C	A	C	B	C
Assess site and environmental issues		B	B	B	A	C	B	C	B	C
Updated project execution plan		B	A	B	B	C	B	C	B	C
Updated process execution plan		B	B	B	B	C	B	C	A	C
Phase review report	K	B	B	B	B	C	B	C	B	C
Phase 2 – Outline feasibility										
Introduce new participants		B	B	B	B	C	B	C	B	C
Appoint core teams		B	B	B	B	C	B	C	B	C
Revised project brief		B	B	B	B	C	B	C	B	C
Updated business case		A	B	B	B	C	B	C	B	C
Updated project execution plan		B	B	B	B	C	B	C	B	C
Updated process execution plan		B	B	B	B	C	B	C	B	C

Key: A – Does the work; B – Co-operates; C – Advises; D – Receives; E – Monitors; F – Supervises; G – Resources; H – Co-ordinates; I – Directs; J – Recommends; K – Approves	Client	Development management	Project management	Resource management	Design management	Production management	Facilities management	H & S, statutory and legal management	Process management	Change management
Initial performance management report		B	B	B	B	C	B	C	B	C
Undertake feasibility study for each option		A	B	B	B	C	B	C	B	C
Assess site and environmental issues		B	B	B	A	C	B	C	B	C
Phase review report	K	B	B	B	B	C	B	C	B	C
Phase 3 – Substantive feasibility study and outline financial authority										
Re-define project brief		A	B	B	B	C	B	B	A	C
Re-define business case		A	B	B	B	C	B	B	A	C
Consider project success criteria		B	B	B	B	C	B	B	B	C
Challenge the need(s)/opportunities		B	B	B	B	C	B	B	B	C
Conduct substantive cost/benefit analysis		B	B	B	B	C	B	B	B	C
Submit applications for statutory approval		B	B	B	B	C	B	B	B	C
Produce the concept design plan		B	B	B	B	C	B	B	B	C
Updated project brief		B	B	B	B	C	B	B	B	C
Updated business case		B	B	B	B	C	B	B	B	C
Initial procurement plan		B	B	A	B	C	B	B	B	C
Concept design plan		B	B	B	A	C	B	B	B	C
Define key systems and criteria		B	B	B	A	C	B	B	B	C
Revise site and environmental issues		B	B	B	A	C	B	B	B	C
Inform statutory criteria and regulatory issues		B	B	B	B	C	B	A	B	C
Initial CDM assessment		B	B	B	B	C	B	A	B	C
Revise project execution plan		B	A	B	B	C	B	B	B	C
Revise process execution plan		B	B	B	B	C	B	B	A	C
Initial IT communications strategy		B	B	B	B	C	B	B	B	C
Updated performance management report		B	B	B	B	C	B	B	B	C
Outline planning approval		B	B	B	B	C	B	B	B	C
Phase review report	K	B	B	B	B	C	B	B	B	C
Phase 4 – Outline conceptual design										
Define the systems		B	B	B	B	B	B	B	B	C
Define evaluation criteria		B	B	B	B	B	B	B	B	C
Identify major interfaces		B	B	B	B	B	B	B	B	C
Facilitate introduction of key system suppliers		B	B	B	B	B	B	B	B	C
Develop outline concept design		B	B	B	A	B	B	B	B	C
Inform design process		B	B	B	B	A	B	B	B	C
Refine project/system solutions		B	B	B	B	B	B	B	B	C
Develop basic schematics		B	B	B	B	B	B	B	B	C
Identify implications of system solutions		B	B	B	B	B	B	B	B	C
Identify production supply chain		B	B	B	B	B	B	B	B	C
Revise project brief		A	B	B	B	B	B	B	A	C
Revise business case		A	B	B	B	B	B	B	A	C

Key: A – Does the work; B – Co-operates; C – Advises; D – Receives; E – Monitors; F – Supervises; G – Resources; H – Co-ordinates; I – Directs; J – Recommends; K – Approves	Client	Development management	Project management	Resource management	Design management	Production management	Facilities management	H & S, statutory and legal management	Process management	Change management
Revise project execution plan		B	A	B	B	B	B	B	B	C
Initial cost plan		B	B	A	A	B	B	B	B	C
Updated procurement plan		B	B	A	B	B	B	B	B	C
Revise CDM assessment		B	B	B	B	B	B	A	B	C
Revise process execution plan		B	B	B	B	B	B	B	A	C
Revise communications strategy		B	B	B	B	B	B	B	B	C
Update performance management report		B	B	B	B	B	B	B	B	C
Phase review report	K	B	B	B	B	B	B	B	B	C
Phase 5 – Full conceptual design										
Review membership of design teams		B	B	B	B	B	B	B	B	C
Review evaluation criteria for concept des.		B	B	B	B	B	B	B	B	C
Identify some of the major systems		B	B	B	B	B	B	B	B	C
Develop system concept design		B	B	B	B	B	B	B	B	C
System interface studies		B	B	B	B	B	B	B	B	C
Identify resourcing requirements		B	B	B	B	B	B	B	B	C
Update project brief		A	B	B	B	B	B	B	A	C
Update business case		A	B	B	B	B	B	B	A	C
Update procurement plan		B	B	A	B	B	B	B	B	C
Full concept plan		B	B	B	A	B	B	B	B	C
Revise site and environmental issues		B	B	B	B	B	A	B	B	C
Update cost plan		B	B	A	A	B	B	B	B	C
Initial maintenance plan		B	B	B	B	B	B	B	B	C
Update CDM assessment		B	B	B	B	B	B	A	B	C
Update project execution plan		B	A	B	B	B	B	B	B	C
Update process execution plan		B	B	B	B	B	B	B	B	C
Update IT communications strategy		B	B	B	B	B	B	B	B	C
Update performance management report		B	B	B	B	B	B	B	B	C
Phase review report	K	B	B	B	B	B	B	B	B	C
Phase 6 – Co-ordinated design, procurement and full financial authority										
Review membership of design teams		B	B	B	B	B	B	B	B	C
Review evaluation criteria for concept des.		B	B	B	B	B	B	B	B	C
Fix major building elements		B	B	B	B	B	B	B	B	C
Update project brief		A	B	B	B	B	B	B	A	C
Update business case		A	B	B	B	B	B	B	A	C
Update procurement plan		B	B	A	B	B	B	B	B	C
Product model		B	B	B	A	B	A	B	B	C
Prepare work packages		B	B	B	B	A	B	B	B	C
Update cost plan		B	B	A	A	B	B	B	B	C
Update maintenance plan		B	B	B	B	B	A	B	B	C

Key: A – Does the work; B – Co-operates; C – Advises; D – Receives; E – Monitors; F – Supervises; G – Resources; H – Co-ordinates; I – Directs; J – Recommends; K – Approves	Client	Development management	Project management	Resource management	Design management	Production management	Facilities management	H & S, statutory and legal management	Process management	Change management
Update CDM assessment		B	B	B	B	B	B	A	B	C
Update communications strategy		B	B	B	B	B	B	B	B	C
Update project execution plan		B	B	B	B	B	B	B	A	C
Update process execution plan		B	A	B	B	B	B	B	B	C
Update performance management report		B	B	B	B	B	B	B	B	C
Phase review report	K	B	B	B	B	B	B	B	B	C
Phase 7 – Production information										
Review membership of design teams		B	B	B	B	B	B	B	B	C
Review evaluation criteria for concept des.		B	B	B	B	B	B	B	B	C
Review and update communications strategy		B	B	B	B	B	B	B	B	C
Finalize project brief		A	B	B	B	B	B	B	A	C
Procure work package suppliers		B	B	A	B	A	B	B	B	C
Start enabling works		B	B	B	B	A	B	B	B	C
Finalize business case		B	A	B	B	B	B	B	A	C
Update procurement plan		B	B	B	B	B	B	B	B	C
Finalize co-ordinated product model		B	B	B	B	B	A	B	B	C
Finalized cost plan		B	B	A	A	B	B	B	B	C
Monitor cost and quality		B	B	A	A	B	B	B	B	C
Production process map		B	B	B	B	B	B	B	B	C
Finalized CDM assessment		B	B	B	B	B	B	B	B	C
Finalize Health and Safety plan		B	B	B	B	B	B	A	B	C
Finalize project execution plan		B	A	B	B	B	B	B	B	C
Finalize process execution plan		B	B	B	B	B	B	B	A	C
Finalize performance management report		B	B	B	B	B	B	B	B	C
Phase review report		B	B	B	B	B	B	B	B	C
Phase 8 – Construction										
Finalize project brief		B	B	B	C	B	C	B	B	C
Finalize business case		B	B	B	C	B	C	B	B	C
Finalize project execution plan		B	B	B	C	B	C	B	B	C
Finalize process execution plan		B	B	B	C	B	C	B	B	C
Finalize drawings for construction		B	B	B	C	B	C	B	B	C
Finalize production information		B	B	B	C	B	C	B	B	C
Place all supplier bodies		B	B	B	C	B	C	B	B	C
Contingency plans		B	B	B	C	B	C	B	B	C
Develop operational product model		B	B	B	A	B	A	B	B	C
Handover plan		B	B	B	C	B	C	B	B	C
Implement handover plan		A	B	B	C	B	C	B	A	C
Monitor procurement		B	B	A	B	B	B	B	B	C
Monitor cost and quality		B	B	B	C	B	C	B	B	C
Manage and undertake construction		B	B	B	C	A	B	B	B	C

Key: A – Does the work; B – Co-operates; C – Advises; D – Receives; E – Monitors; F – Supervises; G – Resources; H – Co-ordinates; I – Directs; J – Recommends; K – Approves	Client	Development management	Project management	Resource management	Design management	Production management	Facilities management	H & S, statutory and legal management	Process management	Change management
Manage on-site resources and labour		B	B	B	C	A	B	B	B	C
Revise and implement		B	B	B	C	B	A	B	B	C
Manage health and safety		B	B	B	C	B	B	A	B	C
Phase gate review		B	B	B	C	B	C	B	B	C
Phase 9 – Operation and maintenance										
Handover		B	B	B	C	C	B	B	B	C
Post-project review		A	B	B	C	C	B	B	A	C
Examine fulfilment of success criteria		B	B	B	C	C	B	B	B	C
Establish continuous communications		B	B	B	C	C	B	B	B	C
Ongoing review of assets		B	B	B	C	C	B	B	A	C
Consider facility life cycle		B	B	B	C	C	B	B	B	C

4.13.1 Defined responsibilities in Process Protocol

Apart from stakeholders, no participant roles are explicitly defined in this document. Instead, the concept of "activity zones" is introduced, which are described as sub-processes involving not only functional expertise, but the whole supply chain related to the eventual output of an activity, specifically suppliers, production, continuous client input. This short list highlights a recurring problem with the document; that participants, processes, objectives and outputs are frequently dealt with as interchangeable concepts. Thus, an activity zone is a team of people, as well as a sub-process and a management procedure. This makes it very difficult to identify specific responsibilities with particular participants.

4.13.2 General comments on Process Protocol

Within the PPM, there is no identification of the relationship between participants and their activities. Because of this lack of clarity, certain assumptions have been made in compiling the matrix. First, the outline PPM chart shows what appear to be the most important activities in relation to each other and in relation to advancing the project. Primary responsibility is portrayed here, so these relationships are identified in the matrix with the code "A" (doing work). Second, the text of PPM identifies several activity zones with "prime responsibility" in each "phase", and these are identified in the matrix with the code "B" (co-operating). Finally, the PPM makes clear that every other activity zone has potential involvement, thus they are identified in the role of "C" (consulting) in the

matrix, indicating that they are consulted and contribute advice and information, but not with responsibility for discharging the activity. There is no mention of any specific management role for any participant in the process, other than labelling every activity zone as "management". Thus, it was not possible to enter any of the role codes associated with control or management in the matrix.

There is a clear articulation in this document that the aim is to provide a framework for carrying out *any* construction project. In this sense, it seems to go against one of the most basic tenets of contingency theory, that there is not one best way to organize. As with many plans of work, there is no attempt to identify the kinds of project for which the PPM is most suited.

The document is useful in identifying the types of documentation that emerge from the processes (deliverables), but it is done at the same level of detail as the RIBA Outline Plan of Work, rather than the detailed plan of work. This is alluded to in a paper by the same authors (Kagioglou *et al.* 2000) in which they state that the mapping of sub-processes within the activity zones is the next step in developing the PPM.

The introduction states that this document applies principles from manufacturing, although it is not specific about which of the manufacturing industries it draws from. The vocabulary that is used throughout the document is currently widespread in industrial production, but the protocol map does not lend itself to systematic analysis, even though the analytical techniques used in this research are based on techniques developed in the same kinds of industry that this protocol map appears to draw from.

The structure of the PPM is based on the identification of outputs (deliverables), and nine areas of responsibility (dubbed "activity zones") are attributed to the work that needs to be done. Projects are split into "phases" that require review and decision between each phase. However, unlike other plans of work, the document makes no attempt to identify the operational steps that are required at each point and does not indicate how participants relate to the work at hand. Although they make clear which of the types of activity are relevant at each step, there are rarely less than six of the nine "activity zones" directly involved, and an indication that the others will potentially be involved. The nature of their involvement is not indicated.

The distinctions between tasks, decisions and responsibilities are not clear. The definitions of "activity zones" appear to define teams of people, but only loosely. People are simultaneously members of many activity zones, and all activity zones apply to all defined tasks and stages. In fact, the "activity zones" focus partly on the way that people relate to the work, for example, resourcing issues are dealt with by a resource team: so some "zones" are defined by the relationship between participants and their work. Other "zones" are defined by the type of operational work, such as facilities management or design management. The desire to apply the vocabulary of industrial manufacturing seems to have overridden the need to identify the

Table 11: Analysis of PPM

Phase	Operations	Complexity	Load	Decentralization	Interfaces	Control (%)	Co-ordination (%)
0	8	65	1.0	1.9	94	0	0
1	10	83	1.0	1.9	159	0	0
2	10	91	1.0	2.0	159	0	0
3	21	190	1.0	2.0	465	0	0
4	20	181	1.0	2.0	572	0	0
5	19	172	1.0	2.0	543	0	0
6	16	145	1.0	2.0	462	0	0
7	18	162	1.0	2.0	519	0	0
8	18	162	1.0	2.0	337	0	0
9	6	54	1.0	2.0	99	0	0
Total	146	1305			3409		
Average			1.0	2.0	341	0	0
Max		190		2.0	572		

minimum necessary and sufficient categories of activity, decision, participant and relationship that would crystallize a clear view of design and construction management.

The terminology in the PPM is inconsistent. There is some confusion in that the text of the document uses terms that differ from those on the outline chart (for example, “update” is consistently used in the text, whereas the outline chart never mentions updates, but does use “revise” in a more or less similar way). There is no apparent reason for this difference. In the outline “map” certain tasks appear with different names to those in the full document. For example, in Phase One, “Prepare Project Brief” seems to correspond to “Project Brief (Initial)” in the main document. Similarly, “Revise Business Case” becomes “Business Case (updated)”. Moreover, many of the “deliverables” that are listed in the main document are not identified in the “map”. This does not seem to help the objectives of explaining and clarifying the processes of design and construction management.

