EXPLORING THE PERCEPTION OF PROJECT RISK ALLOCATION UNDER DESIGN&BUILD CONTRACTS; A CLIENT SIDE PERSPECTIVE

Dave Elwood

This thesis is submitted in partial fulfilment of the requirements for the degree of Master of Science in Built Environment from the University of London

Bartlett School of Graduate Studies
University College London
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ProQuest LLC
789 East Eisenhower Parkway
P.O. Box 1346
Ann Arbor, MI 48106-1346

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BY

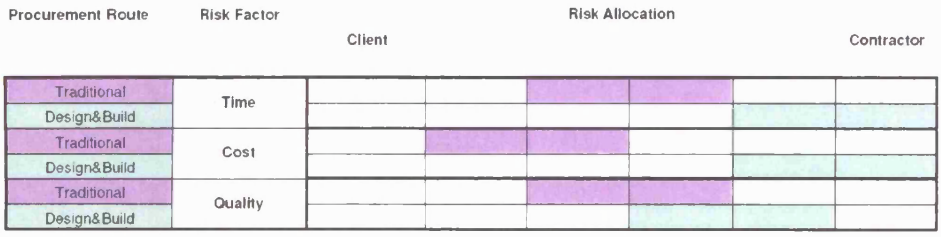
DAVE ELWOOD

"No construction project is risk free. Risk can be managed, minimised, shared, transferred, or accepted. It cannot be ignored."

Sir Michael Latham, 1994.

"In no other industry is the responsibility for design so far removed from construction"

The Barnwell Report, 1964



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Dave Elwood
Flat 4, Brewery Wharf
17 Mowbray Street
Sheffield
S3 8EL

ABSTRACT

Risk and uncertainty are inherent in construction projects and they have been the focus of much attention in recent years. This study reports on a survey of over 40 construction professionals (followed up by semi structured interviews) to understand key procurement selection criteria and the allocation of risk with Design&Build contracts.

It is clear that whilst knowledge of risk management procedures and its application is increasing within the industry, differences in the perception of risk allocation within procurement remain. The report explores how even when risks are transferred from the Employer to the Contractor, they are by no means eliminated and highlights areas where residual risk is retained by the Employer such as design responsibility. It also highlights that many of the central concepts of this procurement route, such as the integration of design and construction, remain only partially realised and as such it is not able to deliver the full benefits advocated.

Since not all risks are foreseeable at the outset, risk and uncertainty are only truly appreciated in the later stages. Employing even the most exhaustive use of contractual conditions to allocate risks at the start of a project can not manage risks sufficiently. This report focuses on some of the residual risks held by the client under Design&Build and stresses that unclear and unfair risk allocation can hurt both parties and that with shared uncertainties, incentives for both parties are required to mitigate these risks.

Risk Management is not something that can be determined entirely through a contract but is instead applied through the attitudes and actions of the parties present. It is only through a collaborative effort involving a Joint Risk Management Strategy, that differences in perception can be comprehensively overcome and the opportunities for project success maximised.

KEY WORDS:

Risk
Risk Perception
Risk Allocation
Procurement Strategy
Design Risk

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1.0 INTRODUCTION

1.1 Rationale for the study

"The construction industry and its clients are widely associated with a high degree of risk due to the nature of business activities, processes, environment and organisation"
(Akintoye and MacLeod, 1998 pg. 5)

Over a decade ago the Latham Report (Latham, 1994) highlighted that the issue of Risk Management should be at the forefront of efforts to establish industry-wide best practice. The selection of the procurement route has long been considered a key decision in the management of risks and accordingly these two topics are intrinsically linked.

This study will outline whether there is general agreement between client and contractor side perceptions of risk allocation; focussing specifically on the risks mitigated or increased through the adoption of Design&Build. It will seek to understand the significance of risk allocation within complex or high value projects; the variations in use encountered in different project sectors and whether the Design&Build contract does lead to Client risk minimisation, transference can in some case lead to an overall increase in project uncertainty when it comes to the issue of design risk and quality.

1.2 The research problem.

Risk within Design&Build contracts is of particular interest to me because of my close involvement with the Design&Build route not only within my current role but also because of the perception of project success within a number of developments in my local area.

From an initial review of the literature an overarching research statement has been put together:

"To assess and understand the perception of risk allocation under a Design&Build contract from a client side perspective."

On further examination this question broadened into three themes:

Risk Management in Procurement selection
Does this perception of risk change by project type, size and complexity or do some project participants think the same way regardless?
Do Client and Contractor sides agree on the key criteria and risk allocations under the different procurement routes for uncertainties governing; Client Involvement, Design / Management Separation, Speed, Price, Competition, Flexibility, Complexity, Quality, Delay, Responsibility, Funding and Health & Safety.
How does Design&Build aim to mitigate these risks?
When risk is a key consideration, is Design&Build favoured by Clients?

Risk within Design&Build contracts
Do contractors have in-house design capability; what are participants' thoughts on the use of novation?
Are contractors best placed to manage and co-ordinate design?
Does Design&Build improve project communication?
Are participants aware of any increased risk within Design&Build?

Key factors of uncertainty in Design&Build and Risk Transference
Do Design&Build contracts provide the effective transference of risk that participants believe they do? Can Design&Build engender additional risk? What risk strategy would provide thorough risk mitigation.

1.3 Methodology

An extensive literature review has been conducted under these three themes and was used to expand upon the overarching research statement. This allowed the development of

questions to be put before a survey of construction project participants and helped develop an agenda for the semi-structured interviews.

Employing research techniques such as snowball surveys data has been collected, presented and analysed using appropriate and engaging techniques. Conclusions have been made and these are related back to the key issues identified within the literature review with any similarities or differences highlighted. Where possible theory has been tested against the evidence uncovered.

Finally all the research analysis has been reviewed for its accuracy and evaluated for its contribution to construction research. Comments have been provided for possible future improvements to this study alongside suggestions for further research into related areas.

1.4 Definitions

For clarity a few of the key definitions used within this study will be given below:

Risk	*Exposure to the possibility of economic or financial loss or gain, physical damage or injury, or delay, as a consequence of the uncertainty associated with pursuing a particular course of action (*Cooper & Chapman, 1987 p. 852)
Risk Management	*A systematic approach to dealing with risk. A risk management system should establish an appropriate context, set goals and objectives; identify and analyse risks; influence risk decision making and monitor and review risk response* (Edwards & Bowen, 1995 p.339)
Risk Identification:	*The process of systematically and continuously identifying, categorising and assessing the initial significance of risks associated with the construction project* (Adams F, 2003 p.23)
Risk Analysis and Evaluation:	*The systematic assessment of decision variables which are subject to risk and uncertainty. The risk analysis process comprises: the establishment of probabilities of occurrence against adverse effects; the setting of assumptive bounds to associated uncertainties and the measurement of the potential impact of risk event outcome* (Edwards & Bowen 1995 p.340)
Procurement	The process of acquiring new services or products. It covers the financial appraisal of the options available, development of the procurement or acquisition of suppliers, pricing, purchasing and administration of contracts (APM 2000, as cited within Langford D, Murray M, 2004 p.656)
Procurement Strategy	*The procurement strategy identifies the best way of achieving the objectives of the project and value for money, taking account of the risks and constraints. The aim of a procurement strategy is to achieve the optimum balance of risk, control and funding for a particular project.* (Achieving excellence in construction procurement guide, 2003 p.2)
Traditional	*The design is undertaken by a team separately appointed by the client, with construction by a contractor competitively appointed on the basis of a detailed specification prepared by the client's consultants.* (Achieving excellence in construction procurement guide, 2003 p.5)

Design&Build	*Those contracts where procurement requires the contractor to accept responsibility for the construction and the design of the project.* (Akintoye, A., Fitzgerald, E. 1995, P.28)

2.0 RISK MANAGEMENT IN PROCUREMENT STRATEGIES

2.1 Introduction

"The Client who wishes to accept little or no risk should take different routes for procuring from the Client who places importance on detailed, hands-on control"
(Latham 1994, p7)

There are three dominant procurement routes in construction; Traditional, Design&Build and Management Contracting. These routes offer differing solutions to the construction client's objectives and selection will depend upon the client's willingness to trade off some categories of uncertainty against others. The situation is further complicated by the large number of contractual variations and amendments present within each procurement route with research by Morledge, Smith and Kashiwagi (2006) indicating that relatively few construction industry professionals fully understand the difference between various procurement systems.

The number of different procurement arrangements on offer has resulted in a demand for a systematic method for selecting the most appropriate contract for a particular project. However consensus even between experts is rare and so it has been difficult to systemize procurement selection. In 1985 the National Economic Development Office (NEDO) produced a chart to demonstrate the priorities of each procurement path and this was later modified by Skitmore and Marsden (1988) to give the priorities a more continuous scale and is illustrated in Figure 2.1

Client's Priority	**Procurement Path**	
	Traditional	Design&Build
Speed	10	90
Certainty	30	100
Flexibility	110	40
Quality Level	110	40
Complexity	100	50
Risk Avoidance	30	100
Price Competition	110	10

Figure 2.1 Procurement Path decision chart (Source: Skitmore R Marsden D, 1988, pp. 73)

Rated on a scale of 10 – 110 this illustrates where the panel of experts used in Skitmore and Marsden's study believe the strengths of each procurement route lie. The attributes used to represent Client priorities have varied over time and Appendix B illustrates how these have been considered by academics over time.

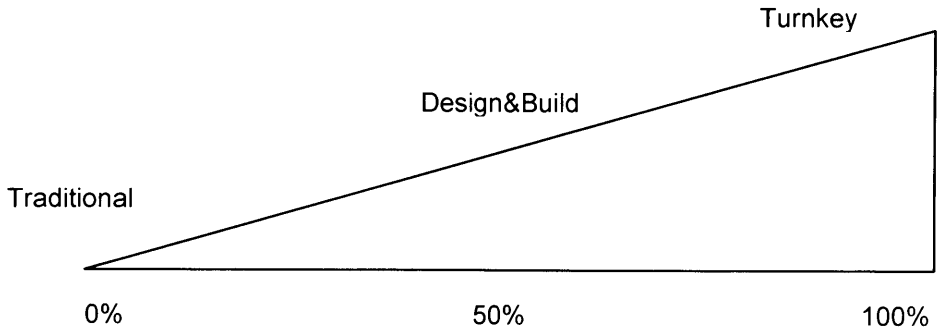


Figure 2.2 – amount of contractor design (Source Skitmore R, Marsden D, 1988, pp.74)

Figure 2.2 demonstrates how procurement selection affects contractor input into design. This choice has a significant impact on the risk borne by the parties involved with the project and will need to be explored in greater depth later in this study.

2.2 Procurement Routes by Value and Number.

Management Contracting tends to be selected only when the client is highly experienced, is willing to accept high levels of risks and is able to manage or absorb them. Through this they can achieve the lowest price for the contract and (potentially) reap the maximum profit. Given that clients in the construction industry tend not to be this experienced, the number of contracts procured this way is relatively small. In broad terms the main choice of procurement choice is between Traditional and Design&Build.

According to RICS' "Contracts in use survey" (2004) 13.3% of all projects are procured using Design&Build, a figure up from 5.6% twenty years earlier. This contrasts with 76.7% of all projects still being procured under the Traditional route. What is interesting to note however is that by value, rather than number, 43.2% of all projects are procured using Design&Build rather than 36.8% employing the traditional route. This would indicate that Design&Build is being used for a smaller number of much higher value jobs. Assuming higher value carries higher risk through cost and complexity it is possible that the Design&Build route is being employed for its risk transfer capabilities. This assumption, alongside other factors that might explain this result, will need to be tested by the study.

2.3 Project Type

Whilst often referred to as one sector the construction industry covers a wide variety of different projects ranging from simple, largely repetitive projects to unique and complex landmark developments. Different project types such as commercial offices, retail, and health have very different requirements which are catered for, with differing degrees of success, by procurement routes. Whilst Traditional is seen as being able to achieve buildings of high complexity without risk of default due to the allowance for high client involvement the same is not true of Design&Build. This is due to the difficulty in conveying all aspects of the scheme through the Employers Requirements alongside the much more limited scope for the designer to work through the design with the client.

2.4 Traditional

The Traditional procurement route involves the appointment of consultants who develop a complete design package and provide a realistic budget estimate before going out to tender. The selected contractor is then appointed under a separate contract. Morledge and Sharif, (1995), have stated this route carries a number of advantages: increased price competition, price certainty, ease of variation and being design led.