4.13.3 Analysis of PPM

The number of phases indicates that there are many opportunities for the client to review progress and make key decisions on the project. The number of operations is of a similar magnitude to many other plans of work, but this strict count disguises the repetition of operations throughout the PPM. In line with their policy of “progressive design fixity”, the authors identify the revision, updating or development of each previous output in every subsequent stage. This leads to a pattern in which operations are repeated in the same cycle during each phase. The involvement of every “activity zone” at every stage inevitable leads to a very high count for organizational complexity in this analysis. Similarly, the approach in the PPM results in no activity zone having more than one role code, producing a (perhaps misleading) load of 1.0 throughout the matrix. The measure for decentralization is also somewhat artificial here,

as the PPM does not seek to disentangle the separate management and operational roles in the project. For the same reason, control and co-ordination score zero, and the number of interfaces between participants is extremely high.

Because the authors of the PPM do not seek to allocate specific responsibilities to individual roles, the document does not provide a basis for comparison with the other plans analysed. Therefore, in subsequent sections, no comparisons are drawn with the PPM.

5 SUMMARY AND ANALYSIS OF SOURCE DOCUMENTS

The collation and analysis of the matrices provides a basis for comparison between different types of documentation, based on the organizational theory reported earlier.

5.1 General comparative analysis

The plans of work analysed here display diverse characteristics, summarized in Table 12, which brings together the measures derived from the analyses in Section 4, omitting the Process Protocol Map because it does not allocate responsibilities to individual roles.

The numbers of stages varies from 5 to 12. Apart from BS 7000 producing 8 stages, the schemes come out at one or other of the extremes, indicating a strong clustering of views around either 5 stages or 12. Given that the primary defining characteristic of a stage of work is that it provides opportunities for key control decisions on the part of the client, more consistency might have been expected here.

Numbers of operations are similarly widely spread, but the CIB scheme is significantly below anything else, with only 22 operations. There is no relationship between number of stages and operations. Discounting the extreme value for CIB, the average of the remaining schemes is 135.

Table 12 shows a wide range for the measure of organizational complexity, from 138 for the CIB scheme, to 1172 for PACE, with an average of 692. Although it is counter-productive to provide over-complex arrangements, organizational theory holds that complex situations demand complex organizations (see Section 3.2, page 18). The CIB, BS and CIC schemes portray the least complex picture of construction projects, whereas PACE scores double the average for organizational complexity. This highlights a major problem for the authors of such documents. The complexity of the organizational structure is fixed by the way that it is described, but the complexity of construction projects is very diverse, and those who organize projects need to identify an organizational structure appropriate to the demands of the particular project. It would appear from this analysis that the CIB scheme is suited to projects of lower complexity than, say, BS 7000.

Most figures for load are close to the overall average of 1.4, indicating that this is perhaps typical, since only two schemes stray far from this. The CIB scheme produces a disproportionately high load, due to the combining of many roles for each participant, whereas RIBA 2000 produces an overall load of 1.1, as few participants are allocated dual roles.

Table 12: Overall summary of analysis of plans of work

	JCT	BPF	BS	R 1964	R 2000	CIC	CIB	PACE
Stages	12	5	8	11	11	12	5	5
Operations	135	127	62	184	186	107	22	144
Complexity	937	556	259	1032	1020	424	138	1172
Load	1.4	1.4	1.3	1.4	1.1	1.2	2.0	1.3
Decentralization	2.8	2.2	2.6	3.0	3.2	3.0	2.0	2.6
Interfaces	577	566	259	1032	1046	412	83	1294
Control	18	27	25	7	0	12	80	17
Co-ordination	72	27	56	1	38	2	22	41

Decentralization tends to vary widely and produces an average of 2.7. The lowest examples are CIB and BPF, indicating that there is little delegation of client authority. The highest are CIC and the two RIBA plans, indicating that much delegation of authority is envisaged. The number of interfaces is a further measure of the perceived complexity of the construction process, in that it indicates how the various participants might interact with each other. This is consistent between JCT, RIBA and CIC and it is interesting that both of the RIBA plans are similar to each other, but quite high. PACE contains more interfaces between participants than all of the other schemes. The CIB scheme identifies very few interfaces, indicating a very simple approach to the design and construction process.

Finally, the measures of control and co-ordination produce highly variable results. This seems to be connected more with the policies of those who drafted the schemes than with the lack of such management procedures in projects. It must be said that co-ordination by hierarchical position (as measured here) is only one means of achieving co-ordination. Other means included standardization, meetings, professionalization, informal communications and the identification of sub-projects, all of which are routinely observed in construction projects. However, control should usually be more formalized and, in most schemes, the lack of definition of responsibility for effective control should be a cause for concern.

Overall, there is an enormous amount of variability in the terms used to describe construction project management responsibilities, not only between published schemes but also in some cases, within schemes. There is no consensus about what to call those project participants who are not contractors. Even the term “client”, universally adopted in plans of work, is not used in contracts. One difficulty that has emerged from this work is the fact that similar words are used to describe processes and outputs (documents); for example scheme design and detail design could be either a process or an output. The fact that this is not explicit in any of the documents may indicate that it is an issue not normally considered.

In conclusion, while there is much guidance about the operational steps needed to undertake a construction project, there is no previously published document offering definitive guidance on the terminology to be used in describing the responsibilities of construction project participants. The

analysis shows that there is a wide range of interpretations about what is involved in designing and constructing a building.

5.2 Comparison of titles

Data from the matrices has been summarized and cross-tabulated in Table 13. Again, the Process Protocol Map is omitted from this comparison, as it does not identify any titles. It is difficult to draw general conclusions from these cross-tabulations, but one that suggests itself is that the drafters of the various source documents have approached their task in two different ways. First, there are those whose choice of title for any given responsibility emphasizes the function that is performed by that project team member (thus: “designer”; “cost consultant”). Examples of this approach may be seen in the JCT, BS 7000 and CIB columns. Second, there are those who prefer to emphasize the person who would normally be expected to fulfil this responsibility (thus: “architect”; “quantity surveyor”; “engineer”). Examples of this approach may be seen in the BPF and RIBA columns. It is interesting that the desk study revealed occasional comments that implied support for the former approach.

On more detailed matters, it is noticeable that the only titles universally adopted are those of “client” (with one exception) and “contractor”. This is interesting in itself, given that the majority of building contract drafters appear to prefer the term “employer” to that of “client”. “Planning supervisor” is also used by all except the BPF form, and would presumably also be adopted there, were an up-dated version to be published.

As to most other titles used, what is striking is the diversity of terms appearing in the various source documents. In relation to design, for example, six of the documents describe three different types of designer (architectural, structural and services); six also recognize the concept of a lead designer. This reflects common ground among some of the schemes indicating a difference between those whose role is limited to design input and those with some kind of management role. However, the only common ground in the entire design field lies in the fact that usually less than half of the documents use term such as “structural engineer” or “building services engineer”. It seems doubtful that such variations (especially the more minor ones, such as “designer (architect)”; architect (design function)”; and “architect (design)” are really intended to convey different shades of meaning.

In relation to those persons or organizations external to the project team (such as planning authorities), a similar divergence is evident. This is, if anything, more surprising, since one would expect to find an “official” title for those bodies invested with statutory responsibilities. The number of responsibilities described by the source documents ranges from 12 in CIC to 21 in the CIB scheme.

Table 13: Comparison of titles used for responsibilities

JCT	BPF	BS 7000	R 1964
Client	Client	Client	Client
Feasibility consultant		Advisory group	
Consultant team manager	Client's representative		Architect, mgmt function
Lead designer	Design leader	Design team leader	
		Design unit leader	
		Design facility manager	
Designer (architect)	Architect	Designer	Architect, design function
Designer (structural)	Structural engineer	Designer	Engineer, civil and structural
Designer, (building serv.)	Building services engineer	Designer	Engineer, mechanical & elec.
Lead cost advisor			Quantity surveyor
Cost advisor			
Specialist	Specialist contractors	Specialist advisor	Specialist contractors
			Specialist suppliers
(Contract administrator[1])	Supervisor		
Planning supervisor		Planning supervisor	Planning supervisor
Development control auth.	Planning authority	Planning authorities	Planning officer
Statutory and other utilities	Statutory authorities	Local utilities	Statutory bodies
Other approving bodies (implied)			
Health & Safety Executive			
Tendering contractors			
	Site investigation contractor		
			Site inspectorate
			Clerk of works
			Demolition contractor
Principal contractor			
Contractor	Contractor	Contractor	Contractor
Sub-contractors		Sub-contractor	
	Client's direct contractors		

[1] Mentioned in the documentation, but no responsibilities are specifically allocated.

Table 13 Continued

R 2000	CIC	CIB	PACE
Client	Client	Client	Employer
		Project sponsor	
Architect as lead consultant	Team management	Client project manager	Project manager
		Stakeholders	
Architect as design leader		Lead designer	Lead consultant
Architect as designer	Architect (design)	Consultant designer	Architect/ building surveyor
Structural engineer	Structural engineer	Consultant designer	Structural engineer
Building services engineer	Services engineer	Consultant designer	Building services engineer
			Civil engineer
Quantity surveyor	Cost consultant	Consultant	Quantity surveyor
		Consultant	
			Landscape architect
			Sub-consultants
	Specialist sub-contractors	Specialist contractors	
	Steelwork sub-contractor		
	M & E services sub-contractor		Building services contractor
			Suppliers
Contract administrator	Contract administrator		
Planning supervisor	Planning supervisor	Planning supervisor	
Development control auth.			Local authority
Statutory and other utilities			Statutory authorities
Health & Safety Executive			
Tendering contractors			
			Geotechnical investigator
Site inspectorate			Site inspection staff
Principal contractor		Principal contractor	
		Lead contractor	
Contractor	Contractor	Contractor	Contractor
Statutory undertakings			
Sub-contractors		Sub-contractor	Sub-contractors
		Adjudicator	
		Mediator	

5.3 Comparison of stages (outputs)

The stages of work are broadly in line with each other, revealing consistency at the most general level. BS 7000 is not intended to deal with construction operations; so little mention is made of stages after detail design. The difference between the JCT stages and the CIC stages is surprising given that the latter was intended to be modelled on the former. The CIB stages seem much more basic than those in the other schemes.

Table 14: Comparison of stages described in plans of work

JCT	BPF	BS 7000	R 1964
A Appraisal	1 Concept	Inception and initial brief	A Inception
B Strategic briefing	2 Preparation of brief	Feasibility study and brief development	B Feasibility
C Outline proposals		Conceptual design	C Outline proposals
D Detailed proposals	3 Design development	Scheme design	D Scheme design
E Final proposals		Detail design	E Detail design
F1 Production information		Information for construction	F Production information
F2 Production information			
G Tender documentation	4 Tendering		G Bills of quantity
H Tender action			H Tender action
J Mobilization			J Project planning
K Construction to practical completion	5 Construction	Construction	K Operation on site
L After practical completion			L Completion

Table 14 Continued

R 2000	CIC	CIB	PACE
A Appraisal	A & B Appraisal and strategic briefing	Getting started	Stage 1
B Strategic briefing		Defining the project	
C Outline proposals	C Outline proposals	Assembling the team	
D Detailed proposals	D Detailed proposals		Stage 2
E Final proposals	E Final proposals		
F Production information	F1 Production information		
	F2 Production information		
G Tender documentation	G Tender documentation		
H Tender action	H Tender action		Stage 3
J Mobilization	J, F2 & K Mobilization, post-production information and construction		
K Construction to practical completion		Designing and constructing	Stage 4
L Construction after practical completion			Stage 5
		Completion and evaluation	

The variety of terms adopted is clear from Table 14, which portrays an initial comparison by placing similar stages in parallel with each other. The initial stages of a project are the most inconsistent, with the design stages becoming more consistent. Overall, there is little consistency in the number of stages, or their titles.

For the purposes of developing a basis for subsequent definitions of roles, it is important to develop a terminological structure for the names of distinctive stages through which a project typically progresses. This will enables participants' roles to be developed in relation to the output of each stage. The analytical matrices show where and how the nature of participants' contributions changes and these have already been

summarized. Here, the information from the matrices is examined from the point of view of how each stage of the project appears to be described. Table 14 is used as the basis for imposing a neutral structure on these descriptions, so that the starting point for discussing the plans of work is independent of any particular plan. In ascertaining the extent to which there are distinct differences between stages, the analytical tables at the end of each matrix are also useful. For example, Table 3 (page 46) shows few differences between stages A & B, but then a significant shift into stage C, which produces similar measures for organizational complexity, load, decentralization and interfaces as stage D. By the same measures, Stage E seems to differ from stage D. In this way, the analyses help to highlight differences and similarities between stages.

In the broadest terms, this shows that a project must begin with some kind of definition of what is intended, followed by design work. Various processes of contract formation precede the actual construction work. Information continues to be provided by the design team during construction and at the end of the project, there is usually specific activity associated with bringing everything to completion. This provides five basic types of work that are fundamentally different from each other:

1. Defining the project
2. Design work
3. Contract formation
4. Construction work (including provision of detailed information)
5. Completion of the project

Each category may contain several stages (design nearly always does), and there are complex interactions between stages. At every point, management effort is needed to maintain progress of the project and to ensure that the project is appropriate to its context (business, social, statutory, etc.). Thus, there are both internal and external demands on the management system.

In this analysis, a broad categorization emerges for stages of work, which splits the work into definition of the project, design, contract formation, construction work and completion. These categories (rather than stages) of work have been chosen because it appears that the nature of the work in each is substantively different. Moreover, the aim of developing this terminology is to produce a structured definition of terms that is independent of institutional or other interests. For this reason, the grouping and classification of project stages begins with neutral groups of ideas.

5.4 Project definition

There are usually two steps in the process of defining the project: selecting appropriate expert advisors and using their advice to decide on the scope and content of the potential project.

5.4.1 Selecting appropriate expert advisors

All of the plans of work cover the appointment of consultants and the project team to varying degrees.

- JCT Draft Schedule of Services: The appointment of consultants takes place at the beginning of stage C, outline proposals and is undertaken by the "client". The documents state that the planning supervisor is appointed before this stage.

- BPF identify the appointment of consultants at every stage in the process except construction, undertaken by "client" with the "client's representative" advising and monitoring. Once the "design leader" is on board, he also advises the "client". At tendering stage, when appointing specialist consultants, the "building services engineer" also advises the "client".

- BS 7000 begins with "client" appointing a "design team leader" and establishing an "advisory group" which is only involved in the "inception and initial brief" stage of the project. The "design team leader" appoints the "design team" with the approval of the "client" during the "feasibility study and brief development" stage.

- RIBA 1964 shows that the "architect" is appointed first, during "Inception". The "architect" is expected to ensure that the practice has the appropriate resources for the commission. During the same stage the "client" appoints the other consultants. During the "Feasibility" stage, the "client" on the advice of the "architect" confirms the appointments.

- RIBA 2000 simply states that one of the assumptions made is that the consultant team has been appointed, comprising architect, quantity surveyor, structural engineer, building services engineer and planning supervisor. Other assumptions are made about the form of the appointment.

- CIC begin their document with the "client" appointing consultants at the stage of "appraisal and strategic briefing". Consultants are also appointed during "outline proposals".

- CIB begin the "getting started" stage with the nomination and appointment of a "project sponsor" and the appointment of a "client advisor" and a "client's project manager". The "client's project manager's" appointment is made by the "project sponsor" with the

"client's" approval and the co-operation of the "client advisor". The CIB identify a stage called "assembling the team" during which the "project team" is appointed by the "client" with the "client project manager" operating in a controlling capacity.