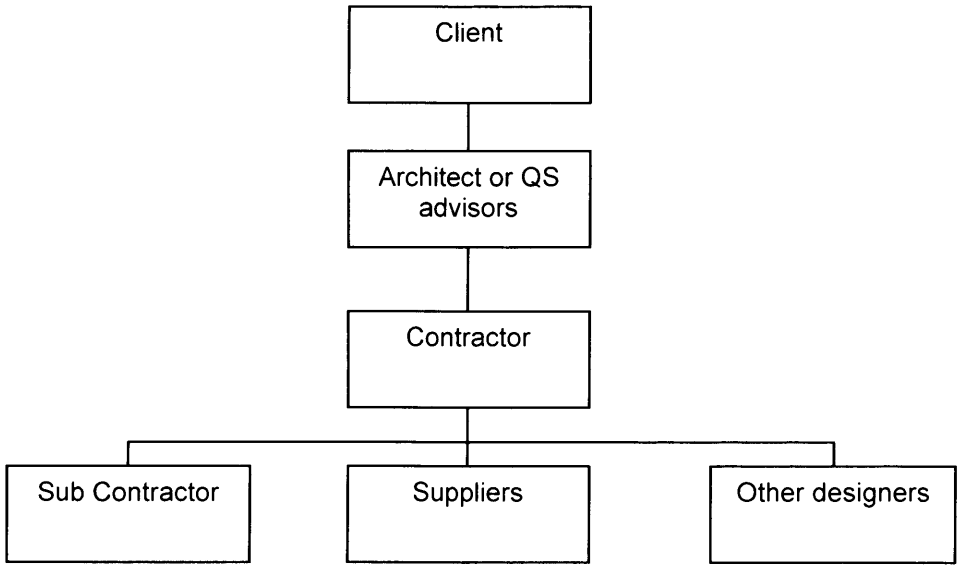


Figure 2.3 Relationships under Traditional procurement

Several variations from the Traditional route have been devised in recent years. These attempt to tackle some of its disadvantages whilst still maintaining its core principles. The majority of these variations attempt to reduce the adversarial relationships, long design lead in period, and provide greater involvement by the contractor in design to promote buildability. Examples of such practices include "negotiated contracts", "two stage selective tendering" and "cost reimbursable contracts".

2.5 Design&Build

Under Design&Build the Client draws up a detailed specification of their objectives which are known as the Employers' Requirements. These are put out to tender with contractors developing against design, programme and cost. The client reviews the submissions and will select the contractor on the basis of a pre-determined set of criteria that should take into account design as well as price. The prominent feature of Design&Build is that work on site can start before the design is fully complete and can result in a shorter contract period. Design&Build also simplifies the contractual relationship between the Client and Contractor and achieves single point responsibility which is cited by many academics; Akintoye, Morledge, Love etc as the key advantage.

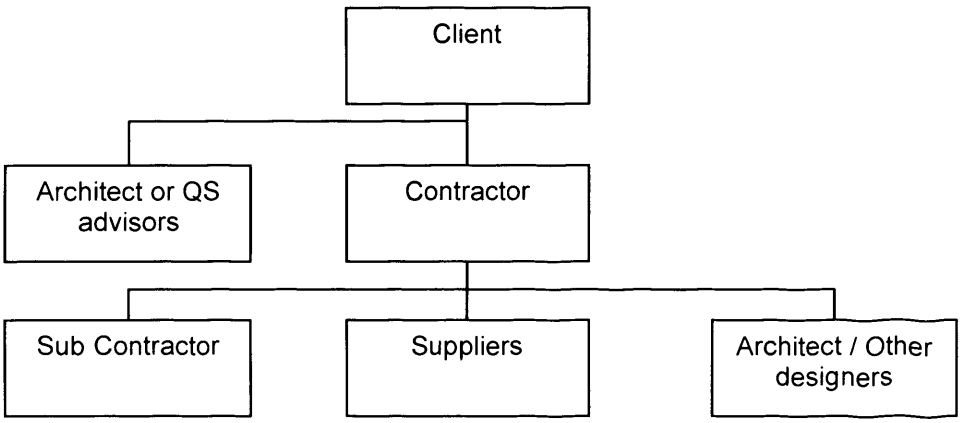


Figure 2.4. Relationships under Design&Build

2.6 The Nature of Project Teams.

Construction projects are generally bespoke, bring together a multitude of differently skilled people and involve co-ordinating a wide range of disparate, yet inter-related activities. In such circumstances whilst procurement route might have an impact on the organisational structures in which people operate, the experience and skill of the design / construction team will still be a significant contributor to project success. Naoum & Mustapha's study in 1994 indicated just this, that lower cost, improved quality and reduced programme are strongly correlated with project team experience. It is also worth highlighting that the technology available and building method adopted (e.g. steel frame or concrete) can equally have a large impact upon programme and cost irrespective of the chosen procurement route. These factors need to be remembered before placing too greater emphasis upon procurement selection.

2.7 Conclusion

Figure 2.5 on the next page has been drawn together from the literature review and represents a summary comparison of the two main procurement routes against the main procurement criteria highlighting aspects which mitigate risks and demonstrating the residual risk to the client which can not be entirely eliminated.

Procurement strategy is driven by the client's need to achieve the paradigms of Time, Cost and Quality but the uncertainties which govern these also need to be considered.

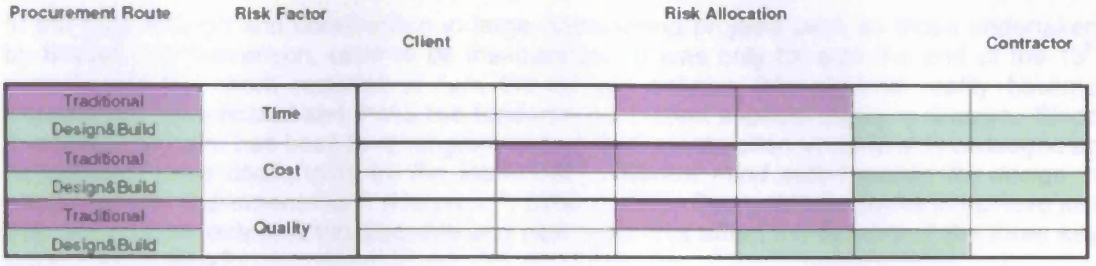


Figure 2.6 broadly demonstrates the time, cost, quality spread of risks between the Traditional and Design&Build procurement routes.

It is debatable whether the Traditional system is better placed to deliver quality and cost, whilst Design&Build can deliver a greater certainty and speed in terms of programme. Anecdotal evidence suggests that in the current economic climate it appears that clients are placing a greater emphasis on single point responsibility, risk avoidance and flexibility rather than on quality or cost.

As such it is client characteristics as much as project characteristics that have a large impact on procurement route selection. Similar projects should have similar priorities, with clients expected to select a "best fit" procurement route. The reverse however is also true, with different clients pursuing different objectives and exhibiting varying perceptions and appetites for, risk. It is however not within the scope of this study to evaluate the differing objectives of construction clients such as, developers, entrepreneurs and Government and how this impacts upon their risk perception.

It is worth highlighting that the transfer of risks is not an end in itself, that risks should only be transferred when it can be demonstrated that the correct disciplines and incentives are in place to help achieve a more favourable outcome. As highlighted by Figure 2.6, and more fully described in Figure 2.5, Design&Build is seen as the least risky option for the client due to the transference of risks (such as design) to the contractor, but the passing of too many risks to the contractor will result in inflated tenders, or through under-pricing by short sighted contractors, could lead to a situation where they would not be able to cope if anything subsequently went wrong (Murdoch, 2000).

Whilst there are many contributing factors, the it is generally agreed that an important influence on the success of a project is the type of procurement route selected. It is also clear that there is no "one best route" for every project but that specific project characteristics will determine an individually tailored best fit procurement route. Given the nature of the construction process, and the often unique requirements demanded of projects this seems a logical conclusion.

2.8 Objectives of research as outlined in this chapter:

- Is the cost of the project related to the selection of the procurement route? Does this reflect a consideration of complexity and risk?
- When risk is a key consideration, is Design&Build favoured by Clients?
- Do Clients, Consultants and Contractors agree on the key procurement criteria and risk allocations under the different procurement routes?

This study will now address how the Design&Build contract addresses the forms of uncertainty commonly found within construction projects through the Time / Cost / Quality paradigm.

A comparison of Traditional and Design&Build using key procurement criteria and risk allocation

Criteria	Description	Traditional		Design&Build	
		Mitigation	Remaining Risk under Traditional	Mitigation	Remaing Risk under Design&Build
Client Involvement:	That it allows a moderate to high level of Client input.	1. The Client is able to be highly involved in the project should they wish.			1. The Client is restricted to a limited involvement.
Design / Management Separation	That there is a low separation between design, management and construction		1. Design and construction remain separated resulting in difficulties in co-ordination, buildability and creating the need for further clarification between teams.	1. There is an efficient single contractual arrangement integrating design and early construction expertise within one accountable organisation.	1. Contractor organisations still tend to replicate external separation of design and contruction internally and create the same issues.
Speed:	The speed from inception to completion.	1. Could consider two stage or negotiated tendering if speed is key.	1. Programme tends to be longer due to the lack of integration between stages and the need to have all tender documentation prepared before going out to tender.	1. Design work no longer has to be completed before tender and will develop alongside construction shortening the overall programme.	
Cost Certainty:	That a high degree of cost certainty can be achieved.	1. The contract sum is agreed before starting work and provides reasonable cost certainty. 2. Variations should be small given the time already spent developing the design to ensure they match the Client's objectives. 3. Any variations that are required can be priced through the Bill or schedule rates ensuring that it is done swiftly and cost effectively.		1.If the Employer's Requirements are well specificed and there are no significant variations then price certainty for the Client is high.	1. Risk for the Client remains quite high as ensuring that all the Client's objectives are specified fully in the Employers Requirements is very difficult, often necessitating expensive variations. 2. Risk for the contractor however is high since any mistakes in design, or pricing will be borne by the contractor.
Competition:	Tendering for the project will not be price competitive.	1. Contractors are familiar with the tendering process. 2. The Traditional route allows for an easier comparison of tenders since all bidding firms are asked to price against the same document. Exceptions / clarifications excluded.	1. High competition can lead contractors to make bids with very low margins hoping to make back profits with later variations / claims	1. It is possible that increased competition might occur given that contractors are competing over so many different factors.	1. Comparing the competitiveness of Design&Build tenders can be difficult since with many varying factors they are not directly comparable. 2. No benefit to the Employer if the contractor seeks greater competitiveness for the specialist work or materials. 3. There are complaints by Contractors that the tender is almost always judged on price, not design.
Flexibility:	The project is unable to cope with design changes.	1. The Client controls design and generally institute variations when desired.	1. There is a danger that the relative ease of variations creates an incentive for the client to make unnecessary variations.		1. Once the contract is signed heavy penalties are incurred for any variations. 2. Flexibility in developing detials or making substitutions is to the contractors advantage.
Complexity:	The Client's requirement for a complex building can not be met.	1. Can be used for both simple and complex projects.	1. Complications can arise if the Client requires that certain sub-contractors be used.	1. Design&Build is considered highly innovative in its use new technology and construction techniques. Contractors generally have a better awareness of new technological developments than consultants which would otherwise not be considered or difficult to suggest given limited cost information.	1. Whilst theoretically used on both simple and complex buildings, there is a general consensus in the industry that more difficult projects are less suitable. 2. There is less scope for the Client to work through the design with architect and make revisions as necessary.
Time:	The project is subject to significant programme delays.	1. The timeframe for completion of the works can be stated on the contract with the contractor made to pay Liquated and Ascertained Damages for late delivery. 2. Could consider two stage or negotiated tendering if speed is key.	1. Programme tends to be longer due to the lack of integration between stages and the need to have all tender documentation prepared before going out to tender.	1. Under Design&Build it is more likely that programme will be kept since delays such as late information, conflicting design information are the responsibility of the contractor. 2. Should programme be exceeded the client also has the right to impose LADs.	
Cost:	The project is subject to significant cost increases.	1. Completed designs can be costed by the quantity surveyor and a reasonable level of cost certainty achieved. 2. Any variations that are required can be priced through the Bill or schedule rates ensuring that it is done swiftly and cost effectively.	1. The relatively low price of variations encourages the approval of late design changes.	1.If the Employer's Requirements are well specificed and there are no significant variations then price certainty for the Client is high.	1. Risk for the Client remains quite high as ensuring that all the Client's objectives are specified fully in the Employers Requirements is very difficult, often necessitating expensive variations. 2. Risk for the contractor however is high since any mistakes in design, or pricing will be borne by the contractor.
Quality:	The Project will not be delivered to the necessary quality.	1. The Client requires certain standards to be shown or described. 2. The Contractor is wholly responsible for achieving the stated quality on site. 3. Quality can be achieved through high specification in the design and subsequent inspection of the works by agents on the client's behalf.		1. Assuming that the performance specification is thorough then the contractor is contractually obliged to provide what is stated.	1. Employer has no direct control over the contractors performance. 2. Contractor design expertise may be limited. 3. Employer has little say over sub-contractors. 4. There is a risk that even though there is clear brieifing, that the quality will not meet the expectations of the Client and in the past Design&Build has been associated with low quality and standardised buildings.
Responsibility:	The project will suffer from significant disputes between the project participants.	1. As mentioned above, the design is normally the responsibility of the clients and construction of the contractor.	1. Disputes can arise when problems become apparent in work packages and it can often be difficult to ascertain whether the issue lies in design or construction.	1. This is an efficient single contractual arrangement integrating design and early construction expertise within one accountable organisation.	1. The prospect of disputes is by no means eliminated with contractual vagaries can still prove highly disasterous to project success. 2. Whilst risk are transferred to the Contractor, they are by no means eliminated.
Funding:	The project is unable to ensure the necessary cashflow.	1. The client to ensure a robust cashflow is in place and make agreed payments to contractor.		1. The client to ensure a robust cashflow is in place and make agreed payments to contractor.	
Health & Safety:	There is a risk that accidents will take place on site.	1. The Client is to ensure that they appoint a suitably qualified designer & CDM co-ordinator at project inception. 2. The architect to propduce risk assessments for work packages		1. The Client is to ensure that they appoint a suitably qualified designer & CDM co-ordinator at project inception. 2. The contractor to produce risk assessments for work packages	

Benefits in COST and QUALITY but at the expense of TIME

Benefits in COST and TIME but at the expense of QUALITY

Figure 2.5 A comparison of Traditional and Design&Build using Procurement Selection and Risk criteria

3.0 GENERAL PERFORMANCE OF THE PARADIGMS UNDER DESIGN&BUILD

3.1 Design / Construction separation

In the past, design and construction in large engineering projects such as those undertaken by Brunel and Stevenson, used to be inseparable. It was only towards the end of the 19th century that the work required to turn the design solution into physical reality became increasingly complicated and these two fundamental project aspects began to diverge. Since this time a key aim has been to reintegrate design and construction which is acknowledged as "*a process made challenging by the intrinsically different mind sets required for design in comparison to implementation*". (Harpum P, 2004 p.434) Design&Build seeks to achieve just this, but to what extent is this possible and how does this affect the delivery of the three key project paradigms?

3.2 Time

Chevin's survey in 1993 showed that 54% of clients thought that Design&Build brought savings in construction time. This is backed up by Akintoye's survey of contractors where the majority claimed that Design&Build can lead to up to a 20% reduction in programme. This is possibly due to the contractor's willingness to start on site with limited information and the need to complete quickly to maximise profits. Whilst the Contractors surveyed in Akintoye's 1993 study also cited speed of response to alterations, buildability and the right solution first time therefore minimising abortive work, these were not considerations mentioned by Architects in the subsequent 1994 survey. There is a clear divergence of opinion regarding the reasons behind time savings needs to be explored further.

3.3 Cost

In Akintoyes 1993 survey 53% of architects thought that Design&Build offered cost savings over a Traditional approach and, whilst not directly contradicted, this is still much lower than the 76% of contractors (excluding 14% non respondents) who similarly believed that it would lead to cost savings. What is also interesting to note within Akintoye's surveys however is the difference in reasoning behind these results. Contractors attributed savings to value engineering, early ordering and the greater acceptance of risk from more competitive pricing by sub contractors. Whilst in Chetham's study (1997) both time and cost improvements could be made by limiting specification choice during design. These views are not entirely supported by architects who believed that costs are reduced by lowering quality standards, reduced professional fees and the dis-incentive for clients to demand variations. Again these differences need to be explored further in the questionnaire and interviews.

3.4 Quality

The concept of construction quality contains at least two levels; Design quality and conformance quality.

It is difficult to maintain design quality under Design&Build, since the separation maintained under the Traditional route made it easier for the client to control design quality. This is certainly a view reinforced by Akintoye's findings which stated that whilst 20% of architectural practices' private sector workload is derived from Design&Build they perceive this procurement type to involve sacrificing design innovation.

This is contradicted by Gidado & Arshi's more recent survey (2204) findings but this had the severe restriction that it only consider contractor side opinions and seemingly did not allow participants to offer a response suggesting a reduction in quality. Therefore more credence should be given to Akintoye's 1993 survey which found that 75% of Architects did not believe that an improvement in product quality occurs within Design&Build, with 10% actually predicting a reduction in quality (Akintoye 1993). Within the contractor's survey over 20% of study participants did not answer this question (Akintoye 1994) which could possibly, by inference, mean that they believe a reduction in quality was more likely.

Under Design&Build the design is expressed in the form of drawings and specifications in the contract documents and plays a key role in assessing conformance. Using an integrated route like Design&Build should make it easier to implement quality enforcement since the liability for any defect is clear (single point responsibility). However the client lacks the technical specification, and must instead rely on the performance specification to judge quality and this is unlikely to comprehensively detail everything.

According to Chang and Ive (2002) no one procurement route enjoys an absolute advantage in quality delivery, since it can be argued that it is more difficult to enforce conformance due to the divided responsibility which exists under Traditional.

3.5 Variants to the Design&Build Contract

It is for the reasons outlined in the preceding items that variants of the Design&Build procurement route have been developed. Pain and Bennett (1988) stated that there were four principle methods of organisation, Andrews (1999) identified five different methods whilst Akintoye (1993) stated there are six and it is these which are elaborated upon below:

- "Traditional Design&Build": under this arrangement payment of the architect's fee is the contractor's responsibility assuming the contractor buys in the design service. There is a consensus among architects that such fees are lower than those that would be paid by the client under a traditional procurement route (Ndekugri & Turner). The unpopularity of this route may therefore be linked to this payment issue and the absence of the direct client-architect relationship.

- "Package Deal": the contractor provides standard building or systems buildings that are adapted to suit the client's space and functional requirements.

- "Design and Manage": the contractor gets a fee for managing all aspects of planning and design and supervising the sub contractors. The contractor retains design responsibility.

- "Novation Design&Build": the client passes to the contractor the design team engaged in preparing any initial design, client's requirements, planning permission and tender documents. Swindall (1993) stated that some clients chose novation Design&Build as a means of engaging the design team to monitor progress on their behalf, although it seems most clients fail to recognise the new loyalty of the design team in the latter stages.

- "Develop and Construct": the architect has the opportunity to provide clients with an initial design, which in turn can be passed to the contractor to develop in terms of design and construction detail with or without further involvement of the original architect. A higher quality architectural design and its development by the contractor. This method of design and build can be described as a "design risk aversion" strategy for building clients.

- "Total Procurement": Design&Build need not always imply contractor led procurement. In many countries and indeed in recent times in the UK, the term "Architect led Design&Build" has appeared and has sometimes been referred to as "total procurement". The architect-led strain of Design&Build is associated with a claim to safeguard quality whilst also maintaining the contractual simplicity of Design&Build (Gallagher,1993). However, despite its advocacy in academic circles, experience was only recorded by one architectural practice in the survey by Akintoye & Fitzgerald. It is likely that clients who have experienced conflicts over time or cost overruns in the traditional, architect-led, procurement route may still hold reservations about adopting this method.

3.6 Objectives of research as outlined in this chapter

- How does the selection of Design&Build affect **Time**. What factors do participants think contribute to this?
- How does the selection of Design&Build affect **Cost**. What factors do participants think contribute to this?
- How does the selection of Design&Build affect **Quality**. What factors do participants think contribute to this?
- What do people think of the variants? What experience do they have these? How are they rated?

This chapter has outlined how project participants view Design&Build through previously conducted research and examined how and why there might be differences in opinion. This requires further examination and, through asking the same targeted questions to both Client and Contractor side project participants, it should be possible to directly compare the results.

It is also helpful to explore the variants of Design&Build that have been developed to see whether these are perceived to have successfully tackled causes of risk and uncertainty which have become apparent with the procurement route. How successful these variations have been in tackling the disadvantages of Design&Build while still retaining its core principles is debatable. Can perceived weaknesses in design be addressed without compromising the aim of single point responsibility?

The literature review conducted previously has highlighted specific issues within Design&Build which generate uncertainty and inhibit the chances of project success. The next chapter will focus on these, and specifically on design risks in order to understand and assess whether the integration of design and construction is fully able to realise its supposed benefits.

FACTORS OF UNCERTAINTY UNDER DESIGN&BUILD

4.1 Introduction

"The construction industry is subject to more risk and uncertainty than possibly any other industry. Buildings tend to be bespoke and each new project involves new design and construction problems that have to be overcome." (Flannagan 1993, p4)

Despite the findings within Latham's Report in 1994, Hibberd and Djebarni's (1996) investigation into procurement selection did not find transference of risk to be a significant factor within procurement selection. This is a surprising result, but given the popularity of Design&Build, and that it is known for its high level of risk transference, it might be that there is an almost unconscious acknowledgement of this fact.

Design&Build is meant to provide value for money, with contractors provided an opportunity to demonstrate key strengths in the management / co-ordination of design and construction works. However given the variability in nature of construction projects and the contrasting experiences of clients, previous research has indicated that contractors may lack a proper understanding of the design process, suffer from similar communication breakdowns as exist in the traditional route, whilst either misinterpreting client goals or developing from an incorrect interpretation of design documents.

From the literature review it is possible to establish some of the key factors of uncertainty which are elaborated as follows:

4.2 Difficulties with the Brief and changing Client requirements

"As an adequate brief is essential to the proper execution of a building project it must be comprehensive and cover fully site conditions, user requirements, cost and time targets and detailed specification requirements sufficient to achieve the standard adopted by the client" (RIBA 1980, as cited in Nicholson M. Naamani Z 1992 p.481)

Nicholson and Naamani (1992) draw attention to the fact that poor briefing is a major factor which interferes with the smooth production of design information. Contracts in Use surveys have shown a recent reduction in the use of Design&Build for civil engineering and refurbishment works due to this very issue whilst, of the top six reasons in Akintoye's 1993 study thought by Contractors to prevent project success, three of them related to lack of clarity in the client's brief. Whilst Nicholson and Naamani have pointed out the effect that project type has on the number of design alterations, e.g. that commercial office and retail projects in general have a higher number of alterations than housing projects, this does not prevent it being a constant theme for all projects and it will be important to see whether the later study confirms a relationship between project type, the design variations required and procurement route.

4.3 Difficulties with the shortened Design period

"Design is an iterative process; there is no optimal solution to a design problem. The more iterations allowed, though, the nearer the designer is likely to get to an optimal solution and a better quality building". (Lawson 1991, as cited in Harpum P. 2004 p.429)

It is rare within a project for the client's objectives to be fully expressed and elaborated upon in the early stages and it has already been established that flexibility in the design and construction process is more limited within Design&Build. As was noted in Akintoye's study of architects' views, the reduced design time compared to the Traditional route has meant less reflection upon the contract documentation and a reduced emphasis on the critique of the proposals. Therefore design time overruns are a significant risk under Design&Build. While more extreme advocates of Design&build might argue that the Client's brief should be limited to basic space and performance criteria studies have shown that even contractors are divided on this issue.

Since Design&Build involves the overlap of design and construction phases then the co-ordination of design becomes critical (Farizo 1988) and in order to reduce design related risk it can be necessary to spend more effort and resource during the early design phases and in particular develop an effective review system, appointing a full time design co-ordinator. Even if this is achieved, reducing the time available for corrections and amendments makes the original outline of the Employers' Requirements critical. This situation is further complicated since the reduction in design time is by no means always accompanied by increased design resource, since design teams can display lesser commitment under Design&Build than using traditional.