- PACE includes model forms for the appointment of consultants and the descriptions of each consultants' role begin with receiving an initial brief from the Employer. Some of the descriptions precede this with an initial inspection and report to be submitted to the Employer, presumably helping to identify the exact scope of the work for which the consultant is appointed.

Generally, the appointment of consultants initiates the process and those appointed first advise on subsequent appointments. The various plans of work go to some detail in identifying the steps required to appoint the project team. The main point from the desk study seemed to be that it is essential to select the team carefully, as so much depends on the ability of these people to form a cohesive and responsive team. However, most documents focus on the mechanics of the process, rather than setting up a useful pattern of interrelationships.

5.4.2 Defining the purpose of the project

Once consultants are appointed, a certain amount and type of activity is generally defined before design work can commence. The emphasis on what happens at this point varies between the schemes, although there is a degree of consistency:

- The JCT identify this stage as "strategic briefing", but consider it outside the design and construction process, so provide little guidance as to what is involved. There is not necessarily a project until after this stage, so there is no reason for the contracts and schedules of service to deal with this.

- The BPF refer to "preparation of the brief", but make it clear in the detail of their plan of work that this takes place in conjunction with the initial design proposals. The initial stage involves quite a lot of detail in terms of project planning and interaction between participants. There is mention of feasibility studies and identifying details of the site. Many of the items identified here are repeated in subsequent stages, indicating that much of the work continues in parallel, and interactively.

- BS 7000 identifies "feasibility study and brief development" as a stage. As well as the operational aspects such as feasibility study, needs evaluation, initial design work and site investigations, there is much detail about planning the management and control of the project.

- RIBA 1964 defines "feasibility" as including initial design work, feasibility studies, site investigation work and the planning of the control and management procedures for the project.

- RIBA 2000 identifies "appraisal", involving clarification of objectives and determining the best way of proceeding. If a building project is needed, then the process moves to "strategic briefing", which is specified as a responsibility of the client. Thus, there is nothing more than an indication of what might be covered and who might participate.

- CIC merge all of the pre-design activity together under the heading of "appraisal and strategic briefing". This includes feasibility study, surveys, initial design ideas and the preparation of a strategic brief.

- CIB identifies "getting started" and "defining the project". It is interesting that this scheme should split the initial project work into two stages, since the majority of the work on the project is subsequently wrapped up into one large stage. The initial stage involves, among other things, confirming the business case, developing a project strategy, a strategic brief and an execution plan.

- PACE draws together all of the initial stages of a project into Stage 1, which is equates to Stages A to C of RIBA 1964. Unlike any other plan of work, the stages of work described in PACE are not named, merely numbered.

Generally, the work at this stage involves some kind of feasibility study, an assessment of the extent to which a construction project will fulfil the client's needs, planning the control and management strategies, and initial ideas for the design of the project. There are differences of detail and of vocabulary among the schemes analysed, but the sense of what is being defined seems fairly consistent.

5.5 Design work

Most of the plans of work separate design into stages, usually three.

- JCT identify "outline proposals", "detailed proposals" and "final proposals". During "outline proposals", the key operations are developing the strategic brief into a project brief, developing a conceptual design strategy and considering the general constraints and options. During "detailed proposals" the "project brief" is finalized, constraints and options are considered and detailed design proposals developed. During "final proposals", a similar pattern emerges.

- BPF identify one stage called "design development", during which the design and the brief are developed interactively. However, during an earlier stage ("concept"), "concept design proposals" are prepared and during the subsequent stage ("tendering"), the "final design proposals" are submitted.

- BS 7000 identifies a preliminary design during "feasibility study and brief development", a "conceptual design", a "scheme design" and "detail design", the latter three being stages in their own right.

- RIBA 1964 identifies design work during the "feasibility", "outline proposals", "scheme design" and "detail design" stages.

- RIBA 2000 shares the same stages as the JCT scheme.

- CIC identify "sketches of ideas" during their first stage, then have three stages called "outline proposals", "detailed proposals" and "final proposals", all of which are broadly in line with the JCT draft schedule.

- CIB simply identify "designing and constructing" as one whole stage, but identify separate operations within it, such as "develop the concept design" and "develop the detailed design". Unlike the other schemes, there seems to be no initial, outline design work.

- PACE describes Stage 2 as comprising Stages D to G in RIBA 1964. By combining these into one stage, PACE reduces the level of detail required to describe the work envisaged.

There is a broad consensus among the eight plans of work that an initial idea for the project arises during the earliest stages of brief development and assessing the need for the project. This then forms the basis for three distinct stages of design, which differ from each other in that each adds significantly to the detail of the previous stage as the various aspects and sub-systems of the design are rationalized and documented.

The detail in the matrices indicates that the identification of sub-stages in design is connected with the need for obtaining statutory approvals of various sorts. In some cases, the "pinch-points" created by these necessary approvals are also used for obtaining client approval for the work so far and commitment for the next stage. While the operational aspects of this process are generally very clearly articulated, the management and (particularly) decision-making structures imposed on it are not as clear or consistent.

5.6 Contract formation

Between design and construction, a decision is generally required about who is going to build the project, and under what contractual conditions.

- JCT identify "production information" in two stages, the second of which happens in parallel with "construction". They also separately identify "tender documentation" and "tender action".

- BPF identify "tendering" as the stage between "design" and "construction", incorporating further detailed design work and the negotiation of various contract documents.

- BS 7000 identifies "information for construction" as the stage between design and construction, acknowledging that there is a distinct phase, incorporating further design information.

- RIBA 1964 identify stages of "production information", "bills of quantity" and "tender action". These are followed by a stage of "project planning", intermediate between forming contracts and executing work.

- RIBA 2000 shares the same approach as JCT, although it is presented in a slightly different way.

- CIC go to a lot of detail in distinguishing "production information" from "tender documentation" and "tender action". They also create a secondary "production information" stage, acknowledging the overlap of this work with the "construction" stage.

- CIB make no mention of production information or contract formation.

- PACE adopts a similar approach to RIBA 1964, merging stages H and J into Stage 3.

The process at this point often incorporates the development of bills of quantity, or some other documentation for pricing, and the preparation of highly specific production information, which may be dependent on a proprietary installer. The needs for detailed installation documentation are driven on the one hand by the technical nature of the process and on the other by the need for clarity in the commercial process of negotiating a deal which is buttressed with some sort of contractual recourse in the event of non-performance. Because more detail is being generated and documented, every aspect of it needs to interact with the design done to date, so there is inevitably the need for further design activity.

From this analysis, contract formation seems generally to encompass three distinct types of activity; information for site work, information for tendering and contractor selection (tendering).

5.7 Construction

Once the contractor is appointed, work starts on site. Most plans of work acknowledge the impossibility (and inadvisability) of documenting everything before construction work begins, by identifying continuing documentation during the construction process. All those prepared since the implementation of the CDM Regulations cover the operations associated with preparing the relevant documentation.

- JCT identify two aspects of construction work, “mobilization” and “construction to practical completion”. This includes carrying out contracted functions, further detailed information provision, inspections, claims administration, testing and commissioning and management and control procedures.

- BPF provides for one stage of “construction”, encompassing further detailed design work (including contractor’s design) inspections, management and control processes, payment, adjudication and so on.

- BS 7000 identifies “construction” and this includes the provision of design information, construction operations, contractor’s design, inspections, preparation of operating and maintenance manuals and completion of record drawings.

- RIBA 1964 describes “operations on site” and includes site meetings, contract administration, management and control procedures, commissioning and testing and preparation of a maintenance manual. Construction operations, as such, are not mentioned.

- RIBA 2000 shares the same definitions as JCT.

- CIC identifies three stages of “mobilization”, “post-production information” and “construction”, but fails to draw distinctions between them. Much is made of the information flow between the various participants, but no mention is made of construction operations as such, or of completion.

- CIB include construction with design in one stage. Although “start construction” is mentioned, along with payment, problem resolution and some control and management functions, there is little else of substance.

- PACE equates the fifth stage to Stage K (Construction) of RIBA 1964 and describes it in considerably more detail.

Construction is the most obvious stage of a building project, but there is much variability in the detail of the various source documents. Those schemes that cover it in the most detail do not seem to differ significantly.

5.8 Completion

Most schemes identify a project stage after the point at which the construction work is completed. This later stage may include such activities as putting right defective work, commissioning and ascertainment of the final account.

- JCT identify in some detail the work that takes place in terms of inspections, rectification of defects and progress reports. "Testing and commissioning" are part of the "construction" stage.

- BPF includes completion activities within the "construction" stage, dealing with claims, insurances, rectification of defects, maintenance and management manuals and commissioning.

- BS 7000 does not deal with completion, probably because it is a document that focuses on the management of design work.

- RIBA 1964 identifies "completion" and includes inspection (including sub-contracts), training of client's staff, insurances, certification, remedial work and final account.

- RIBA 2000, like JCT, identifies in some detail the work that takes place after practical completion.

- CIC do not provide for a stage labelled completion. The scheme finishes with construction.

- CIB identifies "completion and evaluation", but with little detail about what might be involved.

- PACE equates the fifth stage with Stage L from RIBA 1964, and covers the same activities to a similar level of detail.

Overall, there is clearly a significant amount of work that takes place in this final stage of a project, but tremendous variation in the extent to which it is actually described in the various source documents. Those who do cover it tend to pick up similar points to each other, but each has its own focus.

5.9 Establishing a basis for a terminology of titles

The comparative analysis shows that there is considerable variety in the detail of the plans of work, underpinned at a broader level of detail by a consistent need for a project to move through a few fundamental stages. Although it is clear from the literature on organizational structure that stages should be punctuated by clear decision points, it is often difficult to discern such decision points in the plans of work. They have largely been produced for the purposes of planning the operational work on a project, rather than as a basis for planning the management and decision-making procedures. This is particularly so for the older plans and schemes, less so for the JCT draft schedule of services and RIBA 2000.

The titles used for describing the various participants in a construction project are often selected on the basis of historical antecedents. The connotations of each title are sometimes not entirely clear. The analysis

undertaken so far shows that duties are best described in terms of what each person does in relation to the output being produced. Therefore, in order to develop a terminology of titles, the vocabulary for describing project contributions first has to be developed. This requires definitions for outputs and definitions of how people are related to the outputs (verbs) that can subsequently be used for describing the roles and duties usually associated with projects.

In order to inform this exercise more comprehensively, it is important to take account of the way that words and titles are used in practice. This has been done by organizing a series of focus group interviews with experienced practitioners.

6 FOCUS GROUPS

The purpose of the focus groups was to record and transcribe conversations of experienced practitioners so that the researchers could capture the way that terms are used in industry parlance. Five focus groups were undertaken, and the process and results are summarized here.

6.1 Approach

The focus groups took place at the University of Reading during 1999, involving a total of 29 experienced practitioners and clients, from 127 invitations. The membership of these groups is listed in Appendix 1. Each focus group took between 70 and 90 minutes and, based on the experience of the first focus group (lawyers) the conversations were channelled by the moderators, along the lines of guidance notes reproduced in Appendix 2. Check lists were used for ensuring that the full range of issues was covered as far as possible, although the length of these lists reveals the difficulty of getting more than a mention for all but the most important roles in projects.

The focus groups were recorded using two, stereo, digital mini-disc recorders. These recordings were split into tracks of three minutes each, which were then transferred to computer, from where they were used to make CDs for transcription purposes and to form a more permanent record of the conversations.

The text was subjected to content analysis, a research technique for systematic, impartial and quantitative description of the content of research data procured from interviews, questionnaires, schedules and other linguistic expression. This technique is widely used in the social sciences because it enables researchers to make replicable and valid inferences from data to their context. It is widely regarded as an ideal technique for inferring meaning from what people say.

It was agreed with the focus group participants that transcripts would remain confidential and that no direct quotation would be attributed to any participant.

6.2 Guidance used for moderating focus groups

The analysis of the focus group transcriptions was based upon the terms acquired during the earlier stages of the research, i.e. literature search and

analysis of matrices. This produced the list that was used as a starting point for looking at the way that people described their work, included as part of the guidance notes used in moderating the focus groups, shown in Appendix 2.

The following lists were used to check off items as they were mentioned, so that the moderators were able to monitor the conversation and suggest areas (not titles or terms) if the conversation subsided.

6.2.1 List of possible stages of work

A list of stages was compiled from the earlier stages so that the moderators could tick items as they were mentioned, and ensure that the conversation was covering a broad area of project activity. Moderators were careful not to be the first to mention any of these items, so that the words and phrases used for describing various aspects of project activity came from the focus group participants, not from the researchers. The list used for moderating contained these potential terms for stages of work:

- Appraisal
- Assembling the team
- Bills of quantity
- Briefing
- Completion
- Evaluation
- Concept
- Conceptual design
- Construction
- Defining the project
- Design development
- Design
- Detail design
- Detailed proposals
- Feasibility
- Feasibility study
- Brief development
- Feedback
- Final proposals
- Getting started
- Inception
- Initial brief
- Information for construction
- Post-production information
- Mobilization
- Operation on site
- Outline proposals
- Preparation of brief
- Production information
- Project planning
- Scheme design
- Site operations
- Strategic briefing
- Tender action
- Tender documentation
- Tendering
- Value engineering

6.2.2 List of possible job titles

As with the list used for prompting conversation about activity, a list of possible job titles was compiled from the earlier stages of the research. Again, the researchers were careful not to be the first to mention any of these words or phrases, ticking them (or adding them to the list) once the participants had raised them. In this way, the vocabulary used to describe the work came from exclusively from the participants. The initial list of job titles contained the terms listed below.

Once one of these items had been mentioned, participants were asked to talk about what is involved with the role, how it varies between different projects, how it varies between different stages of the same project and what alternative terms might be used to describe the same or a similar role.