4.4 Difficulties with Design Team integration

"Design&Build raises fundamental questions about the integration of skills within construction generally and design management and co-ordination in particular" (Akintoye, A. 1994 p.156)

One of the key benefits claimed for Design&Build was that, by reducing the historical separation of design and construction responsibility, the number of design revisions should decrease. Design&Build requires that the contractor have access to architects and engineers either in house or through the hiring of external consultants but whilst Akintoye's 1993 survey demonstrated that contractors possess good capability for more professional services such as construction management, they still possess little internal architectural ability as demonstrated by participants reporting just over 30% of design work was conducted in house. The survey supports the notion that Design&Build firms are looking to consultant designers rather than employing in house and correlates with the relatively high usage, 42%, of novation Design&Build. This is an area that will need to be explored in the survey.

With Design&Build comes major changes in the roles, relationships and responsibilities of the project participants in particular for the architect but, as Cecil (1983) highlights, novation may not necessarily be the ideal answer since its promotes a divided loyalty owed to both contractor and client. It is interesting to note that architects have expressed little interest in role of contract administration within Design&Build projects and are reportedly much more concerned with maintaining their position as an independent source of innovative design, this issue also will need to be further explored.

4.5 Difficulties in Design Team Communication

Single Point responsibility is cited as one of the major advantages of Design&Build and Walker (1984) reinforces the importance of design co-ordination and communication. He highlights that different organisational patterns are developed by different procurement routes but that both formal and informal methods of information and communication are required. It can be argued that by keeping everything in house, Design&Build can avoid the adversarial relationships commonly experienced in the traditional procurement route. This is however undermined by the apparent lack of in house design services with Design&Build contractors. If consultant architects are still to be required for the innovation and design quality of projects then they will need to make a meaningful collaboration with contractors to satisfy the Client's requirements, ensure value for money and promote successful project performance.

4.6 Difficulties in Design Team Management

Under a Traditional form of contract the architect occupied the roles of Design Manager and Co-ordinator on behalf of the client. With contractors under Design&Build now charged with the overall liability and responsibility for design and construction they must acquire these skills. As Evans (1978) highlights, this represents a fundamental change for the integration of skills with construction.

Contractors often encounter many problems relating to the management of design which can include: contractor staff not being familiar with the design process; that they are too busy to engage with design issues; that they lack the expertise to manage the interfaces between consultant and sub contractor designers or that they leave them to co-ordinate works themselves (Smith (1992). These are factors which are reinforced by Hood's (1994) comments that argued that contractors often have no experience of design from concept to

completion, and attempt to apply similar contracting planning methods to it failing to understand its expressive nature Unlike many architects contractors are not interested in design for its own sake which leads onto the next issue within Design&Build

4.7 Difficulties in Design Quality

"Design&Build places power firmly in the hands of the contractor and not designers, and represents a significant shift within the industry to those participants for whom the profit motive is the overwhelming objective and where buildings are the means to another end" Akintoye, A., Fitzgerald, E. (1995) pp.29

As previously cited Gidado and Arshi's 2004 survey of contractors found the majority believed Design&Build could increase the quality of the product standing in stark contrast with Akintoye's previous surveys and much anecdotal evidence. This certainly needs to be questioned and investigated. Latham's call to reduce costs by 30% might be achievable (although far beyond the original timescale) but only through improvements in design quality will the use of Design&Build broaden.

4.8 Objectives of research as outlined in this chapter

- What do the project participants view as being the key risks under Design&Build?
- Who do the project participants feel is best placed to manage and co-ordinate design?
- Does Design&Build improve project communication. What barriers exist to prevent this from being fully recognised?
- What other design related considerations are considered to have a major impact under Design&Build?

To achieve success in Design&Build there needs to be a clear understanding of obligations and performance standards of the parties and clarity of the client's brief and requirements. With the increased reliance upon the production and management skills of the Design&Build contractor, the positive support of the architect is also required if the client is to achieve more than just value for money but also value added by design innovation and buildability. If this is not achieved then the building will merely provide a low cost solution to a limited set of functional demands and the client will fail to achieve the true benefits of this procurement route.

5.0 Contract Risk Management

5.1 Contracts and Risk Allocation

Contracts are a vital tool for assigning project risks between the different parties and Figure 5.1 on the next page demonstrates how the two main forms of contract for Traditional and Design&Build are able to accommodate different procurement requirements and allocate varying degrees of risk. This diagram is based upon a chart produced by the "Local Government Task Force, Rethinking Construction" but has been directly amended to more fully capture the key categories within procurement selection as identified in the literature review and built upon previously in Figure 2.5. It also highlights key areas of project risk and their allocation to either employer or contractor. This chart is not only a useful visual aid but will be employed later to measure how the participants view key procurement criteria and risk allocations and whether there are any demonstrable differences in perception of procurement routes between the project participants.

5.2 Risk Transference

Risk Management theory states that should a party seek to transfer risk to another party, but resists the transfer of its control then it will generally increase the cost attached to this risk. This is especially true since the party could end up paying not only for the risk transfer but also the consequences should it materialise. This could be further compounded by legal costs if the allocation of responsibility is not clearly stated and disputed.

Therefore whilst theory would suggest that when a client becomes more risk averse when considering different procurement strategies for the same project, they will, all other things being equal, select Design&Build over Traditional. But is this, and should this be, the case? Selecting Design&Build can be seen as a method for the client to insulate themselves from the exposure to uncertainty in a high risk project as is demonstrated by Figure 5.1 earlier, but how far this works is dependent upon the effectiveness of the contract and the attitudes of the people involved.

5.3 Contractual ambiguity

Construction risks are supposedly allocated in the conditions of the contract but contractual language alone is in some cases insufficient to clearly specify the risk apportionment between the contracting parties. It is not uncommon for members of the same group to interpret contract clauses in a different way, this is particularly true between different groups of contracting parties (Hartman et al 1997).

Should the contract be incomplete then this risk transfer intention can have the opposite effect, especially since it is hard to cover all contingencies and loopholes, and may promote facilitate opportunism by different parties. An incomplete contract can allow one party to exploit the situation leading to disputed claims, increasing distrust and resulting possibly in litigation. Disputes are generally a lost cause to any party with an interest in the success of a project and the client even if successful in the dispute can sometimes be left with the only option of replacing the main contractor, which will be costly – especially under Design&Build.

There are therefore residual risks arising from any risk strategy as was demonstrated in Figure 2.6. In allocating design risk to the contractor through a contract, the responsibility of the risk is simply transferred but a residual risk to the client remains. For example through Design&Build the client achieves single point responsibility for uncertainties regarding design and construction, however since the design is produced speculatively, even though the risk is transferred, it is in fact also increased compared to the level in a traditional contract. This is because the client's level of input is reduced which can lead to lower functionality and threaten the Client's objectives.

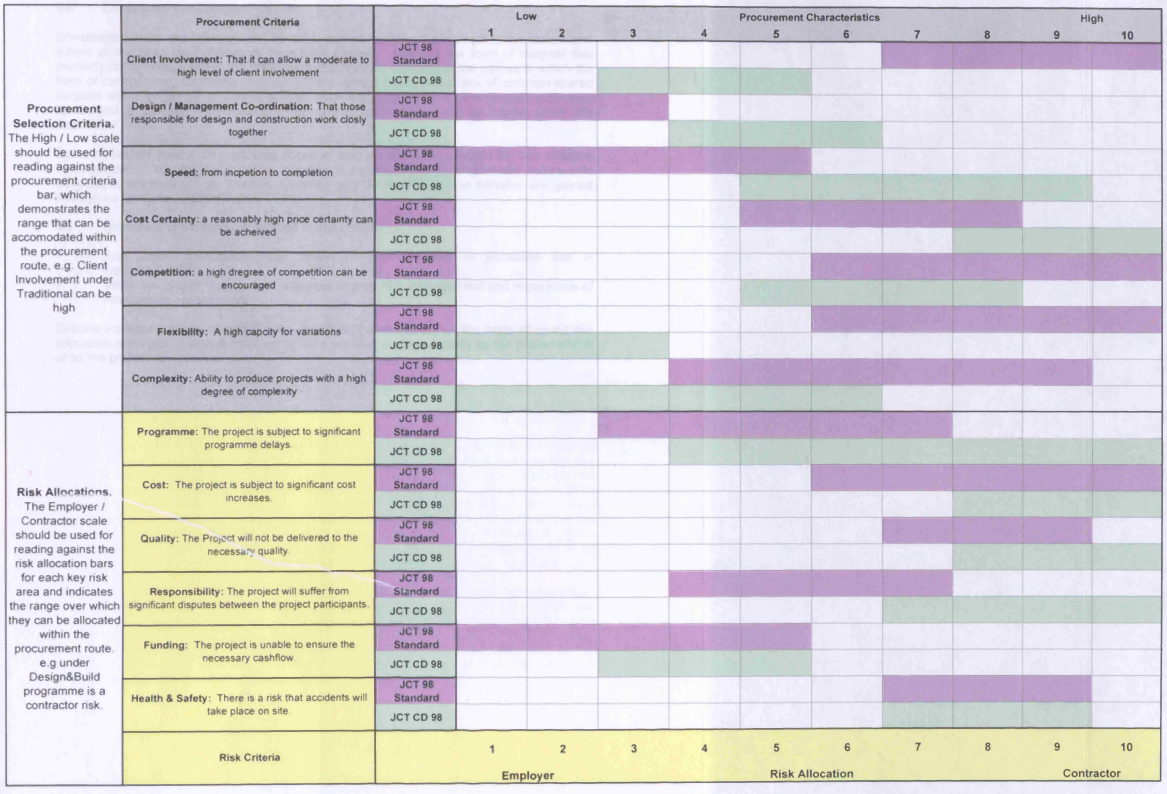


Figure 5.1 A comparison of procurement criteria and possible risk allocation under the JCT Standard Form and JCT CD 98.

5.4 Conflict and Confrontation

Construction risks are often project specific, and as a project progresses, the nature and extent of the risks may change or new risks emerge. It is not the form of contract that primarily determines whether the targets are met, but the attitudes of the parties to which the form of contract may contribute. Latham (1994) upheld that is was a lack of common shared purpose within projects that lead to confrontational management, a consideration supported by Dulami & Daziel's (1994) study showing that disharmomy was far higher under the Traditional Route.

Some risks may require the combined efforts of both parties to the contract for their effective management. Yet the construction industry is notorious for its fragmented nature and adversarial environment so there is no easy way to ensure mutual benefits are gained through co-operative relationships.

5.5 Objectives of research as outlined in this chapter:

- Are project participants fully aware of the instances of increased risk in Design&Build?
- What are project participants' attitudes to joint risk management and experience of relationship management.

Despite increasing efforts to assign risks clearly and contractually on the basis of sound risk allocation principals, it appears that some risks are best managed jointly by the pooled efforts of all the project participants.

6.0 METHODOLOGY

6.1 Introduction

For the purpose of this study the primary sources of data collection are from:

- A questionnaire as contained in Appendix A) which was issued via email to client and contractor side participants in an attempt to achieve full coverage of the construction industry. Respondents were asked to forward this on and complete the questionnaire within ten days of receipt, with reminder emails sent to improve the return rate.

- A series of semi-structured interviews were conducted to expand understanding, to clarify anecdotal opinion ascertained in the literature review and also to build upon some of the answers given in the survey.

6.2 Method, sampling, data collection

A structured questionnaire was considered a suitable method for data collection for a number of reasons. It facilitated the collection of a large number of participants' opinions on the subject, and has been employed by many previous studies in this field – allowing direct comparison.

The questionnaire employed was standardised as this suited a quantatitive approach although some questions allowed for qualitative answers. The key benefit of questionnaires being the reliability of measurements and its ability for statistical analysis. As has been noted by previous academics questionnaires allow objectivity, are relatively cheap to conduct and place a low demand on peoples' time. The disadvantages being that they keep the researcher remote from the respondents and are therefore unable to check given responses or delve further with follow up questions.

The questionnaire employed a two section format. Section one was designed to be simple to complete, encouraging respondents to become more familiar with the style and helping ease them into the more questions later which required greater consideration. Section two required greater thought about past projects the participants have worked on and the procurement routes employed. In the first half of this section the data obtained is factual and objective and can therefore be treated as quantitative. However in the second half of this section the participants are asked to review factors in procurement route selection and risk allocations as identified in the literature review. This is clearly subjective in nature but is highly relevant to the study given that it is trying to ascertain participant perception and specific opinions.

From the literature review it became apparent that alongside this survey, semi-structured interviews would also be highly beneficial to help investigate in greater depth the attitudes and perceptions of key participants in procurement selection and risk management. It was decided that structured interviews consisting of pre-determined questions would be limiting and undermine the reason for holding the interviews since it would deliver little more than the questionnaire. An unstructured interview with no pre-set questions was considered wasteful of time since there are definite targets to be explored.

7.0 SURVEY RESULTS

- What role do the respondents have within the project team, what is their profession, level of experience and highest qualification.

Findings:

It is clear that whilst this survey was aimed at capturing a broad range of project participants the majority of respondents are from a project or cost management background.

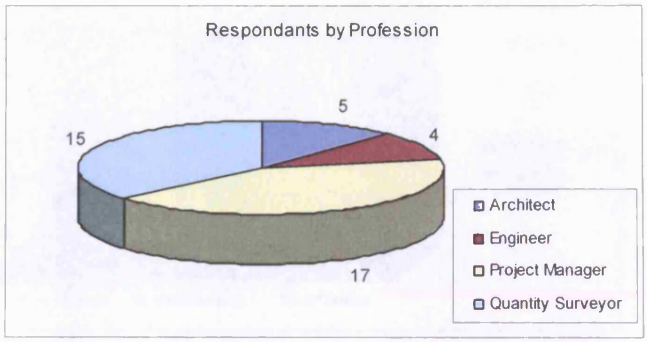
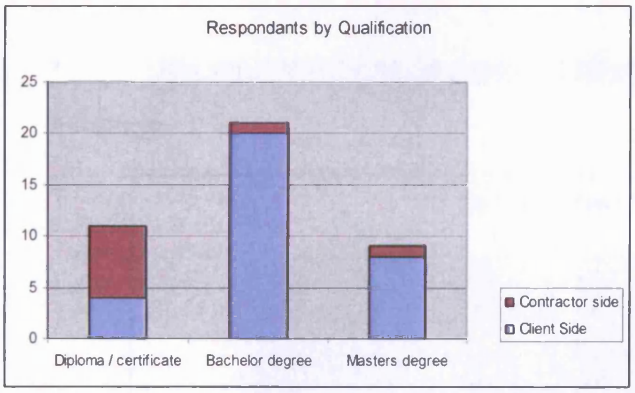


Figure 7.1



We can see that the respondents possess a reasonable level of qualifications indicating that they are academically knowledgeable about the workings of the construction sector.

Figure 7.2

It is clear that the majority of respondents have a large amount of construction experience with almost half possessing more than 10 years experience in this field.

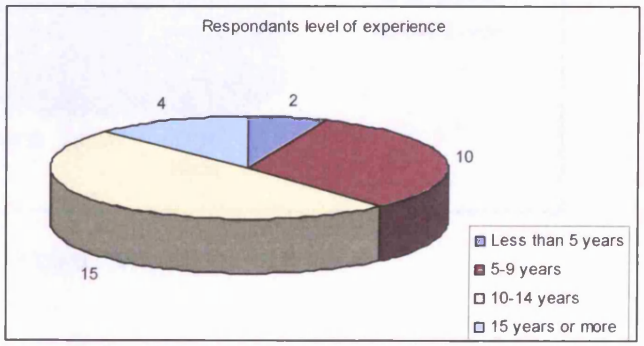


Figure 7.3

Comments: We can consider the respondents highly qualified and experienced both academically and professionally. Whilst the respondents are drawn from a range of project participants the majority sit on the client side and by role are project / cost managers.

- How much influence do you believe your firm has over the chosen procurement route?

Findings:

The results indicate that over half of the participants surveyed stated they had an influence over procurement route selection. It should be noted that these were all client side consultants, whilst contractor side participants believed they had little or no influence over the route selected.

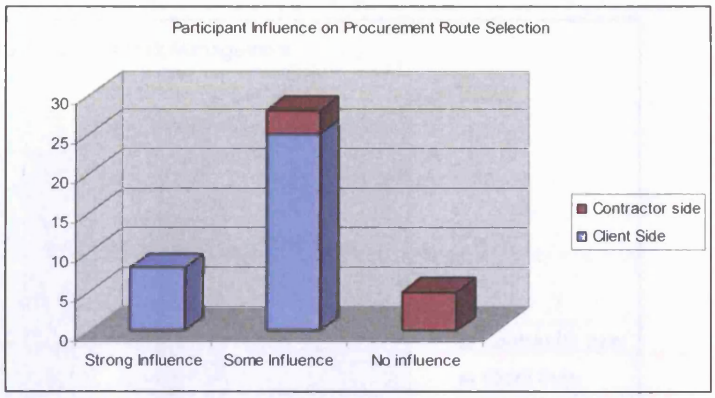


Figure 7.4

- How you rate the Risk Management Methodology of your current employer

Findings:

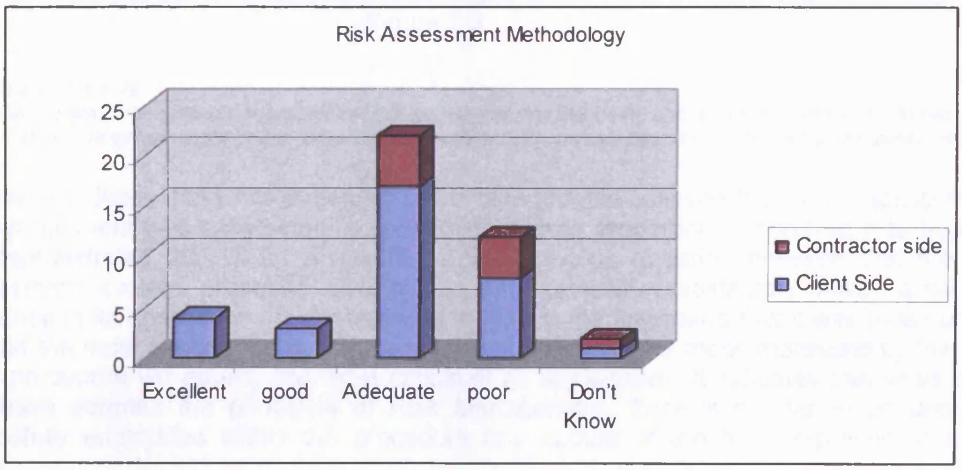


Figure 7.5

Interview Comments:

"The firm recently spent a great deal of time and effort in creating a new Risk Management tool to increase project success. We encourage all our clients to use this although take up within the private sector is still limited"

"I am not aware of any formal Risk Management strategy by my firm, our efforts are very much focussed on the task in hand, we don't have time for any what ifs."

The results indicate that whilst the majority of participants believe the Risk Management practices currently employed by their respective firms are adequate there still remains a significant proportion who consider it unsatisfactory. When contrasted with previous studies such as Ellis & Wood (2003) or Simister (2003) this result does at least demonstrate that employee awareness of formalised Risk Management procedures has increased and indeed risen to the extent that employees are can now pass critical judgements on the procedures of their employer.

- How you rate the Risk Management Practice of your current employer

Findings:

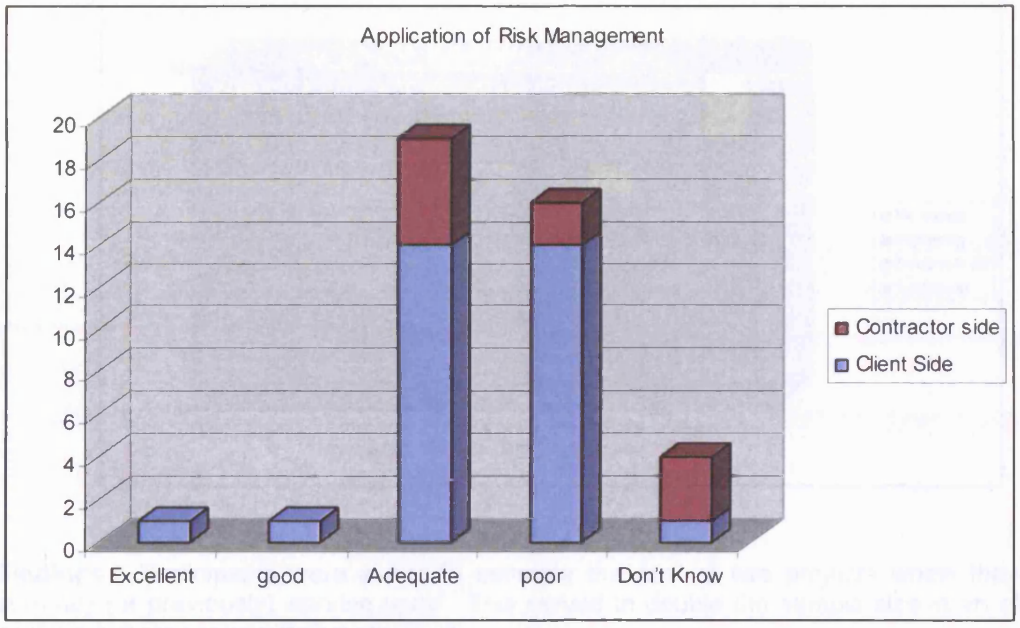


Figure 7.6

Interview Comments:
"Despite our firm's formalised risk procedure, risk management is still being applied poorly; either conducted once and then forgotten about or it is wheeled out every meeting, quickly becoming laboured and repetitious".

The results indicate that while a majority of the respondents believed their firm's application of risk management was satisfactory a concerningly large proportion considered it to be poor. This demonstrates that whilst a majority in the previous question believed that the Risk Management system proposed was robust and generally satisfactory fewer expressed confidence in its application. It is interesting to note in the interviews that it was those people who had the most experience in risk management that were the most impressed by the firms stated procedure yet equally the most critical of its application. It indicates that while many firms have adopted the principles of Risk Management, there is still far to go until it is successfully embedded within the procedure and culture of the firms represented in the survey.

- What is the value, type and procurement route of two projects you are currently working on?

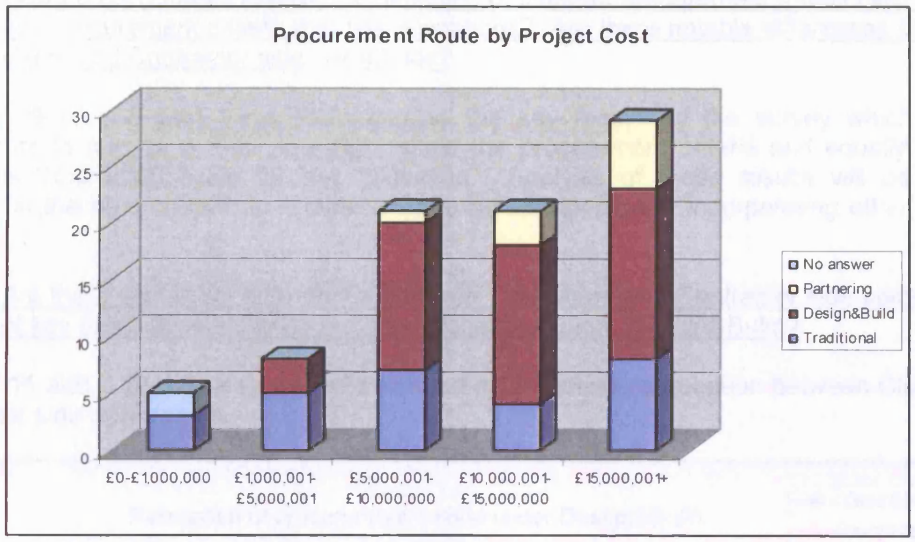


Figure 7.7

Findings: Participants were asked to estimate the cost of two projects which they were currently (or previously) working upon. This served to double the sample size in an effort to achieve a more representative result.

The results indicate that there is a general correlation between increasing project cost and the selection of the Design&Build procurement route. This is in line with the findings of the "Contracts in Use" surveys suggesting that Traditional Procurement is more popular for lower value projects. This may also goes some way to explaining the dominance of Design&Build in numerical terms within the sample since fewer lower value jobs are represented.