Focus groups

- Adjudicator
- Advisor, specialist
- Advisor, cost
- Advisor, cost, lead
- Agent
- Architect
- Architect, design function
- Architect, mgmt function
- Architect, landscape
- Clerk of works
- Client
- Client's representative
- Client's direct contractors
- Client's project manager
- Consultant
- Consultant designer
- Consultant team manager
- Consultant, cost
- Consultant, feasibility
- Consultant, landscape
- Consultant, lead
- Contract administrator
- Contractor
- Contractor, demolition
- Contractor, lead
- Contractor, principal
- Contractor, specialist
- Cost planner
- Design facility manager
- Design leader
- Design team leader
- Design unit leader
- Designer
- Designer (architect)
- Designer (building services)
- Designer (structural)
- Designer, lead
- Development control authority
- Employer
- Engineer, building services
- Engineer, civil and structural
- Engineer, fire
- Engineer, geotechnical
- Engineer, materials
- Engineer, mechanical & elec.
- Engineer, services
- Engineer, structural
- Ground investigators
- Health & Safety Executive
- Local utilities
- Mediator
- Planning authority
- Planning officer
- Project manager
- Project engineering manager
- Project manager, client's
- Project sponsor
- Quantity surveyor
- Site inspectorate
- Site investigation contractor
- Specialist
- Statutory authorities
- Sub-consultants
- Statutory bodies
- Sub-contractor
- Sub-contractor, labour-only
- Sub-contractor, M & E services
- Sub-contractor, nominated
- Sub-contractor, specialist
- Sub-contractor, steelwork
- Sub-contractor, supply-only
- Sub-contractor's, designer
- Supervisor
- Supervisor, planning
- Suppliers, specialist
- Team management
- Valuer

Table 15: Frequency with which outputs were mentioned

	Client	Consultant	Contractor	Lawyer	Trade cont.	Totals
Project definition						
Appoint consultants	10	10	10	16		46
Select consultants		3				3
Appraisal						0
Assembling the team	1					1
Feasibility study	1	8		1		10
Inception	1					1
Design						
Bills of quantity	2	1	4	3	1	11
Brief	6	2	3		3	14
Brief development						0
Brief preparation						0
Buildability studies						0
Concept	8			5	3	16
Business case						0
Conception	1					1
Conceptual design	1			1	1	3
Construction information						0
Cost plan		10				10
Design brief	2				1	3
Design development				1	9	10
Design programme						0
Design generally	13	22	10	51	21	117
Detail design	5	3	3	5	4	20
Documentation			4	6		10
Final proposals						0
Initial brief						0
Outline design		1		1		2
Outline proposals						0
Performance specification		2				2
Production information				2		2
Risk assessments			1			1
Scheme	1			3	1	5
Sketch design				3		3
Specification	1	3	4	3	5	16
Strategic briefing						0
Tender documentation						0
Value engineering		1			1	2
Statutory approvals						
Approvals						0
Building regulations				1		1
Detailed planning				1		1
Outline planning				1		1
Planning	5	2	1	2	1	11
Planning approval						0
Planning consent				1		1
Regulations				1	1	2
Submissions						0
Contract formation						
Award			1			1
Bid	1	3	9		2	15
Drafting	3		2	20	1	26
Fee agreement		1				1
Fee-bid		4	2			6
Negotiation		2	2	4	1	9
Novation	2	1	17	6		26
Partnering agreement			2		1	3
Pre-contract			1	2		3
Pre-tendering						0
Price		3	14	8	3	28
Tender	1	7	8	13	4	33
Tender action						0
Site work						

	Client	Consultant	Contractor	Lawyer	Trade cont.	Totals
Construction	31	16	5	15	2	69
Mobilization			2			2
Site investigation	1					1
Site	28	22	6	4	17	77
Site operations					1	1
Trial hole report		1				1
Completion						
Commissioning	1		1	1		3
Evaluation						0
Feedback						0
Final account		1	3		4	8
Practical completion	1		1		8	10

6.3 Summary of focus group data

As explained in section 1.5.2, the recordings of the focus groups were used to create CDs, which were transcribed verbatim and checked carefully against the recordings, to ensure that the transcript was an accurate record of what was said. The numbers of words transcribed are: Clients – 13 133, Consultants – 17 049, Contractors – 12 487, Trade contractors – 14 586, Lawyers – 16 448.

In coding the text, with the analytical software, the unit of analysis chosen was one line of the transcript. Each line was coded as many times as necessary to catalogue the words being used and the context in which they were used. Table 15 shows the frequency with which each kind of output was mentioned. The analytical software enabled powerful filtering to be applied to the searches. For example, anything said by the moderators is specifically excluded from these tables.

Many items that are specifically mentioned in the plans of work did not crop up at all in the focus groups, such as appraisal, final proposals, evaluation and so forth. It is also interesting that there was very little mention of statutory approvals, such as building regulations.

Table 16 shows how often each action (verb) was mentioned. These are grouped according to the background on organizational theory, which helps to distinguish different types of activity. The items in this list only arose from the actual text of the transcripts. There was no need for a list of prompts to elicit these words. Control was an action that was mentioned many times, but in looking at the detail of whether people were talking about time, cost, quality or some other kind of control, it is interesting to note that cost control and time control were nowhere near as important as quality control. It is also interesting that quality control was mentioned usually by clients and trade contractors.

Table 16: Frequency with which actions were mentioned

	Client	Consultant	Contractor	Lawyer	Trade cont.	Totals
Control						
Approve	1	1	7	1	1	11
Control generally	3	6	6	10	2	27
Cost control		2	2	2		6
Cost management				1		1
Decide	6	5	3	5	10	29
Design control			2	1		3
Freeze	3			13		16
Measure	1	3	1			5
Monitor	1	1		2	2	6
Program control			1			1
Project control		4		1	3	8
Quality control	7		2	2	10	21
Sign-off	3	0		1	4	8
Test		1	1		1	3
Time control			1			1
Operational						
Certify	5		1	3		9
Check	2	5			3	10
Design	10	29	13	48	20	120
Estimating		6	4	1		11
Inspect	2	4	1		1	8
Produce	4	5	3	5	10	27
Represent			3			3
Management						
Administer project	16	6	2	5	0	29
Co-ordinate overall	5	8	2	13	26	72
Co-ordinate construction	1					1
Co-ordinate design	6	7	20	9	4	46
Direct		2	1	1	1	5
Exercise authority	1	3	3	2	2	11
Facilitate	1				2	3
Instruct	6	7	1	1	7	22
Integrate		1		1	1	3
Lead		2	4	7	3	16
Liase	9	2	1			12
Manage	13	6	6	7	10	42
Motivate	1					1
Report	5	5		1		11
Resolve problem					1	1
Supervise	1	4		2		7
Value engineer		1	1		1	3
Legal						
Resolve disputes		4	1	10	1	17
Sue		3		5		8

Table 17 shows the frequency with which role titles were mentioned. As previously stated, many titles are mentioned in the literature and in the plans of work analysed in the early stages of this work. Not every item in the list of titles taken as a starting point was mentioned, but as the focus groups progressed, the list developed, leading to clear differences between the list in 6.2.2 (page 121) and that in Table 17. In dealing with the coding of the focus group transcripts, categories of titles emerged and were refined as the coding progressed. These are included in Table 17 in bold typeface.

Table 17: Frequency with which titles were mentioned

	Client	Consultant	Contractor	Lawyer	Trade cont.	Totals
Regulators						
Building control officer				1		1
Environmental Health Officer						0
Fire officer						0
Local authority	3	2				5
Planning officer						0
Client						
Client	60	71	41	30	52	254
Client liaison officer	2					2
Commissioner	1					1
Developer	3	2		3		8
Development manager	9					9
Employer	8	6	14	19	1	48
End-user						0
Funder		1	3	2		6
Owner		1				1
Private sector	3		1			4
Public sector	4	4	2			10
Purchaser				1		1
Tenant	13	1	2	2	2	20
Voluntary sector						0
Builders						
Building contractor				3		3
Construction manager	10	2		6	7	25
Contractor	57	20	32	38	27	174
Design and build contractor	3				2	5
Design contractor					2	2
Engineering contractor				1		1
Main contractor	4	1	2	7	30	44
Maintenance contractor	1					1
Package contractor				3		3
Process contractor				1		1
Site agent	4		4			8
Site manager	1					1
Soils investigation contractors		2				2
Specialist	6	5	2	6	10	29
Sub-contractor	16	5	16	23	18	78
Trade contractor	2			26	3	31
Works contractor				1		1
Advisors						
Architect	101	151	152	209	44	657
Architect, landscape	3	6	9			18
Clerk of works	2	5				7
Consultant	49	49	39	28	51	216
Consultant team manager						0
Consultant, acoustic	4					4
Consultant, cost	4		1	5		10
Consultant, lead		15	3			18
Consultant, specialist	7	11	1	1	1	21
Consultant, traffic	2	2				4
Contract administrator		1				1
Design co-ordinator						0
Design manager	1		6			7
Designer, aesthetic						0
Designer, specialist	4	15		9	3	31
Employer's agent	3	3	2	1		9
Employer's representative				6		6
Engineer	20	47	15	24	9	115
Engineer, civil		9	3	12		24
Engineer, consulting		1	1		5	7
Engineer, electrical	5	8	5	10	3	31
Engineer, environmental		1				1
Engineer, geotechnic		9				9

	Client	Consultant	Contractor	Lawyer	Trade cont.	Totals
Engineer, mechanical	3	2		1	1	7
Engineer, structural	12	20	8	26	4	70
Lead designer			1			1
Letting agent	4					4
Planning supervisor	10	6	10		7	33
Project administration				1		1
Project manager	132	127	55	38	56	408
Quantity surveyor	51	58	52	29	7	197
Sub-consultants		2				2
Superintending officer		2				2
Supervising officer		4				4
Town planner	1					1
Valuer		1				1

7 ANALYSIS OF FOCUS GROUP TRANSCRIPTS

The focus group transcripts were made for the purposes of analysing not just how frequently words were mentioned, but the context in which they were mentioned, to aid the development of a terminology that is based firmly in the way that words are used in practice.

7.1 Analysis of the incidences of outputs

For the purposes of defining roles and actions, this section defines outputs, i.e. the things that participants are working on. References to phrases defined or used in source documents are in quotation marks. The analysis of texts and focus groups reveals that there is tremendous diversity in the way that project work is split into stages. .

7.1.1 Appoint consultants

From the transcripts (see Table 15, page 123), the mentions of "appointment of consultants" were: clients – 10, consultants – 10, contractors – 10, lawyers – 16, trade contractors – 0.

The clients' transcript shows that comments were made about appointing consultants early in the process and two of these emphasized the need to make obligations clear. Some comments referred to the possible practice of a single appointment by the client of someone who would then sub-appoint the rest of the team, but this seemed rare and was only a response to a specific prompt from a moderator. At one point, reference was made to "assembling the team". The consultants' discussion added nothing to this picture. Contractors discussed the appointment of consultants from the point of view of employers of consultants, for example under design and build arrangements. They talked about making their own initial appointments and about appointments being novated. Much of the lawyers' discussion revolved around the use and amendment of standard forms of appointment. They emphasized the need to clarify responsibilities and for explicit discussion and agreement of terms between clients and consultants. Trade contractors did not mention the appointment of consultants at all.

An alternative phrase was "assembling the team", which occurred in passing when one of the clients was talking about the earliest phases of a project. The consultants used the phrase "select consultants" three times.

7.1.2 Feasibility study

From the transcripts (and Table 15, page 123), the mentions of "feasibility" were: clients – 1, consultants – 8, contractors – 0, lawyers – 1, trade contractors – 0.

Only the consultants made more than a passing mention of feasibility, and several comments came in response to a prompt from a moderator about the RIBA stages. One consultant sought to emphasize that some preliminary "research" work (e.g. into the general problems of building on sites not previously encountered) may be regarded as carried out prior to a feasibility study proper.

Alternatives that were investigated were appraisal and business case, which were not mentioned in any group, and inception, which was mentioned only once as preceding "concept".

7.1.3 Design

Design proceeds as a consequence of the initial project definition. There seem to be distinct phases in the design process, with some diversity in the way that these phases are split. However, there is consistency in that design is always split into stages. The analysis of the focus group text may shed some light on the distinctions between stages.

First, there are some phrases that were sought, but not discovered: "design programme", "outline proposals", "final proposals", "buildability studies" and "tender documentation".

Other terms that cropped up only occasionally produced nothing of relevance for this analysis. "Sketch design" was mentioned only by one member of the lawyers' focus group, in response to a prompt from one of the moderators, and to express doubt as to whether it really identified a separate stage or merely formed part of the general process of design development. Apart from one mention in the lawyers' focus group (where it was used as a general term to embrace a number of more detailed descriptions found in the RIBA plan of work), "design development" was used only by the trade contractors. Their strongly expressed opinion was that the meaning of this term is very unclear and that the industry would benefit greatly from a clear definition of this term. This was especially because of the difficulty of distinguishing between "design development" (for which a consultant is responsible) and "co-ordination" (for which the contractor is responsible).

The two mentions of "value engineering", in the consultants' and trade contractors' focus groups, produced nothing of interest. "Bills of quantity" features in all the focus group transcripts, but is invariably used to describe the document rather than a stage of work. "Risk assessments" are mentioned once, in the contractors' transcript, referring only to the increased volume of documentation required from contractors in recent

times. "Production information" (alternatively "construction information") was mentioned only twice, in the lawyers' focus group, one of which was in a specific reference to the RIBA plan of work. The entries coded under "documentation" are for the word "document" used generally, and are of little or no interest.

7.1.4 Concept/Concept design/Conception

In terms of "design", the first important clustering of information is around the stage variously called concept, concept design and conception. These alternative terms suggest a high degree of consistency in the terminology used for the early design work.

From the focus group transcripts, the mentions of these three terms were: clients – 10, consultants – 0, contractors – 0, lawyers – 6, trade contractors – 4.

A view that emerged clearly from all three focus groups in which "concept design" was mentioned was that this would always be the responsibility of a consultant, and that the input of specialist contractors would relate to the development of the concept. It is interesting, therefore, to note that this phrase does not appear in the consultants' transcript. A telling comment on "concept design" from the lawyers' transcript was that, while engineers would claim to know what was meant by this phrase, it was never specifically defined in contract documents and so it was not possible to be sure whether other participants would understand it in the same way.

Despite featuring as a separate stage in 3 out of the 6 plans of work analysed, the phrase "outline proposals" was not used in any of the focus groups. "Outline design" was mentioned once in each of the consultants' and lawyers' transcripts, where the detailed breakdown of stages given in the RIBA plan of work was referred to with approval. These phrases would appear to be synonymous with "concept design".

7.1.5 Scheme design

From the focus group transcripts, the mentions of "scheme design" were: clients – 1, consultants – 0, contractors – 0, lawyers – 3, trade contractors – 1.

A member of the lawyers' focus group made the comment that splitting the design stage into separately identified sub-stages (including that of "scheme design") is a valuable exercise, since it enables a client to know what final decisions have been made. However, the same member made the point picked up in Section 7.1.4 that, while engineers would claim to know what was meant by this phrase, it was never specifically defined in contract documents and so it was doubtful whether other participants would understand it in the same way.

7.1.6 Detail design

From the transcripts, the mentions of "detail design" were: clients – 5, consultants – 3, contractors – 3, lawyers – 5, trade contractors – 4.

In all the focus groups, emphasis was placed on the extent to which detail design is increasingly the responsibility of a specialist contractor rather than a design consultant.

7.1.7 Design documentation

While there was nothing to suggest that "design documentation" should be a fundamental part of the search, some documents that are obviously related to the design process were mentioned. These form part of the output of the design process.

"Brief" was mentioned in the focus groups (see Table 15, page 123) as follows: clients – 6, consultants – 2, contractors – 3, lawyers – 0, trade contractors – 3. From the transcripts a difference of usage emerges between the clients on one hand and the contractors and trade contractors on the other. The clients clearly envisaged the brief as an analysis of the problem to be solved at a very early stage in a project, even in some cases before any decision had been taken that construction would offer the best solution to those needs. The other focus groups used the term more in the sense of a client's instructions to consultants. It is notable that the more specific terms "initial brief", "brief development" and "strategic brief", each of which appeared in at least one of the plans of work analysed, did not feature in any of the focus group transcripts. It is also interesting that the references to briefing equate the brief to an instruction, rather than to the ongoing dialogue between designers and their clients, often referred to in analyses of the architectural process discussed in Section 2.2 (page 12).

"Specification" was mentioned: clients – 1, consultants – 3, contractors – 4, lawyers – 3, trade contractors – 5. This term, in all the focus groups, was most commonly used to identify a document or set of documents, rather than a stage in the design process. However, it was also used in the sense of "performance specification".

"Cost plan" featured only in the consultants' focus group, where it was mentioned 10 times. The usage generally suggested a concentration on controlling cost (as opposed to obtaining "value for money"). Of particular interest was the assertion that this is a specialist role and that it is unrealistic of clients to expect adequate advice on this matter from the consultant team in general.

7.1.8 Statutory approvals

While it is quite clear that, in practice, planning legislation plays a significant role in the development process, there was very little detailed discussion of it in the focus groups. The number of mentions of terms such

as “detailed planning”, “outline planning” and “planning consent” were too few to do anything other than merge them generally as “planning approval”.

From the transcripts, the mentions of “planning” were: clients – 5, consultants – 2, contractors – 1, lawyers – 6, trade contractors – 1. No particular insights emerge from the focus groups, other than the predictable one that the question of planning approval is a matter of greater concern among clients and lawyers than the other participants. Most people tended to refer to “planning” rather than anything specific.

“Building regulations” warranted only a passing mention in the lawyers’ group.

Specific terms such as “regulations”, “submissions” and “approvals” were not mentioned in any focus group.

7.1.9 Contract formation

The discussions about “contract formation” produced a variety of terms, and a lot of detail about the various processes.

First, “contract drafting” was discussed; getting three mentions each from the clients and consultants, but 20 from the lawyers. Predictably, perhaps, the lawyers’ focus group was the most preoccupied with this subject, although one of the clients related how many of its contracts were drafted by quantity surveyors. The lawyers were critical of standard form contracts in general, as failing to address some important issues; they also expressed some criticisms of the standard of drafting, which can lead to heavily amended standard forms which still fail to address what is necessary.

“Negotiation” was mentioned once by each of the consultants’, contractors’ and lawyers’ focus groups. Interestingly, each comment was to the effect that negotiation is normally a very limited matter; in practice one side dictates terms and the other merely bids a price based on those terms.

“Pre-tendering” was not mentioned in any focus group and “pre-contract“ attracted a few insignificant mentions. “Award” was mentioned once, only in passing.

The topics of “pricing” and “bidding” caused a lot of discussion. “Price” was mentioned 28 times, 15 of them by contractors, all of which discussed the large amount of effort and time required to put a price together. In a similar vein, the 14 mentions of “bidding” (9 by contractors) were generally focused around distortions of the market process and the details of how that happens.

From the transcripts, the mentions of “tender” were: clients – 1, consultants – 7, contractors – 8, lawyers – 13, trade contractors – 4. No particular points of interest emerged from the mentions of tendering in the clients’ or consultants’ focus groups. The contractors were highly critical of the way that the tendering process is often carried out, since the heavy demands for

information placed upon them result in inflated tendering costs. There was a general consensus (echoed by both lawyers and trade contractors) that the documents on which tenders are based are all too often incomplete and uncertain, and that bids are sometimes submitted without any real understanding of the risks that the bidder is being asked to take on. "Tender action" was not mentioned at all.

"Novation" warranted 26 mentions, client – 2, consultants – 1, contractors – 17, lawyers, 6, trade contractors – 0. The discussions focussed on how this has become a very widespread practice and the consequences that it has for the patterns of responsibility.

"Fee agreements" and "fee bidding" were mentioned in passing, with little of significance. Finally, "Partnering agreement" generated a little discussion, but nothing of interest.

7.1.10 Site work

All but one term about site work was generally very uninformative. Although the word "Construction" is picked up by the analysis many times, it occurs in the general sense, rather than as part of a discussion about site operations. Other words under this category (see Table 15, page 123) only got passing mentions.

However, the word "site" cropped up many times; clients – 28, consultants – 22, contractors – 6, lawyers – 4, trade contractors – 17. Clients focused on the need to ensure progress, quality control, inspections and so on, and mentioned how the person in charge of the site was variously called "contracts manager", "project manager", "site manager" or "site agent". The consultants also talked about "inspections" and "quality", and made several remarks about the need for co-ordination. Contractors pointed out the value of a good site manager and comments were made on how contractors, who have the most knowledge of what happens on site, are usually the last to be involved in the process. Lawyers mentioned the need for a design freeze and for frequent site meetings. Trade contractors were very worried by a general lack of knowledge about what happens on site. They felt that they bore the brunt of having to resolve interface and co-ordination problems that ought to be resolved before site work begins, although they were not sure who would have the skill and knowledge to do this.

7.1.11 Completion

The activities surrounding completion were "practical completion", "final account" and "commissioning".

From the transcripts, the mentions of "practical completion" were: clients – 1, consultants – 0, contractors – 1, lawyers – 0, trade contractors – 8. The main point to emerge was the view, strongly held by the trade contractors,

that the issue of a certificate of practical completion is often a "political" matter; trade contractors find it very difficult to obtain such a certificate unless and until the client finds it expedient to have one issued.

"Final account" was mentioned on very few occasions, and usually in passing. However, one of the consultants specifically referred to this as a core activity of a quantity surveyor or cost consultant, and one of the contractors referred to an experience with a client wishing to renegotiate the "conclusive" nature of final account/final certificate.

"Commissioning" was mentioned only once, in the contractors' focus group, and offers nothing of interest.

"Evaluation" and "feedback" were not mentioned in any focus group.

7.2 Analysis of the incidence of actions (verbs)

The analysis from the desk study phase of this work indicated a limited number of verbs that would describe roles and grouped them together into three categories, operating system, control system and managing system. The analysis of focus group data reveals a fourth category – legal. While this may be seen as a sub-set of the control system, the context in which these verbs arose indicated that these were significantly different from other aspects of control.

In the process of transcribing and analysing the focus group data, it became clear that many different verbs were being used to describe the actions undertaken by participants. Codes were allocated for those that seemed to have some specific connotation, to be sure of identifying a vocabulary that reflected the way that work was being described in the focus groups.

7.2.1 Verbs associated with control

A number of verbs were grouped together as being primarily clustered around the processes of control. But the word is also frequently used in its general sense. Table 16 (page 125) shows that the mentions of "control" were: clients – 3, consultants – 6, contractors – 6, lawyers – 10, trade contractors – 2. The usage of this word in the focus groups is very varied. Sometimes it is used in the legal or contractual sense, sometimes in the practical. It is certainly a key idea in determining the way that people relate to a construction project.

One of the consultants gave a specialized meaning to "project control", as describing a particular group within the consultant's own organization. On the few other occasions on which it appeared it was generally used in relation to a project manager.

"Cost control" was mentioned a few times, and a point that emerged from both the consultants' and the contractors' focus groups is that the term "cost controller" is frequently used to describe a "born-again quantity surveyor". "Cost management" was used only once, apparently as a synonym for "cost control".

"Program control" and "time control" were each used only once, in the contractors' focus group, where they were used to describe one of the functions of a project manager.

"Quality" was mentioned several times. However, the coding picks up the word "quality" generally, rather than the concept of "quality control". It appears to be used mainly as a synonym for "good quality". What mentions of quality control there are suggest that responsibility for this is not always attributed to the same person – it may be an architect, building surveyor, construction manager or project manager, depending on the way the particular project is set up.

"Design control" as a concept, rather than the phrase itself, appeared twice in the contractors' and once in the lawyers' focus groups, but nothing of significance emerged.

A sub-set of control (in the terms of the analysis given in the desk study phase of this work) is "measure". Table 16 (page 125) shows that it cropped up 5 times, but this was invariably connection with the work of a "quantity surveyor".

"Monitoring" was used in relation to construction managers and project managers, and in the context of keeping control of programme (time) and cost.

"Approve" appeared significant only in the contractors' focus group, where it was used repeatedly in a single part of the discussion. The group was concerned at the difficulty of obtaining the architect's explicit approval of drawings and (less often) workmanship.

The coding picked up a number of instances where "decide" and "decision" were used in a general and informal sense. However, it was interesting to note that both contractors and trade contractors appeared more concerned about formal decisions affecting contractual positions, and the difficulty of obtaining these from clients or consultants. An idea associated with this is the phrase "sign-off", which occurred 8 times. Clients used this expression in the context of concern about agreements to treat a design or partial design as agreed, and thus not to seek further changes. Trade contractors, on the other hand, used this as a synonym for "approval", and emphasized the difficulty of obtaining this from consultants or project managers. Similarly, "freeze" was used only by clients and lawyers (the latter in one concentrated discussion). It was notable that, while clients appeared to regard the concept of a "design freeze" as perfectly acceptable and normal,

the lawyers were extremely sceptical, doubting whether the typical client would ever regard a design as completely frozen.

"Test" produced nothing of any interest.

The analysis of control systems in the desk study phase revealed that control required planning and then the three aspects of monitoring, supervising and resourcing, and suggested that certain decisions would flow from the exercise of these actions. It is difficult to rationalize this model with the way that words are used in practice. The analysis of the focus group data shows that there is no generally shared set of words or systematic definitions for these concepts.

7.2.2 Operational

A variety of verbs emerged to describe the operational work undertaken by the various participants.

"Estimate" was used by the consultants to describe a particular function normally associated with quantity surveyors. The contractors, on the other hand, expressed concern about the inadequacy of contract documentation and their consequent need to have estimators checking this.

"Produce" appears quite frequently, to describe the creation of anything from a contract through drawings to a physical object.

"Design" was one of the most commonly used of the identified verbs, but it is difficult to identify any useful lessons to be learned from the discussions. The breakdown coded above under "outputs" is, in this respect, of much more value.

"Certify" was used by lawyers only in the traditional sense, invariably relating it to the architect's function, whereas the clients discussed payment systems under which work was effectively self-certified by the contractor.

"Inspect" occurred in conjunction with architects, engineers, building surveyors, clerks of works and tenants' inspectors. In all cases, it was used in the usual sense of the word.

"Check" and "represent" produced nothing of interest.

Again, there is little that comes from this analysis, other than trite statements like "designers design" and "estimators estimate". Clearly, Operational responsibility is not a concept that needs breaking into elemental parts.

7.2.3 Management

The verbs associated with management responsibilities were many and varied. The desk study indicated that useful verbs would be "approve",

"recommend", "co-ordinate" and "direct". As well as these, any other verbs that emerged from the focus groups were coded for and considered.

"Manage" was one of the more frequently used terms, but there emerges no clear consensus as to its meaning. This is partly because it is used at all levels from managing an entire project through managing (i.e. co-ordinating) the design process or the design team to managing a building. The object of the qualitative analysis of these focus groups is to de-construct the idea of "managing" so that its elemental parts can be organized.

"Direct" appeared only once in each of the focus groups (other than the clients). It is of some interest in being related in each instance to the client or a project manager, and specifically not consultants.

"Liase" was used most frequently by the clients, who invariably mentioned it in connection with either someone within the client organization itself, or (less frequently) the project manager appointed by the client. It was not used in connection with any of the more "traditional" participants.

"Co-ordinate overall" and "co-ordinate design" were mentioned with some frequency (see Table 16, page 125). A significant point was the difference between overall co-ordination and design co-ordination. Sometimes a project manager would do both of these, but this was by no means always the case. Other points of interest to emerge from the focus groups were that:

- one participant had acted as architect on a job with a separately appointed "design co-ordinator";
- contractors under design and build effectively take on this role, and often appoint a person especially to carry it out;
- "design manager" is an alternative description;
- the standard forms of appointment are deficient on the question of co-ordination, and one of the lawyers specifically amends such forms of appointment to make explicit the consultant's responsibility for co-ordination;
- the line between "design development" and "co-ordination" is very difficult to draw in practice.

"Co-ordinate construction" was mentioned only once, in the clients' focus group, but this is of interest because it referred to persons from a finance or planning (i.e. non-construction) background who were nevertheless in a position of co-ordinating construction operations.

"Supervise" was mentioned on relatively few occasions, and with little consistency. It was used in relation to construction managers, project managers, architects, resident engineers and clerks of works.

"Instruct" was used by the contractors and trade contractors almost exclusively in their formal contractual sense, the other groups used them to mean any communication from one party to another which involved telling that other what to do.

"Lead", with very few exceptions, was used in conjunction with either architect (where the phrase "leader of the team" occurred several times) or project manager. Two groups suggested that the architect's traditional leadership was now tending to pass to the project manager.

"Administer project", in fact, relates to administration of the contract rather than the project. As such, it is hardly surprising that all the focus groups saw this in terms of the JCT "contract administrator". The term was therefore used for the most part in relation to architects.

"Exercise authority" produced nothing significant, unless perhaps a feeling that, on many projects, the question of who actually has authority to make things happen is not entirely clear.

"Report" is interesting only from the point of view that the clients appeared to see this term as applying to a relatively low-level administrative task, such as that carried out by a clerk of works.

"Value engineer" was mentioned on only three occasions in total. Interestingly, however, it was used in relation to structural engineers, contractors and specialist trade contractors.

"Facilitate" was mentioned only three times, and not significantly.

"Motivate" was mentioned once, in relation to the client's project manager.

"Resolve problem" was mentioned only once, and provides nothing of significance.

"Integrate" produced nothing of significance.

Once again, there is little consistency or systematic meaning in the use of these terms. One thing that is clear is that co-ordination is an extremely important element of management.

7.2.4 Dispute resolution

Finally, dispute resolution appeared to be different in some respects from other areas of discussion. To test for this, some of the words associated with it were specifically isolated and checked.

"Resolve disputes" was used purely descriptively, often in terms of introducing a participant in terms of what his organization does. Not surprisingly, it appeared most frequently in the lawyers' focus group. However, it was noticeable that participants in the other groups also appeared to accept the inevitability of disputes in the construction context.

"Sue" was mentioned in only two of the focus groups, and nothing of any significance emerged.

7.3 Analysis of the incidence of titles (nouns)

The search for titles revealed a wide range of terms, many of which were synonymous with each other. These are summarized in Table 17, page 126. Those terms that seem not to be mentioned arose from elsewhere in the research project, often from the steering group meetings, some of which has been recorded and transcribed to enable the researchers to practice their approach to the techniques of recording, transcribing and analysing conversations. The titles have been grouped together initially in terms of distinct contributions to the process, using generic labels that are as neutral as possible: regulators, clients, builders and advisors.

Titles mentioned most frequently were the most general or traditional ones, such as client, contractor, architect, engineer, project manager and quantity surveyor. This information is used in Section 8, to help develop the terminology. One interesting point about how roles were discussed in focus groups is that although the literature and plans of work clearly show a progressive fragmentation of the architect's role, in practice the title is used as a blanket term to refer to any aspect of a traditional architectural function.

7.4 Summary of focus group findings

The analysis of the focus group transcripts reveals some useful information for defining the terminology of roles in building contracts.

First, confirming what the analysis of plans of work suggested, projects typically progress through five stages, some with sub-stages:

1. Project definition
2. Design
3. Contract formation
4. Construction
5. Completion

Second, the verbs used to describe the work that people do in practice are not consistent or systematically defined. People use verbs in the everyday sense, rather than with any special meaning attached to them.

Finally, the titles used to describe roles are diverse, but rooted in the traditional uses of such terms.

8 TERMINOLOGY

The terminology section deals first with outputs, then with actions, finally with titles, in terms of the actions done to outputs. The terms and definitions given here arise from the full variety of information sources used: desk study, analysis of plans of work and focus group data.