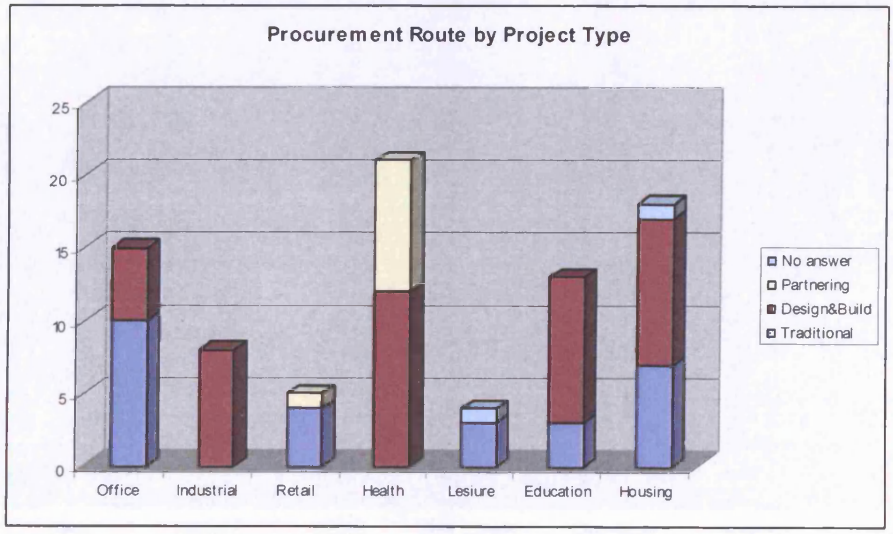


Figure 7.8

It is clear from the survey results above that Design&Build is clearly favoured by some project types more than others. Its use on light industrial works is unchallenged and perhaps explains why Design&Build was represented so strongly on a number of lower value jobs within the previous question. What is also clear from the survey is that whilst Design&Build is not considered suitable for most leisure projects, presumably because of their bespoke

design-led nature, it was still favoured within the generally complex Health sector which will require clarification later.

- How do participants believe the selection of different procurement routes cater for the key procurement criteria and risk allocations? Are there notable differences between Client and Contractor side weightings?

Figure 7.09 on the next page demonstrates the key results of the survey which asked participants to rate on a 1-10 (low-high) scale the procurement criteria and equally a 1-10 (Employer-Contractor) scale for risk allocation. Analysis of these results will be drawn together in the next chapter to enable a more holisitic approach incorporating other survey findings.

- Are there significant differences between Consultant and Contractor side perceptions of key procurement criteria and risk allocations under Design&Build?

Figure 7.11 and 7.12 demonstrate the averaged differences in perception between Client and Contractor side participants.

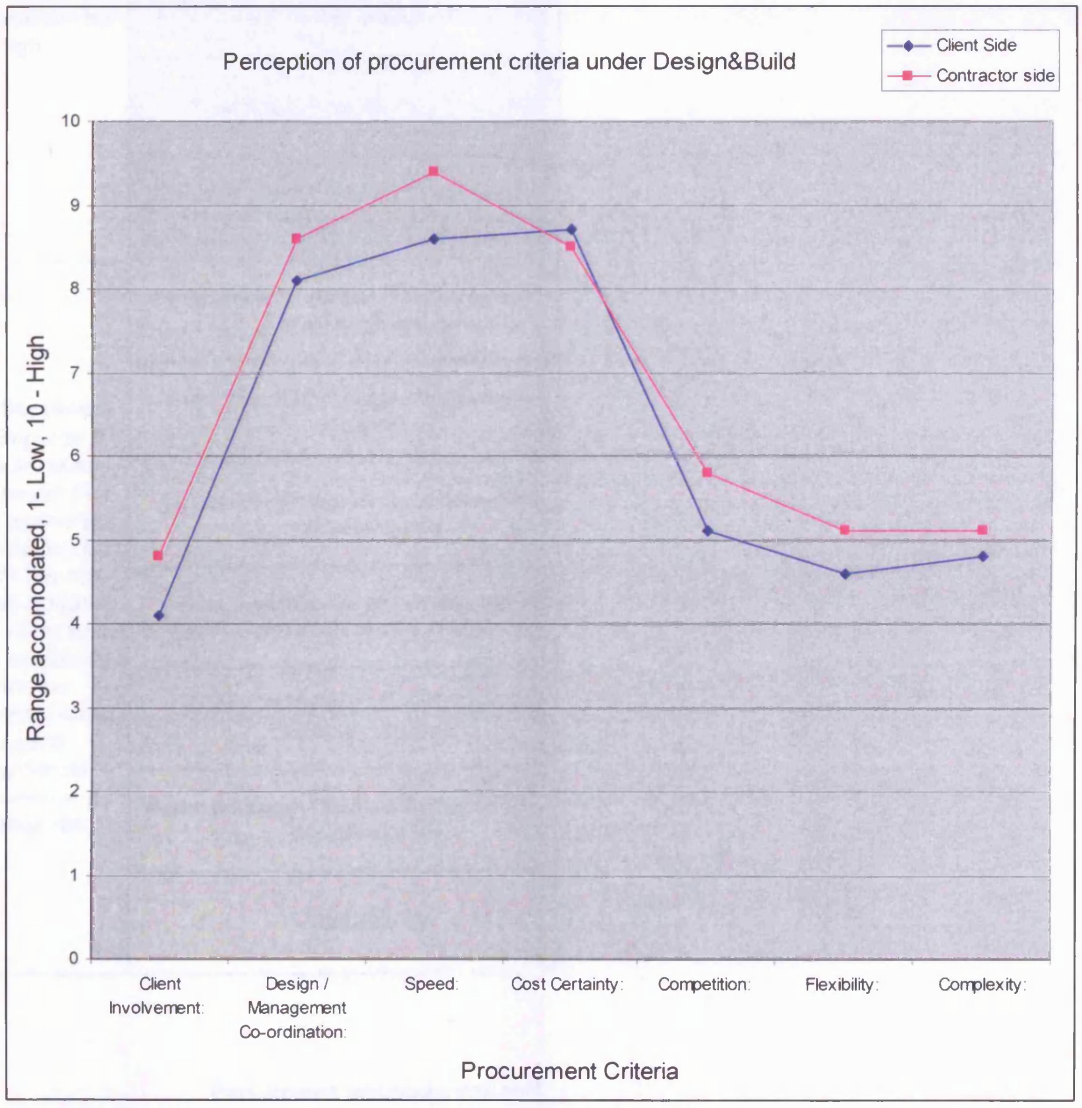
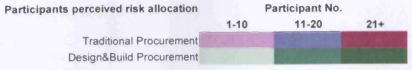


Figure 7.10

Figure 7.9 Respondent perceptions of procurement criteria and risk allocations under Traditional and Design&Build



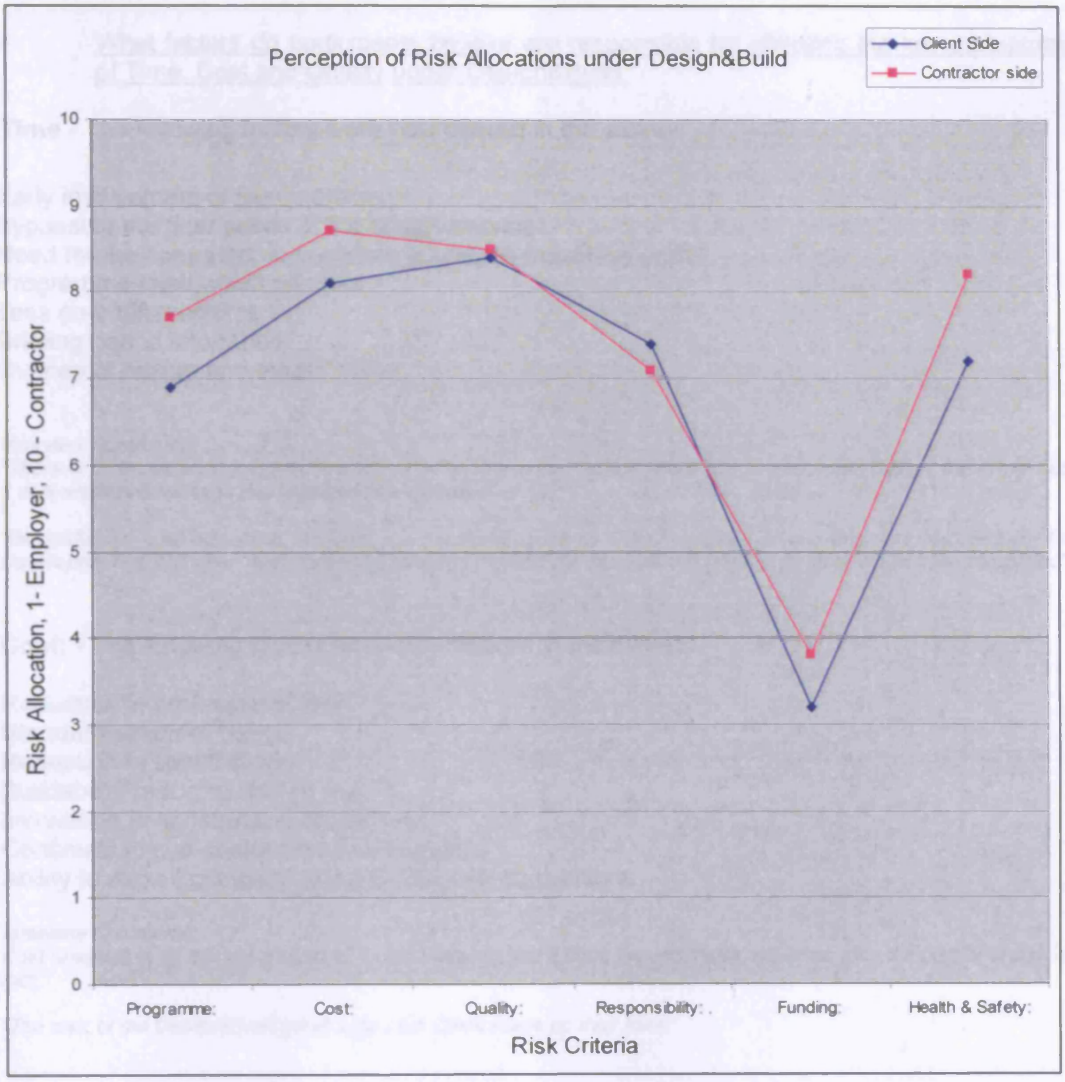

Perception of Risk Allocations under Design&Build
Client Side
Contractor side
Risk Allocation, 1- Employer, 10 - Contractor
10
9
8
7
6
5
4
3
2
1
0
Programme:
Cost:
Quality:
Responsibility:
Funding:
Health & Safety:
Risk Criteria

Figure 7.11

- What factors do participants believe are responsible for affecting the key paradigms of Time, Cost and Quality under Design&Build.

Time - The following factors were volunteered in the survey:

Early involvement of the contractor.
Bypassing the finer points of the design service
Need for the contractor to complete quickly to maximise profit
Programme fixed within contract
Less co-ordination time
Briefing period shortened
Overlap of design and tender stage

Interview Comments:
"There is an expectation that programme will be shorter under Design&Build due to concurrent design, but in practice it delivers little advantage due to co-ordination issues"

"Design&Build contracts often separate out the building works from the Client fit out, this may help reduce the Developers risk, but it can often extend programme beyond the date when a Traditional route would have completed"

Cost: - The following factors were volunteered in the survey:

Reduction in professional fees
Standardisation of fittings
Reduction in specification
Buildability reducing design rework
Innovation in construction techniques
Continuity in sub-contractors and suppliers
Ability to exploit competitive market for sub-contractors.

Interview Comments:
Cost is meant to be the key advantage – cost certainty, but if there are significant variations then the control of cost is lost.

"The crux of the Design&Build issue is has the Client made up their mind"

Quality: - The following factors were volunteered in the survey:

Client can expect to receive only what is recorded within the performance specification
Conformance should be easier to measure and control.
Design&Build involves limited Client control and reduced supervision which impact on quality
Contractors will attempt to reduce or achieve minimum specification

Interview Comments:
"Client expectations of lower costs are often unrealistic"

"You are limited to the contractors supply chain, usually maintained in the contractors interest"

This is not transformational design but standardisation.
Depends upon the tightness of the specification as to what you get, if you are over prescriptive within the Employers Requirements then you might as well have used the traditional route.