The structure for the terminology is based on three overall groups of terms, each of which has many sub-divisions and layers. The main divisions are outputs, actions and titles. By defining outputs and actions first, titles can then be described with some consistency. The definitions given here arise from observations and discoveries in the research that has been undertaken and are not simply recommendations of how words and phrases ought to be used.

To provide an overall view of where terms are grouped, Table 18 shows the first three levels of the structure. (Table 19, page 155, gives more detail for the part of Table 18 shown in italics.)

Table 18: Overall scheme of the terminology

Outputs	Project definition	Select appropriate expert advisors Define the purpose of the project
	Design	Outline stage Detailed stage Final stage Information for site work
	Contract formation	Define the work to be done Agree contractual terms Identify the builder Identify the price
	Construction work	Construction work
	Completion of the project	Completion
Actions	Operational actions	Advise Co-operate Operate Receive
	Controlling	Certify Monitor Supervise Resource
	Managing	Co-ordinate Direct Recommend Approve
Titles	*Project team*	*Client* *Advisors* *Constructors*
	Regulators	Statutory authorities
	Dispute resolvers	Adjudicator Arbitrator Mediator

8.1 Outputs

The basic structure for the stages of work arises from the analysis of the plans of work and is augmented where possible by the findings from the focus groups. The theoretical background to this research established the principle that work is divided into stages and the beginnings and ends of stages are marked by decision points. Decisions give purpose to activity. They also commit the client to expenditure and resources, as well as offering opportunities to veto or abandon the project. Some decisions are in the hands of the client, others are in the hands of external agencies, which may or not have a statutory basis. Most stages of work are targeted at generating sufficient information for a specific decision to be taken and, potentially, for the further commitment of resources.

8.1.1 Project definition

There are two aspects to project definition. First is the selection and appointment of the members of the project team and second, identification of the scope of the project in sufficient detail for work to begin.

Select appropriate expert advisors:

At the outset of a project, the need for consultants should be identified. Commonly, the first consultant appointed will advise on the appointment of the others. Responsibilities are allocated in the documents that record these appointments. It is very important to consider not just the mechanical processes of setting up agreements and contracts, but also the creation of a cohesive, appropriate and responsive team.

There is little variation in the terms used to describe this activity.

Appoint consultant team	The phrase used in the JCT draft schedule
Appoint consultants	The usual term, used widely.
Assemble the team	The CIB use this phrase to encompass the distinct activities of selecting and appointing.
Select consultants	Occasionally, the selection process is identified separately, suggesting that there is not universal agreement as to the point at which the “project” begins.

Define the purpose of the project	
The work at this stage involves some kind of feasibility study, an assessment of the extent to which a construction project will fulfil the client's needs, planning the control and management strategies, and initial ideas for the design of the project. There is a wide diversity of terms used for this stage, but the most apt seems to be "defining the project"	
Appraisal	Used by the CIC as a generic description of much of the early work in initiating a project.
Business case	Currently popular for describing client's requirements in the context of the client's activities.
Demonstrating the need	Used in PPM for the initial identification of the client's business needs.
Feasibility study	Used by RIBA 1964 and BS 7000 to describe the early exploration of alternatives as well as the establishment of management and control of the project.
Getting started, defining the project	Both identified by CIB as the initial two stages in a project. These include establishing the business case for the project and developing a project strategy.
Initial (project) brief	Synonym for *initial statement of requirements*.
Initial statement of requirements	Used in RIBA 2000 to describe the client's preliminary definition of what is required.
Preparation of the brief	A phrase used by BPF who make it clear that this takes place in conjunction with initial design proposals.
Preliminary feasibility studies	Used in PACE to describe early exploration of alternatives
Sketches of ideas	Used by CIC to describe the earliest design suggestions arising in the initial stage of the project.
Strategic briefing	A term used by CIB, JCT and RIBA 2000 to indicate the statement of the broad scope and purpose of the project and its key parameters including overall budget and programme, agreed before design commences.

8.1.2 Design

Design is split into three sub-stages, each of which requires client approval for the decisions taken and commitment to the next stage. These three stages are closely allied to the procedures for obtaining planning consent and building regulations approval. Finally, a fourth aspect of design is the provision of detailed information for site operations.

Outline stage	
The initial ideas for the design are developed in conjunction with the development of the brief, involving a dialogue between client, designers and regulators. A general design strategy (overall design concept, design philosophy) for the project is articulated and agreed between the client and the design team. Risk assessments are undertaken, the project is notified to the Health and Safety Executive and outline planning consent may sought, if necessary. General site conditions and connections are ascertained. If necessary, Environmental Impact Assessments are undertaken. The procurement method may be decided and specified during this stage.	
Concept design	The outline architectural and engineering designs for the project, based on an early statement of client needs. The phrase used by BPF and CIB.
Conceptual design	The phrase used in BS 7000.

Design concept	The fundamental concepts and ideas that underpin all design decision on a project.
Design philosophy	Synonymous with *design concept.*
Outline conceptual design	Used by PPM as synonym for *outline proposals*
Outline proposals	Development of the *strategic brief* in sufficient detail for a *project brief* to be prepared: in conjunction with proposals sufficient for strategic decisions to be taken about spatial arrangements, appearance, materials, structure, services and environmental performance and for those proposals along with their cost and programme implications to be authorized as suitable for proceeding to the next work stage, as defined by JCT. The phrase is also used by RIBA and CIC.
Project proposals	Used by PACE as synonym for *outline proposals*.

Detailed stage

The project brief is finalized, constraints and options are considered and detailed design proposals developed and documented, based on a review of decisions to date. The details of engineering and services sub-systems are developed and co-ordinated into the whole design. Documentation for financial, quality, time and safety requirements is developed with the design. Management procedures are developed and applied for the project. Full development control approval is sought. Where relevant, employer-selected specialists are identified, via specialist tendering procedures, and their input incorporated into the design. Presentation drawings are prepared. The brief is frozen with a client commitment. Further risk analysis and assessment is undertaken for Health and Safety Plan.

Design development	The phrase used by BPF.
Detailed proposals	The phrase used by JCT, CIC and RIBA 2000.
Full conceptual design	Used by PPM as synonym for *detailed proposals.*
Project brief	The full statement of the client's functional and operational requirements for the completed project, as defined by CIB and JCT, based upon the *strategic brief*.
Scheme design	The phrase used by RIBA 1964, BS 7000 and PACE.

Final stage

The final proposals are confirmed after a detailed review of all previous decisions and completion of much of the documentation. Designs are documented, as far as is practicable, to the point from which they can be built. Details are prepared by the design team on large-scale drawings. Engineering designs (specialist work) are co-ordinated into the design documentation and, where necessary, specialists are appointed via competitive tendering in order that their input can be secured. If it has not yet been achieved, final planning consent is sought. Essentially, this stage involves similar, but more detailed documentation than the previous stage.

Completion of design	The phrase used in PACE.
Co-ordinated design	The phrase used in PPM.
Detail design	The phrase used by RIBA 1964 and BS 7000.
Detailed design	Synonym for *detail design*, used by CIB.
Final proposals	The phrase used by JCT and RIBA 2000.
Post-production information	Identified by CIC as information required by the contractor during site operations.

Information for construction

Final construction details are articulated and documented, in conjunction with input from engineering specialists. Lists of preferred contractors and sub-contractors are prepared. Preferred components and materials are specified and selected. All design documentation is reviewed and adjusted as necessary.

Both CIC and JCT identify this stage twice, once before construction begins, and again after it has started, acknowledging that the flow of information continues throughout the construction process. Different terms are used to portray the two-way nature of information flow, between *builders* and *designers*.

Construction information	Synonym for *production information*.
Documentation	Generally, any document describing any aspect of the project.
Information for construction	Identified by BS 7000 as the stage between design and construction, during which the *designers* produce information for the *builders*.
Production information	Information produced by the designers, checked by cost advisors, and approved by the *client*, for use by the *builder* (used by JCT, RIBA 1964, RIBA 2000 and PPM).
Shop drawings, workshop drawings	Special drawings produced by *specialist contractors* for integration with the rest of the design information, to enable the manufacture of certain items of their work.
Working drawings[1]	A term that used to be common but seems to have fallen into disuse, describing information produced by *designers* for *builders*.

[1] For a full articulation of the distinctions between types of detailed information, see the Co-ordinated Project Information documents (Gordon 1987)

8.1.3 Contract formation

The processes of selecting contractors and suppliers, and arriving at a price for each part of the work are necessary pre-cursors to the commencement of construction work. Many of the schemes analysed split this into stages. There are four processes that have to take place, defining the work to be done, identifying the contractual terms, selecting a contractor and agreeing a price. Traditionally, these are simultaneous, the choice of contractor being dictated by the lowest price. But it is perfectly plausible to select a contractor on a basis other than price.

Define the work to be done	
Documents that enable contractors and specialists to bid for the work. This documentation may be extremely comprehensive, detailing and quantifying every aspect of the work, or it may be just an indication of the client's requirements for the project.	
Bills of quantity	Prepared in accordance with standardized measurement and description rules to enable all bidders to submit prices based on a precise description of the work that has been designed (the phrase used by RIBA)
Contractor's proposals	Documents prepared by a *builder* for a design and build project, in which the *builder* offers a price and specification for the work.
Employer's requirements	Documents prepared by the employer's team for a design and build project, in which the employer invites offers from contractors, upon which terms a contract can be let.
Performance specification	A document specifying what a finished article is intended to achieve, leaving the decision about how it is to be achieved to the organization installing or building it.
Tender documentation	All of the documentation necessary to enable *builders* who are bidding to calculate a price for the work (the phrase used by JCT, RIBA 2000 and PACE).

Agree contractual terms	
In forming a contract, agreement has to be reached on the contractual terms that will form the legal relationship between the parties. Even when a standard form of building contract is used, there will frequently be amendments and alterations to the text of the standard form.	
Conditional tender	A contractual provision proffered by a *builder* that forms a condition of the tender. If the client does not accept this contractual provision, the *builder's* price will not stand.
Drafting	Writing the specific terms of a contract.
Negotiation	Discussions covering the apportionment of risk, contractual duties and responsibilities of the parties.
Qualification	A synonym for *conditional tender*.

Identify the builder

There are different ways in which a *builder* might be chosen, although this is commonly done on the basis of competition on price. If the contractor is chosen on a basis other than price, the price (or a basis for calculating it) must be identified separately. (See also *identifying the price*, below, in which some approaches include identifying the contractor)

Competition	Choosing one contractor from many potential contractors according to some criteria, usually price, but often involving some consideration of quality or value for money.
Contractor selection	The process of choosing a contractor for a particular project.
Negotiation	Discussions between potential contracting parties in order to reach agreement on the terms of a contract.
Pre-qualification	The short-listing of a number of contractors, any of which are acceptable to the client, so that a subsequent competition on price will enable the final choice to be competitive.
Qualification	Synonym for *pre-qualification.*

Identify the price

Identifying the price may be part of the process of identifying the *builder*, in the case of competitive tendering, or it may not be.

When a *builder* is being selected on a basis other than price, the process of agreeing a price for the work needs to be undertaken. There are circumstances, such as a cost-reimbursement contract, where a price is not agreed until after the work is undertaken, but, even so, at the outset, the basis for calculating the final price would usually be agreed.

Bidding	Competitive pricing, see *pricing*, below.
Competitive tender	Selecting from a number of *builders* based upon the prices offered by the *builders*, whether fixed price, lump sum, cost reimbursement, schedule of rates or other form of pricing.
Negotiation	Discussions between potential contracting parties with a view to reaching agreement on price.
Pricing	The submission by a *builder* of a price for the work specified by the *client*, often synonymous with *tendering*. *Builders'* bids are based upon their (internal) estimates, tempered by their commercial view of the appropriate pricing level for the project.
Tender action	All of the activities by the various project participants that form the tendering process (used by JCT, RIBA 1964 and RIBA 2000)
Tendering	Several *builders* submit a price based on documents provided to them by the client, with the aim of choosing the lowest bidder.

8.1.4 Construction work

Some definitions of construction work separate this stage into two or three stages. However, it is considered that such a split is difficult to sustain in practice, and the evidence from focus groups indicates that in practice, it is perceived as a single category of activity.

Construction work	
Site operations involve mobilization by the *builder*, ascertaining ground conditions, site preparation, setting out the site, undertaking the work, co-ordination of specialist work, payment, site meetings, contract administration, security, statutory obligations, resolving problems, contractor's design, documentation, contract administration, provision of detailed information, insurances, control, management, inspection and testing of finished work, and record drawings.	
Construction	The phrase used by BPF, BS 7000 and PPM
Construction to practical completion	The phrase used by JCT and RIBA 2000.
Contract works	A comprehensive and precise definition of what a *builder* is obligated to build.
Mobilization	Identified by CIC as a separate stage before Construction
Operations on site	The phrase used by RIBA.
Works	Synonym for *contract works*, used by JCT.

8.1.5 Completion of the project

After the contractor has finished the work, several steps remain before the project is completed.

Completion

The first step in completion occurs when what remains to be done is trivial. At this point, the contractor leaves the site and the client can begin to occupy the building, while the building is commissioned and the services tested. During this period, final details of defective work and whatever has to be finished by the contractor can be ascertained. Maintenance manuals, management manuals and the Health and Safety Plan are finished and handed over to the client. Any necessary staff training for the client is carried out. The balance of account between *client* and *contractor* is finalized.

After practical completion	The phrase used by JCT.
Completion	The phrase used by CIB (in conjunction with evaluation), and RIBA 1964.
Construction after practical completion	The phrase used by RIBA 2000.
Defects liability period, defects correction period	A specified period, after the contractor has left the site, during which any defects that become apparent can be identified for rectification at the contractor's expense. JCT refer to this as *defects liability period,* ICE use the term *defects correction period.*
Final account	Used by JCT to signify the final payment from the *client* to the *contractor*.
Final certificate	A certificate issued by the *contract administrator* (or similar) with specific contractual effect acknowledging that certain obligations have been fully discharged (the precise effect of such a certificate depends on the wording of the particular contract).
Maintenance period	A misleading synonym for *defects liability period* (the contractor is not usually obliged to maintain what has been built).
Practical completion, substantial completion	The point at which the *contractor* leaves the site, the *client* takes possession of the facility and the *defects liability/correction period* commences. JCT use the term *practical completion*, whereas ICE use *substantial completion*.

8.2 Actions

In order to be consistent in defining the way that construction participants relate to their tasks, the diverse range of verbs needs to be considered. The desk study on organizational theory shows that there are various distinct types of involvement and authority, but the analysis of plans of work and the focus group transcript analysis showed that there is very little consistency in the way that verbs are used in practice.

For the purposes of systematic description, the actions defined in Table 2 (page 27) offer the most structured approach to describing the way that participants relate to activities. For the purposes of clarifying other uses of these words, this section outlines the full range of activity-related verbs encountered in the research.

Operational actions The basic operational activity is to do work, i.e. apply mental or physical effort to a purpose.[1] To the primary responsibility for doing work are added other, associated operational responsibilities for supporting the work.	
Advise	The provision of technical or other information when asked for it. Typically undertaken in the construction industry by professional consultants.
Co-operate	Carrying out work as part of a team or committee with partial responsibility for output.
Do the work	Synonym for *operating*.
Execute	Synonym for *operating*.
Operate	Carrying out work (i.e. performing an operation) on some aspect of the project, and having overall responsibility for its output.
Produce	Documenting ideas and solutions, or making goods from raw materials[2].
Receive	Receipt of information about the project for purposes outside the management of the project; for example the accounts department of a client organization.