- What do the participants believe are the key risks retained by the Client under Design&Build?

The following factors were volunteered in the survey:

Unclear consultant duties
Limited Design Time, and the possibility to delay
Limited capacity and cost for variations

Difficulty in establishing the Brief
Concerns over quality.

- What experience do the participants have of the Design&Build variants? How are they rated?

Findings:

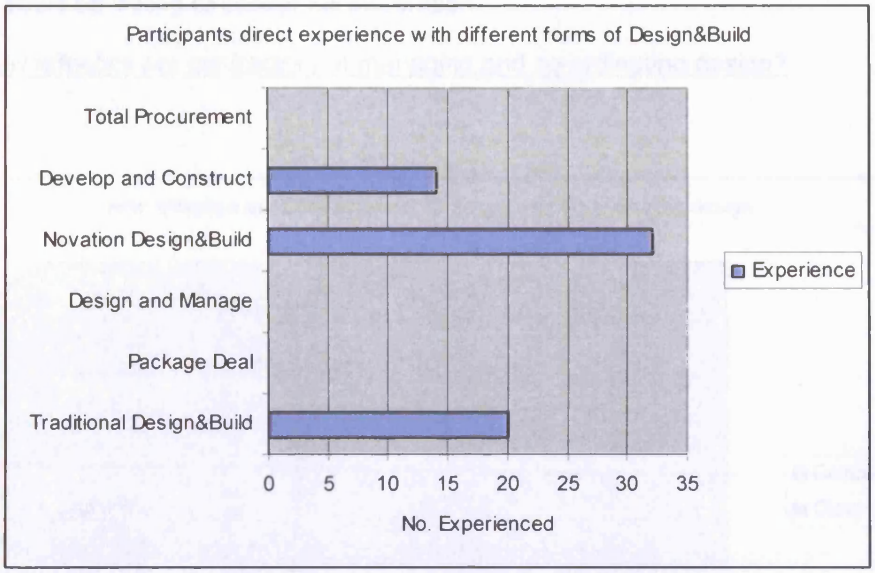


Figure 7.12

From the survey it is clear that participants have a much greater experience of "Novation", "Develop and Construct" and "Traditional" than the other forms. Whilst definitions of the different variants were provided on an appendix to the questionnaire it was interesting to note how many people within the semi structured interviews were not aware of "Total Procurement" or Architect led Design&Build.

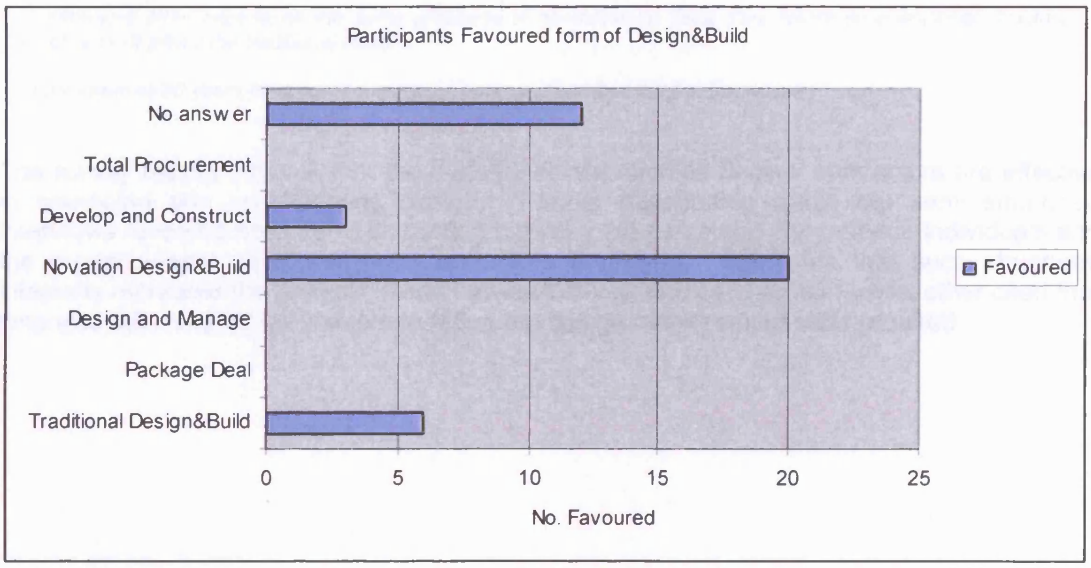


Figure 7.13

Interview Comments:

"Architects are still not willing to embrace the actual construction side of the job"
"Novation firmly places designers within the supply chain for Contractors, a position they do not appreciate"
"Issues such as the timely payment of sub-contractors now also affect sub-consultants"
"Architects may only provide a limited service offering since fees will often be capped"

The survey indicates that "Novation" Design&Build is considered the preferred choice, followed by "Traditional" and then "Develop and Construct". It is however worth noting the high number of respondents who did not answer the question.
During the semi-structured interviews discussion focussed on why contractors had little in house design capability and the impact this had on Design&Build. It was generally felt that Novation whilst providing the Client with greater initial control over design meant that design and construction were still failing to achieve full integration. Doubt remained as whether architects would be willing to accept full integration.

- How effective are contractors at managing and co-ordinating design?

Findings:

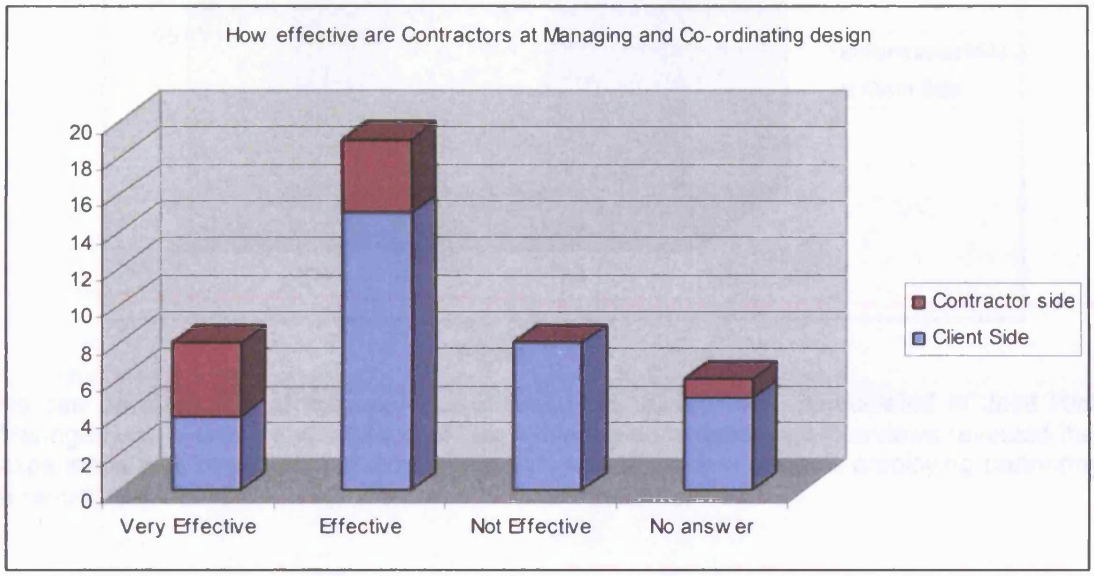


Figure 7.14

Interview comments:

"Contractors often experience the same problems of co-ordination since they create organisational structures which almost mimic the traditional route"

"A minimum of 30 years for a new construction process to embed itself in the industry"

The survey results indicate that the majority of respondents believe contractors are effective in managing and co-ordinating design. Further questioning within the semi structured interviews revealed however a distinction between the perceived competence individuals and the organisational structures that contractors employed. Many felt that such structures internally recreated the artificial divide between design and construction whilst other cited that time was still need for contractors to refine the design management skills required.

- What experience do the participants have of joint risk management

Findings:

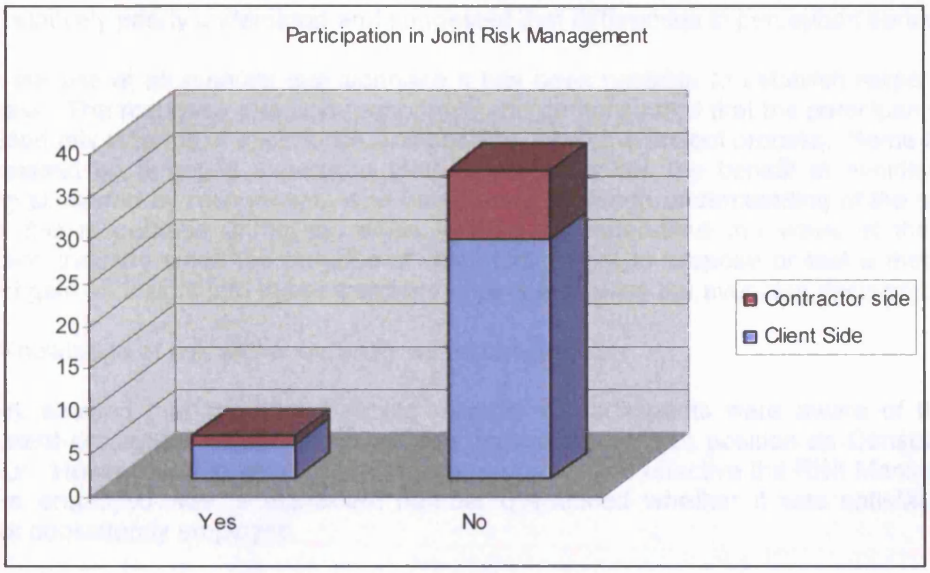


Figure 7.15

As can be seen few of the participants within the survey have participated in Joint Risk Management. Further investigation of this within the semi structured interviews revealed that experience was based almost exclusively from involvement in projects employing partnering arrangements.

8.0 Analysis of fieldwork

The aim of this study was to look at how project risks are managed under differing procurement routes and focus on the perception of risk allocation under Design&Build contracts. The literature review established that risk allocation within the procurement routes was still relatively poorly understood and suggested that differences in perception persisted.

Through the use of an emailed questionnaire it has been possible to establish respondents' perceptions. The response rate was reasonable and demonstrated that the participants were a fairly good mix in terms of experience and position within the project process. Some studies have focussed on targeting experts in their field as this has the benefit of avoiding data becoming skewered by respondents who have a less thorough understanding of the subject. However this is perhaps unrealistic when seeking to understand the views of the wider construction industry since the purpose of this study is not to propose or test a theoretical model but gain an insight into the perceptions of people making the everyday decisions.

8.1 Knowledge of risk and uncertainty within construction

The study showed that the overwhelming majority of participants were aware of the risk management procedure within their own firms regardless of their position as Consultant or Contractor. However when asked about how appropriate and effective the Risk Management procedure employed was, a significant number questioned whether it was satisfactory in content or consistently employed.

What was interesting to note from the semi-structured interviews was that those participants who had the greatest academic and working knowledge of Risk Management tended to be both the most impressed by their firms procedures but also least satisfied with its application. Many cited examples of Risk Management being either conducted once as a tick box exercise and later shelved, or the exact opposite with a laborious process exercised every meeting. This suggests that Risk Management in construction still has significant strides to make before it approaches the structured and systematic approach, proportionately applied, advocated by many academics such as Adams, Dent, Flanagan etc.

8.2 Influence on Procurement Route selection

When looking at the result for who most influences the selection of the procurement route it is perhaps unsurprising to note that it is still consultants rather than contractors who consider themselves to have the dominant role. Whilst previous studies have shown that some contractors possess quite sophisticated marketing departments able to promote particular services and influence decision making, it is ultimately the client (on the advice of consultants) who make the choice.

This does however raise an interesting point relating to perceptions. One of the main issues uncovered within the semi-structured interviews, was that when questioned most respondents were inclined to respond initially with opinions more in tune with general industry-wide attitudes before later asserting their own opinion. Future studies should be aware of this and take the necessary steps to encourage the advancing of individual opinions for fear of surveys becoming an exercise of industry wide "group think".

8.3 Procurement Selection by Value and Type of Project

As noted earlier, the RICS Contracts in use survey (2004) found that the Traditional route was still favoured for jobs of lower value and this is generally supported by this study. However the study did highlight that Design&Build could still prove popular on jobs with lower contract sums depending on the project type - demonstrated by the number of industrial jobs procured using this route. This highlights that it is complexity, rather than a crude analysis of cost that determine the route applicability.