Controlling actions The purpose of control is to ensure that what is being done on a project makes a useful contribution in terms of what was intended. If there is a difference between what was intended and the output being produced, the control system should enable this difference to be detected and corrective action implemented either by changing what is being done, or by adapting the requirements. Thus, a control system requires a plan, the collection of data relating to the execution of the work, comparison of the data to the plan and corrective action applied to the output or to the plan. Additionally, control sometimes has connotations of restricting, restraining or dominating.	
Certify	Signing a certificate that records payment is due, or a specific contractual event has taken place.
Monitor	Recording and filtering information about an operation and communicating it to those who may take action.
Supervise	Comparing progress with a predetermined plan and bringing about some sort

[1] Based on Concise Oxford Dictionary, 9th Edition.
[2] Based on Concise Oxford Dictionary, 9th Edition.

	of response to the situation.
Resource	Ensuring that those who carry out operations have sufficient resources (in terms of both skill and economic resources).
Sign-off	Signing a certificate that records agreement with what has been done.

Managing actions The managing system consists of a combination of actions that direct the controlling and operating systems.	
Co-ordinate	Ensuring that information flows successfully between organizational links and assembling diverse outputs.
Direct	The executive responsibility for ensuring that the output of activities is orientated towards the objectives of the project.
Recommend	Passing information or the results of an activity to someone who must take a decision on it.
Approve	The executive function of taking decisions about the output of activities. This decision will usually form the input of a subsequent activity. In some cases, depending upon the nature of the decision and the stage of the project, the person exercising this role has the authority to veto the entire project.

In addition to the verbs defined here, many verbs that were used, such as build, design, resolve disputes, sue, value engineer, and so on, would be better expressed as nouns, describing parts of the project work to which operational, control and management duties need to be allocated. It is too restrictive to use such words as identifiers for how people relate to the project work.

8.3 Titles

With a clear picture of the outputs and the range of actions, this section describes the basic roles usually encountered in construction projects, and provides titles and synonyms for each. First, all the titles encountered during the project are collected together and grouped. Table 19 expands the portion of Table 18 (page 143) that deals with project team roles.

Table 19: Scheme for terminology of titles in project teams

Client/ commissioner/ developer/ employer/ owner/ project sponsor/ promoter/ purchaser	Representative	Agent/ client liaison officer/ client project manager/ client's representative/ development manager/ employer's agent/ employer's representative/ project manager/ site agent.
	Advisor	Advisory group. Feasibility consultant. Letting agent. Valuer.
	Stakeholder	End-user. Funder. General public. Landlord. Tenant. Workforce.
Advisor/ Consultant	Design Leadership	Architect. Design leader/ lead designer.
	Management	Architect (management function)/ consultant team manager/ design co-ordinator/ design manager/ design team leader/ lead consultant/ project manager/ project management team. Construction manager. Project engineering manager. Team management.
	Design	Architect (design function)/ architect (design)/ architectural designer/ consultant designer/ designer (architect). Designer/ specialist advisor/ specialist designer/ engineer Consultant (etc.)
	Administration	Architect. Contract administrator/ site inspectorate/ superintending officer/ supervising officer / supervisor. Planning supervisor. Project administration
	Site inspector	Clerk of works. Resident engineer. Site architect. Site inspector.
	Financial	Cost advisor/ cost consultant/ cost planner/ quantity surveyor. Lead cost advisor
Constructor	Overall responsibility	Builder/ building contractor/ contractor/ lead contractor/ general contractor/ main contractor/ principal contractor. Design-builder/ design-build contractor. Design contractor. Management contractor.
	Constructor's staff	Construction manager. Construction planner. Contract manager. Person in charge. Project manager. Site agent. Site manager.
	Partial responsibility	Engineering contractor. Package contractor. Process contractor. Specialist. Specialist contractor. Specialist sub-contractor. Specialist supplier. Specialist trade contractor. Domestic sub-contractor. Labour-only sub-contractor. Named sub-contractor. Nominated sub-contractor. Nominated supplier. Specialist sub-contractor. Supply-only sub-contractor. Sub-contractor. Trade contractor. Works contractor. Sub-contractor's designer. Supplier.
	Direct contractor	Artists and tradesmen. Client's direct contractor. Preferred supplier. Supplier.

8.3.1 Summary of titles observed in the research

The various titles observed from all stages of this research have been drawn together in a comprehensive list, which identifies most of the possible titles and variants encountered in construction projects. The structure imposed on the list for members of the project team is summarized in Table 19.

Within the project team, categories are client, builder and advisor. Synonyms are placed on the same line, separated by a "/". Similar and associated titles are separated by full-stops. The categories for regulators and dispute resolvers are not included here as they are less complex and are clearly described in Sections 8.3.5 and 8.3.6 (pages 166 and 167 respectively). The terminology of the titles in Table 19 is developed below.

8.3.2 Client functions

The client functions begin with the overall definition of the organization that is initiating and paying for the project. Within this overall concept there are sub-themes of representatives, advisors, workforce, suppliers, stakeholders and tenants.

Client

The client initiates the project and sets the project objectives. On appointing the early *consultants*, the client develops the objectives through dialogue with the consultants and *appoints a project team*. The client responds to requests for information, pays invoices promptly according to agreed commitments and ensures that client decisions are timely and authoritative. The client has operational responsibility for identifying basic requirements and constraints, appointing the planning supervisor and the consultant team, developing a *strategic brief*, providing information for the *project brief*, appointing the *contractor* and *principal contractor*, fulfilling duties under the various contracts. The client has executive responsibility for decisions concerned with the commitment of resources at the beginning of work stages, and decision concerned with approval at the end of work stages. At the beginning of the project, the client seeks advice on leasing, land ownership/acquisition, taxation issues and so on.

Client	A very widely used term, generically describing all client functions
Commissioner	Occasionally used term to emphasize that a property developer "commissions" a building project.
Developer	A private sector organization that builds frequently for the purposes of letting or selling.
Employer	A contractual term for the person or organization that is in contract with a supplier of goods and services. This term denotes the client, in terms of its contractual relationship with the contractor. Common in both building and civil engineering.
Owner	A synonym for client, commonly used in USA
Project sponsor	In the public sector, the Department or its representative that is seeking to get a facility constructed
Promoter	The organization behind the project, usually implying that there is a "client" interest behind those dealing directly with the project.
Purchaser	A synonym for client, used to emphasize that the client is the recipient of goods and/or services within a commercial relationship.

Client's representative

Someone who represents the client's interests. This person may be an employee or a consultant to the client. The purpose is to act as a primary interface between the various parts of the client organization and the members of the project team. These include some of the earliest appointments in the process. Generally, such a person would be expected to have experience of the construction industry and would be able to advise on all general aspects of project management and co-ordination.

Agent	A basic term referring to someone who represents another. Usually qualified by preceding it with the name of the person or organization represented. On its own, a very ambiguous term.
Client liaison officer	An individual within a client organization who is responsible for ensuring communication between the parts of the client organization and the members of the project team.
Client project manager	A representative of the client who manages the project on the client's behalf (cf Project Manager).
Client's representative	1–Any representative of the client, usually with a contractual role representing the client. 2–The BPF, in avoiding the use of the term **quantity surveyor**, allocates many cost planning and control functions to the client's represent-ative, but this usage is rare.
Development manager	Usually an employee of a developer who acts as the interface or liaison person between the Project Manager and internal bodies within the client company and the tenant organization. Generally found only on larger projects (cf Project Manager).
Employer's agent	1–Specifically in a JCT Design-Build contract, the contract administration function, without impartial certification duties. 2–Synonym for client's representative (1).
Employer's representative	A neutral term for someone representing the interests of the employer (for the purposes of a contract)
Project manager	1–The person managing the whole project. 2–The person within any particular organization managing that organization's participation.
Site agent	1–Contractor's representative on site (see Section 8.3.4, page 162). 2–Client's representative on site (rare) (See also *Clerk of Works*, page 162).

Advisor

A variety of specialists are retained by the client, particular during the early stages of the project, to provide information and advice on specialized aspects of the project.

Advisory group	BS 7000 term for a group set up to help determine the most appropriate design procurement process and the initial brief. An embryonic project team.
Feasibility consultant	Appointed at the outset in JCT draft schedule to advise on requirements, constraints, options and feasibility of the project. Also help to develop management procedures.
Letting agent	Manages the letting of a development to tenants on behalf of the developer.
Valuer	Specialist in ascertaining market values of property and land.

Stakeholders	
A generic term to describe those who have an interest or concern in something. In construction projects, those who are affected by the project in some way. Sometimes, stakeholders are able to contribute to the briefing and design processes. In major developments, the planning process will ensure that such people are given a voice.	
End-users	Those who will ultimately populate and use the facility.
Funder	The organization that pays for a development scheme, usually where the construction project is a means of investing money. This function may be associated with wide-ranging powers of approval about what is to be designed and built.
General public	Members of the community in general.
Landlord	A person or organization that has an estate in the premises being developed, superior to that of the Developer. A landlord may be associated with wide-ranging powers of approval about what is to be designed and built.
Tenant	The organizations that rent the finished facility from the owner.
Workforce	Those who will be employed to work in the facility.

8.3.3 Advisor/consultant functions

In this category are those consultants and advisors who are retained for the purposes of a specific construction project. Some have general responsibility across the whole project, whereas others are commissioned for specific aspects or sub-systems of the project. The relationship between design and management is complex; since there are aspects of design work that involve co-ordination and direction of others. Therefore, some terms fall under both design and management aspects, whereas others can be dealt with as one or the other.

Design leadership	
This is the most important function in the project, involving ascertaining what has to be done and why. This person usually has responsibility for eliciting the brief in dialogue with the client, developing the overall design concept (design philosophy) for the project, co-ordinating the design of others, producing the design documentation, negotiating with the local planning authority, inspecting the work as it progresses, clarifying constructional details, etc.	
Architect	In building projects, the consultant responsible for developing the overall design, from eliciting the brief through to full design documentation and construction supervision.
Design leader	1–Synonym for *lead designer.* 2–Responsibility for co-ordinating some part of the design. This neutral term avoids any pre-suppositions about professions.
Civil engineer	In civil engineering projects, the consultant responsible for developing the overall design, from eliciting the brief through to full design documentation and construction supervision.
Lead designer	A *designer* who provides the approach and direction for the design and co-ordinates the design. This neutral term avoids any pre-suppositions about which profession should exercise the role.

Management	
Overall responsibility for managing the project, usually with exceptions as to the extent of liability. Many of these terms have emerged to avoid any pre-suppositions about which profession should exercise the role.	
Architect (management function)	Those parts of the architect's duties that involve co-ordinating the work of other designers.
Construction manager	An organization that provides management and co-ordination for a building project where there is no general contractor. (Also see page 164.)
Consultant team manager	Defined by JCT: Responsibility and authority for: Direction, co-ordination, programming and monitoring of the performance of the members of the Consultant Team; Development and review of programmes, resources and Work Stage procedures; Making and/or obtaining from the Client decisions necessary for cost control; Communications between the Client and the members of the Consultant Team; (If appointed for the construction period Work Stages) exercising the powers and duties of and associated with the role of the Contract Administrator under the Building Contract and direction, co-ordination and monitoring of any site inspectors. The use of this term avoids any pre-supposition as the profession of such a person.
Design co-ordinator	A designer who integrates several diverse design inputs into a cohesive design.
Design manager	The manager responsible for co-ordinating the design team to ensure that information of the appropriate quality is delivered within the project time scale to meet the needs of the design, manufacturing and construction process.
Design team leader	The person responsible for overseeing and co-ordinating the work of the design team, the primary link between project management and design management (BS 7000).
Lead consultant	Synonym for *Consultant team manager*
Project manager	Client's representative with authority and responsibility for managing the whole project.
Project management team	A team of participants who collectively ensure that the project is run properly.
Project engineering manager	The responsibility for ensuring that the various engineering aspects of a project are integrated in the design and in the construction of the project.
Team management	The responsibility for getting project participants to work as a team.

Design

Designers with specific responsibilities bring many different specialist skills to the process of design. As well as different design disciplines, there are differences in involvement. Most designers are consultants, and members of the client's design team. However, in some design and build packages, the consultants are employed by the contractor for some or all of the project. Also, some specialist contractors employ their own designers.

Acoustic consultant	Consultant designer with specific responsibility for contributing advice and information on civil engineering aspects of the design.
Architect (design function)	That part of the architect's role connected with design.
Architect (design)	Synonym for *Architect (design function).* (RIBA)
Architectural designer	A designer undertaking the design function of an architect.
Building services designer, Building services engineer, Services engineer, Engineer (building services), Electrical engineer, Engineer (Mechanical and electrical), Environmental engineer, Mechanical engineer	Consultant designer with specific responsibility for contributing advice and information about building services installations.
Civil engineer	Consultant designer with specific responsibility for contributing advice and information on civil engineering aspects of the design.
Consultant designer	Any designer employed in the client's design team, with responsibility for a specific part of the design.
Consulting engineer, Engineer	Synonymous with *consultant designer* with the emphasis on one of the engineering disciplines, implying a Chartered Engineer of some sort.
Designer	Any person with responsibility for part or all of the design.
Designer (architect)	Synonym for *architectural designer.*
Designer (structural), Structural designer, Structural engineer	Consultant designer with specific responsibility for contributing advice and information about the strength and stability of the structure.
Engineer (civil and structural)	Term used in the RIBA plan of work to identify the interfaces that the architect had with civil and structural engineers.
Fire engineer	Consultant designer with specific responsibility for contributing advice and information on civil engineering aspects of the design.
Geotechnical engineer, Geotechnic engineer	Consultant with specific responsibility for contributing advice and information on aspects connected with conditions below the surface of the ground.
Ground investigator	Consultant with specific responsibility for contributing advice and information on ground and site conditions.
Landscape architect, Landscape consultant	Consultant designer with specific responsibility for contributing advice and information on landscaping aspects of the design.
Materials engineer	Consultant designer with specific responsibility for contributing advice and information on materials science aspects of the design.
Specialist advisor, Specialist consultant, Specialist designer	Responsibility for specialized advice, connected with some specific aspect of the project.
Sub-consultant	Consultant employed by another consultant for the purpose of providing specific advice and information covering some specific aspect of the design input.
Traffic consultant	Consultant designer with specific responsibility for contributing advice and information on traffic engineering aspects of the design.

Administration

The main building contract usually contains provisions for a third party to oversee the contractor's work, issue certificates and make independent decisions in regard to claims–additionally, the incumbent will need to co-ordinate, direct and monitor any other people with specific administrative responsibility. While this was traditionally a part of the architect's duties, the involvement of non-architects in this work, and the fragmentation of the architect's role have led to the emergence of a range of terms.

Architect	Originally the architect undertook these duties.
Contract administrator	Term used when someone other than an architect undertakes such duties, because "architect" is a legally protected term.
Planning supervisor	A statutorily defined role that is part of Health and Safety legislation, specifically the Construction (Design and Management) Regulations.
Project administration	Alternative term for *contract administrator*.
Site inspectorate	Generic term for those with inspection duties on site.
Superintending officer	Synonym for *contract administrator* usually used in government contracts.
Supervising officer	Synonym for *contract administrator* usually used in local authority contracts.
Supervisor	BPF term for contract administrator

Site inspector

Inspectors are employed on the works to ensure compliance with the contract provisions with regard to standards of materials and workmanship.

Clerk of works	In the building sector, an inspector employed by the client to assist and inform the architect.
Resident engineer	1–A role similar to the clerk of works, but more senior, not always paid by the client, sometimes appointed for monitoring just the engineering aspects of the project, and therefore reporting to one of the consultant engineers. 2–In the civil engineering sector, the member of the Engineer's organization who maintains a constant presence on site.
Site architect	A member of the architect's organization who maintains a constant presence on site, for the purposes of inspecting work to ascertain conformance with contract documents and issuing instructions and information.
Site inspector	Generic term for those who inspect work on site, with the objective of ascertaining the extent to which it conforms with the contract documents.

Financial	
Overall responsibility for providing financial planning, advice and information for the project. Although the purpose is to estimate or ascertain market *prices*, the tendency in the industry is to refer to this as *cost* advice. Where specialist cost advisors are appointed, the general responsibility includes the co-ordination of specialist cost advice.	
Cost advisor	Usually used where there is only one source for financial advice in the project. This term also implies that this role need not necessarily be undertaken by a qualified professional quantity surveyor.
Cost consultant	Synonym for *cost advisor.*
Cost planner	Early stage advice about expenditure patterns during the project.
Lead cost advisor	The cost advisor with overall responsibility for the project, responsible for co-ordinating diverse inputs of cost advice.
Quantity surveyor	The professional title for this role, usually implying membership of RICS. Also, the label used in standard-form building contracts for denoting this role. Quantity surveying includes measurement and compilation of bills of quantity, and valuation of work done.

8.3.4 Builders and contractors

The next main category of participant consists of those who build or supply goods and materials. Some of these participants have general responsibility for input across the whole project, whereas others have an input only to a section or sub-system. Although there is a growing trend to distinguish management from operational responsibility in the design aspects of construction projects, this is less developed in relation to builders' work. Therefore, both aspects tend to occur together.

Constructor

In general contracting and design-build procurement routes, one person or organization takes on the general responsibility for particular *contract works*. This means procuring and marshalling all of the resources required for assembling the building in accordance with the documented design. Procurement routes differ in the amount of design responsibility and in the level of construction responsibility taken on by the builder. Also, building differs from civil engineering where it is expected that the "builder" will design temporary works and any final unresolved details. In the building sector, it is customary for builders not to take on design responsibility. Although English courts would not tend to imply terms that eliminated design obligations for a builder, building contracts have routinely incorporated express terms that achieve this. In design and build procurement, the opposite situation holds, in that the builder takes on general design responsibility as well as construction responsibility. Finally, there are two other mechanisms for allocating design responsibility for part of the work to the builder: a "contractor design portion supplement" or a *performance specification*.

Builder	Generic term for a person or organization that buys materials, procures labour and arranges for work to be done on site.
Building contractor, Contractor, General contractor, Main contractor	A builder who is contracted to do the whole of the building work.
Design-builder, design-build contractor	A builder who is contracted to design the building and erect it.
Design contractor	An organization contracted to produce design information.
Lead contractor	In the event that there are several contractors on the site, the contractor who is responsible for overall co-ordination.
Management contractor	A general contractor who sub-contracts the whole of the building work to various *works contractors* and (in principle) takes on no independent contractual liability for the sub-contracted work, thus identifying a separation between operational and management responsibility.
Principal contractor	A statutorily defined role that is part of Health and Safety legislation, specifically the Construction (Design and Management) Regulations.

Constructors' staff

An organization providing the resources for the construction work will usually have a number of key staff involved with a project. While these are not usually identified in the contracts between the constructor and employer, these job titles are frequently encountered in detailed descriptions of the process of construction.

Construction manager	Generic term for any manager responsible for construction operations. (Also see page 159.)
Construction planner	A builder's employee responsible for preparing the construction plan.
Contract manager	A builder's employee who manages the particular contract.
Person-in-charge	A builder's employee whom the builder may be contractually obliged to maintain on site.
Project manager	A builder's employee responsible for the builder's input to the project.
Site agent	The builder's representative on site.
Site manager	A builder's employee responsible for co-ordinating the work on site.

Direct contractor

A person or organization contracted to the client, under a contract separate from the main building contract, for the supply of goods and/or services in connection with the project. During the construction stage, such organizations may need to be co-ordinated with others working on the site. However, their involvement may occur before construction commences, or after it is completed.

Artists and tradesmen	Obsolete term for *direct contractor*.
Client's direct contractor	Synonym for *direct contractor*.
Preferred supplier	A person or organization that supplies goods and services to the *client*, in connection with a building project, particularly one with which the *client* is developing medium to long-term business relationships.
Supplier	A person or organization that supplies goods to the *client*.

Partial responsibility	
Organizations who are contracted to provide building work for part of the project. This sometimes involves them in designing the things they install. There is a variety of terms to describe these organizations in general, none of which is connected with the type of work being undertaken. Further terms simply describe the nature of the specialist's contractual involvement with the project.	
Domestic sub-contractor	Person or organization who supplies labour and/or other resources to a contractor under terms that maintain the main contractor's liabilities.
Engineering contractor	A *contractor* whose work involves engineering. Usually indicating a category of sub-contractors distinguished by the need for the associated *contract administration* function to be carried out by an *engineering consultant*.
Labour-only sub-contractor	Person or organization that provides labour to a building contractor.
Named sub-contractor	Sub-contractor selected by the employer (specifically under the JCT Intermediate Form of Contract).
Nominated sub-contractor	Sub-contractor selected by the employer (specifically, for example, under the JCT Standard Form of Building Contract, and the Institution of Civil Engineers Standard Form of Civil Engineering Contract).
Nominated supplier	Supplier of resources (excluding labour) selected by the employer (specifically, for example, under the JCT Standard Form of Building Contract, and the Institution of Civil Engineers Standard Form of Civil Engineering Contract).
Package contractor	A *sub-contractor* whose work forms one of the packages in a *construction management* or *management contracting* project.
Process contractor	A *specialist contractor* whose work involves chemical engineering processes. The associated *contract administration* function will be carried out by a consultant chemical engineer.
Specialist	Usually, a synonym for *specialist contractor* but occasionally a *consultant*.
Specialist contractor	A general term for any *contractor* or *sub*-contractor providing specialist work.
Specialist sub-contractor	A sub-contractor who provides specialist work.
Specialist supplier	A supplier who supplies equipment or components that require specific design work for the purposes of incorporating them into the project.
Specialist trade contractor	A *contractor* whose work involves the design of the things they install. This will (generally) require some kind of interaction with the design team.
Sub-contractor	A person or organization employed by a contractor. Usually distinguished from a supplier by the inclusion of labour as part of the agreed services.
Sub-contractor's designer	A designer who works for a specialist trade contractor.
Supply-only sub-contractor/ supplier	A sub-contractor providing materials and/or components, but not labour.
Trade contractor	1–Any *contractor* who specializes in one particular set of skills and techniques. 2–In Construction Management procurement, one of the various *contractors* who are in direct contract with the client.
Works contractor	*Sub-contractor* in a *Management Contract*

8.3.5 Regulators

Those who become involved by virtue of regulatory functions are not appointed by client, contractor or consultant. Therefore they are identified here in a separate category. There are some functions associated with clients and stakeholders (see section 8.3.2)that have an effect similar to

regulatory approval, in that the power of approval over a project, whoever wields it, may lead to a project being changed or even abandoned. However, these are excluded from the definitions in this section because this section deals only with regulatory functions with a statutory basis.

Statutory authorities	
Generic term to cover organizations set up under statute for ensuring that those areas of activity governed by statutes are carried out in accordance with the relevant laws.	
Statutory authorities	Generic term for all organizations that are established for the purpose of monitoring or implementing rules that govern what is permitted in the design, construction, use, maintenance or demolition of buildings and associated structures.
Utilities	Water, sewage disposal, gas, electricity and telecommunications suppliers.
Statutory and other authorities	Generic term for all organizations that are established for the purpose of monitoring or implementing statutes that govern what is permitted in the design, construction, use, maintenance or demolition of buildings and associated structures as well as authorities that have been established for monitoring and implementing non-statutory rules.
Statutory bodies	Synonym for statutory authorities.
Health and Safety Executive	A government department whose role is to ensure that risks to the health and safety of individuals at work are properly controlled. In the construction industry, the responsibility also extends to ensuring that all who use a building are not exposed to adverse risks.
Local utilities	Water, sewage, waste disposal and associated utilities, usually organized by the local authority, who have a statutory obligation to ensure that adequate standards are conformed with, even if the responsibility for doing the work is contracted out to the private sector.

Local authority	
Government at a local (municipal) level. There are five different types of local authority: County and Districts Councils, London Boroughs, Metropolitan Districts, Unitary Authorities. Their involvement in construction projects generally comes about because of their obligations in connection with building control legislation, planning law, environmental health and fire safety.	
Development control authority	The authority that is responsible for controlling property development in the area in which the project is being built.
Planning authority	Synonymous with *development control authority*.
Planning officer	The person who is named as the planning authority's contact for the purposes of seeking planning permission.
Planning manager	Newer term for *planning officer*.
Town planner	Generally, anyone who is involved with town planning.
Building control officer	The person responsible for checking submission for the purposes of approving submissions for building control. This person may be either a member of the local authority or a private sector consultant.
Environmental health officer	A specific local authority officer.
Fire officer	A specific local authority officer.

8.3.6 Dispute resolution

Dispute resolution In the event of a dispute between parties to a contract, a third party is often introduced to help achieve a resolution. Such roles were intended to avoid the expense and delay of litigation.	
Arbitrator	Independent third party engaged to resolve a dispute in a quasi-judicial manner, resulting in an award binding upon both parties. Where the arbitration agreement is in writing, the process is controlled by the Arbitration Act 1996. Arbitration is an alternative to litigation.
Adjudicator	Independent third party appointed to give a decision on a dispute arising under a construction contract which will be binding on both parties, at least temporarily (though subject to being set aside at a later date in court or at arbitration). The right to insist on adjudication is contained in the Housing Grants, Construction and Regeneration Act 1996
Conciliator, mediator	Someone who helps disputing parties to come to an agreement, sometimes involving a recommendation if no agreement is forthcoming.

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APPENDIX 1: FOCUS GROUP PARTICIPANTS

Lawyers (5th May 1999)
Simon Burch, Linklaters and Paine
Catriona Dodsworth, Masons
Anthony Edwards, D J Freeman
Roger King, Trowers & Hamlin
Christopher Meara, Cyril Sweett
Christopher Whittington, Shoosmiths

Consultants (21st September 1999)
Mike Boughen, Thorburn Colquhoun
Vic Dunham, Peter Brett Associates
Peter Hyde, Somerset County Council (retired)
Christopher Miers, Probyn-Miers
Dennis Singleton, Foster Wheeler Energy Ltd
Bruce Vickers, Peter Foggo Associates

Clients (23rd September 1999)
David Fulford, University of Reading Buildings & Estates Office
Peter Holden, BAA Lynton plc
John Hunt, Royal Berkshire Hospital
Neil Pennell, BAA Lynton plc
Richard Smith, Wycombe District Council
Nick Williams, Chartwell Land

Contractors (1 October 1999)
David Cook, John Sisk
Phil Fry, Wates Construction South Limited
Paul Monk, John Mowlem Civil Engineering
David Williams, Moss Construction
Colin Weekley, Sir Robert McAlpine Ltd

Trade contractors (7 October 1999)
Tony Barry, CFC Group Ltd
Ian Browne, Honeywell Control Systems Ltd
Alan Laycock, Balfour Kilpatrick Ltd
Eddy Oliver, Bug-Alu Technic UK Limited
Peter Wren, MITIE Engineering Services (Bristol) Ltd

APPENDIX 2: GUIDANCE FOR FOCUS GROUP MODERATORS

Welcome – Overview of the topic – why you're here – we are undertaking a research project for the Joint Contracts Tribunal on the terminology used in contracts to describe the roles of the major participants.

- The aim of the research is to develop guidance for those who draft construction contracts about the terms and concepts surrounding the various roles in construction projects. There are two strands to the work; academic research into the sciences of lexicography and terminology; and focus group interviews with practitioners to develop a comprehensive picture of contexts and meanings from their points of view.
- The purpose of these Focus Groups is to find what meanings are attached to the words usually used to describe the roles of the participants in the design and construction processes, we will be recording the conversations, transcribing them and analysing what was said using qualitative research techniques. In our reports to the JCT and in anything that they publish about this research, your participation will be acknowledged although no specific statements will be attributed to you and none of the transcripts of the sessions will be seen by anyone but the researchers. Also, it is understood that the views we are seeking are your personal views and will not in any way be represented as those of your organization.

Guidelines and ground rules:

- We're recording this discussion
- Your names will be acknowledged in our reports, but no comments will be attributed to any individuals. Your responses are personal views only.
- The study is sponsored by the Joint Contracts Tribunal to seek a wider view than their representative groups.
- The role of moderator is to guide the discussion, but not to take part. Our primary aim is to listen to you talking to each other, rather than to us.
- We aim to finish in about 90 minutes.
- We are not seeking answers or decisions, only the range and diversity of points of view.
- Please turn off mobile phones and alarm watches.
- Only we will hear the tapes, which will be transcribed and analysed. The sponsors will only see findings from the discussions, not the discussions themselves. If selected extracts are shown in any of our reports, they will not be attributed to any individual. Please introduce yourselves, both to enlighten us and to help with transcription of the recording.

Opening question – taking as a starting point the project with which you most recently dealt, what is the typical constitution of a project team? (Alternatively: Whom do you usually expect to see as a participant in the project?)

For each participant mentioned:

- What is the role of each of these participants in a project? (To whom are they answerable? Who reports to them? What do they produce? Who pays them?)
- Is this standard, does it vary? Would it always be the case? How does it vary between projects?
- Does this change between stages?
- What alternative terms might there be to describe this role? (Look for the significance of the differences between terms)
- Having mentioned differences between stages in a project, what are the typical major stages and how does this vary between projects?
- In your own contract drafting experience (project set-up for non-lawyers), how do you go about describing roles and choosing terms?

Finally, there are a few issues of interest to the JCT Working Party where your comments might prove helpful.

- Liability of consultants - level of skill, impact on project programme or budget.
- Obligation on client to co-operate.
- Client instructions; should the consultant have a reasonable right of objection, should the client be obligated to issue instructions that the consultant suggests?
- Should there be any circumstances under which the consultant becomes entitled to extra payment?
- Should there be clauses about set-off and should set-off be allowed before or only after sums have been subject to adjudication?
- Should the client's right of objection, to the performance of part of the consultants' work by others, be subject to a test of reasonableness?
- Should client's right of objection to a replacement of the consultant's representative be subject to a test of reasonableness?
- Should there be a period stated in the contract limiting the right of action against the consultant?
- Should there be a general cap on the liability of consultants?
- Should the consultants' liability be limited to net contribution?
- Should the consultant indemnify the client for damage or injury to persons and property?

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