It was proposed that as the value of projects increases so does the complexity, cost, number of people involved and therefore by implication, the risk to both Employer and Contractor.

The results of this study provide some evidence to support this but findings are limited by the small sample size.

8.4 Key Criteria and Risk Allocation by Procurement Route

A key aim of this investigation was to understand whether all project participants rated the importance of different procurement selection criteria equally or whether opinions diverged. Figure 7.10 shows that there is a broad level of agreement as to the key strengths under each procurement route although, as represented by the darker colours, there was more consistency in the rating of Traditional than of Design&Build.

One of the key reasons for this emerged within the semi structured interviews where some of the respondents confided that it was difficult to assess the criteria when considering a range of different project types. For example the level of Client Involvement under a Design&Build industrial project is likely to be very different to the level experienced on an Office build. Had more time been available a separate analysis of this would have been desirable.

Another central objective of this study was to compare and contrast the different project participants understanding as to the key procurement strengths. The greatest divergence of opinion existed under "Speed" which contractors rated as the routes key strength and this is cited by Songar & Molenaar (1994) as one of the key US / UK client objectives in selecting Design&Build. The client side consultants in contrast, believed cost certainty to be main focus When Songar & Molenaar results are filtered to include for only UK Clients then this in fact becomes the key success criteria. In broad terms however as Figure 7.11 demonstrates there is little disagreement between the participants as to the key strengths of Design&Build.

It has been previously established by Hartman (1997) that a joint understanding of where risk lies between the project parties is needed to ensure it is effectively managed and projects led to successful conclusion. In general Figure 7.12 demonstrates that there is a fair level of agreement as to where the risk lies under Design&Build but it is interesting to note that contractor side participants consistently believed the Contractor allocation of risk to be higher than that of the Employer for Programme, Cost, Quality, Funding and Health & Safety risks. It is perhaps not surprising that contractors rated their allocation of risk higher than client side professionals, presumably as they are more conscious of the increased risk they themselves have to carry under Design&Build.

The health & safety risk misalignment could be explained by recent changes in CDMC regulations which highlight the increased responsibility of the client and consultant team, perhaps bringing this issue more into the client side mindset.

8.5 The Time, Cost and Quality paradigm under Design&Build

The participants were asked to consider the impact of selecting Design&Build upon the key project paradigms and the results support the findings within the literature review and established with Figures 2.5 and 7.10.

Time

The participants agreed that Design&Build reduces the necessary programme time from inception to completion. In line with Akintoye's (1993) findings the main reasons given were the early involvement of the contractor, the overlap of the design tender stage and the incentive for the contractor to complete quickly to maximise profit. However further investigation within the semi structured interviews highlighted that many on the client side thought programme benefits were exaggerated by the separation of building packages such as main building works and fit out works.

Cost - Ndekugri & Turner

The participants agreed that Design&Build can help provide cost certainty and reduce costs compared to Traditional procurement. Examples cited such as reduced professional fees,

reduction in specification and standardisation out numbered more positive considerations of increased contractor involvement such as innovation in construction techniques or increased buildability reducing the need for remedial work. The factors cited failed to support Chetham's (1997) study concluding that cost savings were achieved through the limiting specification and choice early on in the design.

Quality

The study was unable to support Gidado & Arshi's (2004) study which advocated that there has been a shift in perception on quality with Design&Build. Figure 7.10 again demonstrated that the participants did not believe Design&Build was as accommodating as Traditional in ensuring the projects quality requirements were met. When ask to provide examples in the interviews of how Design&Build determines quality the participants reinforced the idea that while quality conformance was easy to measure through the Employers Requirements, the limits of Client Involvement could restrict functionality. It was re-iterated that this requirement had a large influence on the procurement routes applicability to certain project types and that in being over prescriptive with the Employers Requirements, the advantages of Design&Build are reduced and the selection more favourable.

8.6 Risks within Design&Build Projects

When asked to provide examples of residual risks within Design&Build the participants largely confirmed the findings identified in the literature review. Many cited the increase in risks incurred by shortening the design time confirming Fazio (1988) comments that the reduction in available time can jeopardise the ability to fully flesh out the Employers Requirements and ensure the functionality that the client is expecting.

Positive results from the survey regarding Design Team co-ordination and Design Management seem to allay some of the concerns expressed by Smith (1992) but notes from the semi structured interviews seem to suggest that contractors still have some way to go to ensure that there own internal organisation maximises the benefits promised by the procurement route. An example of this is Novation, where despite relatively receptive views by the participants of the survey are in some ways contradicted by Songer, Molenaar & Robinson (1994) concerns that novation reduces innovation and restricts potential input regarding buildability.

8.7 Joint Risk Management

Finally experience of Joint Risk Management was assessed and was clearly very limited. It is interesting to note that this was almost exclusively linked to large projects engaged in partnering. It would need to be investigated further whether the required incentives for shared risk managed only exist in these conditions.

8.8 Summary

In summary having assessed and reviewed the data collected it can be argued that this thesis has made some progress in understanding the perception of risk held by construction professionals, the role of risk in procurement selection and the features of Design&Build that help mitigate or promote uncertainty within the project paradigms

9.0 CONCLUSIONS, LIMITATIONS AND RECOMMENDATIONS

9.1 Conclusions

In this study, relevant literature and information has been presented with regard to risk within procurement selection and the allocation of risk within Design&Build contracts. It has demonstrated that even when risk is transferred from the client to the contractor it is not eliminated with some residual risk retained.

It is clear that whilst knowledge of risk management procedures and its application is increasing within the industry, small differences in the perception of risk allocation remain. Since not all risks are foreseeable at the outset risk and uncertainty are only appreciated in the later stages with even the most exhaustive allocation of risks is therefore not achievable through contract conditions alone. This report has highlighted the residual risks held by the client and stressed that unclear and unfair risk allocation can hurt both parties and that with shared uncertainties, incentives for both parties are required to avoid and mitigate risks. This is not something that can be determined entirely through a contract but through the attitudes of the parties present. Experience of collaborative efforts involving a joint risk management was very limited, but this represents the key method in dispelling differences in perception and maximises the opportunity for the opportunity for project success.

9.2 Limitations

It became apparent that there were a number of limitations present when conducting the study, these are detailed below:

- Perception.

It should be stressed that this exercise is based upon perception, not objective fact. This study does not provide any absolute values or conclusions since the answers provided by the survey participants are subjective. Most of the participants whilst experienced and qualified in their field did not claim to be risk experts.

- Sample method and size

The sample size used in this survey was very limited as a result of time pressure and work commitments by the researcher. Given the method of sampling, a snowball survey, it is possible that the majority of respondents are from a similar location with only a small number of firms represented. In the opinion of this researcher these reservations are qualified by the restrictions imposed by the resources available, and that this method allowed far greater ease of contact, accessibility and relative speed than would otherwise have been the case.

- Client Type.

This study did examine the different perceptions participants had of different project sectors, it did not focus upon how different types of client treat risks. It is clear that the concerns of a local council building new social housing will be different to an established developer constructing new homes or indeed an entrepreneur developing a new commercial facility. This would require a more in depth analysis before any real conclusions could be drawn.

- Economic Climate.

Within the questionnaire respondents were asked to consider the most recent projects procured. Therefore all data collected was from within the same economic climate and fails to take account of different conditions and therefore does not take account of fluctuations within the economic cycle on procurement choice. It is clear that the economic context has a direct and indirect influence on people and organisations risk appetite, businesses tend to be more risk taking in a boom and act with greater caution in a recession.

- The nature of the team.

Like all forms of procurement, the success of the project is not necessarily directly attributed to the method of procurement but more to the experience, skill and aptitude of the individuals involved. This must be kept in mind when considering the impact of the procurement route choice and the application of the Design&Build contract. It is very hard to understand and record participants experiences regarding past project teams and near impossible to accurately mitigate any variation in order to aid direct comparison of project team experience against procurement route selection.

9.3 Recommendations for future research

There are several directions that future research could take:

- Perception

During the semi structured interviews it became apparent that those being surveyed were attempting to anticipate the views of other project participants. It would be interesting to conduct this in a more scientific manner, by directly testing participants views of other people's perceptions e.g. questioning a contractor on what an architect would think about a specific issue.

- Joint Risk Management.

As has been addressed in the case study, despite increasing efforts to assign risks clearly and contractually on the basis of sound risk allocation principles, it appears that some risks are best managed jointly by the continued efforts and collaborative behaviour of all the major project participants. This more open approach would lead to more accurate anticipation of risks as well as a streamlined resolution process ensuring most risks can be resolved within the project and reducing the possible disruption in relationships.

If this is the case then further research needs to be directed to those procurement routes and contracts that promote this team attitude such as Partnering or the NEC 2005 contract, since Design&Build is seen by many as a stepping stone to full partnering arrangements.

- Architectural Practices attitudes to Design&Build.

Akintoye's 1994 survey of Architectural practices needs to be followed up to see whether attitudes have changed with increasing experience. Design&Build promoted the incorporation of design services into the contractor's supply chain creating a significant shift in the position and role of the architect which some heralded as an attempt to destroy professionalism. A current study on how far architects have been able to build collaborative relationships with contractors needs to be conducted and conclusions drawn about whether this means Desgin&Build is able to deliver on all its theoretical promises.

- A Focus back on Traditional.

From the literature review it has become clear that the relative advantages of Design&Build are being discussed and argued. However in recent times this is no longer the case with Traditional – a surprising result given its pre-dominance as the most used procurement route. Whilst the Egan (1998) and Latham (1994) reports both promoted the use of partnering is there a danger that the very success of Traditional is causing it to be overlooked? With growing experience of Design&Build many architects are gaining insight into buildability and technological issues that could well bring focus back onto traditional whilst elements of partnering arrangements can be "bolted on" to improve collaboration and relationship management.

- Under Represented Risk Categories.

Finally Risk Management research has tended to focus on the managerial and technical categories. This is not unexpected as they represent some of the key areas of uncertainty. However as a result research into the political, economic and financial categories, this is largely under represented. Recent changes in the economic climate can have dramatic consequences for procurement route selection and only a study collating evidence over a number of economic cycles can accurately assess its impact. With the increasingly globalised construction market come new risks for Clients and Contractors as they are subject to increasing threats and opportunities with work outside the country of their origin. Alongside this the shift in many countries from command to more market based economies is likely to present whole new logistical and financial risks. It is likely that future construction risk research into these categories is both desirable and overdue.

- A renewed Focus on the Brief

A key focus of research to develop will be the relationship between briefing and procurement route selection. Regardless of the route taken the brief if all important since insufficient detail runs the risk of not achieving the original objectives as new aims are added which are only of secondary importance. Conversely by over specifying the brief can reduce innovation and eliminate many of the advantages that Design&Build has to offer. Research into the optimum method of integrating the briefing process and procurement route choice should be explored.

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11.0 APPENDICES

Appendix A

Priority variables affecting client choice of procurement systems

Skitmore & Marsden (1988)	Bennett & Grice (1990)	Turner (1997)	Love, Skitmore & Earl (1998)
Speed	**Time**	**Timing**	**Speed**
How important is early completion to the success of the your project?	Is early completion required.	How important is early completion to the success of your project.	How important is early completion to the success of your project.
Certainty	**Cost**	**Price Certainty**	**Certainty**
Do you require a firm price and / or a strict completion date for the project before you can commit yourself to proceed with construction.	Is a firm price needed before any commitment to construction is formed	Do you need to have affirm price for the project before you can commit to proceed.	Does your organisation require a firm price or strict completion time for the project before your organisation can commit to a building project?
Flexibility	**Flexibility**	**Controllable variation**	**Flexibility**
To what degree do you forsee the need to alter the project in any way once it has begun on site.	Are variations necessary after work has begun on site.	Do you forsee the need to alter the project in any way once it has begun on site, for example to update machinery layouts.	During the course of a building project, to what extent does your organisation feel it necessary to alter the project in any way once it has begun on site.
Quality Level	**Quality Level**	**Quality Level**	**Quality**
What level of quality aesthetic appearance do you require in the design and workmanship	Is high quality important	What level of quality do you seek in the design and workmanship.	What level of quality, aesthetic appearance o you require in design and workmanship.
Complexity	**Complexity**	**Complexity**	**Complexity**
Does your building need to be highly specialised, technologically advanced or highly serviced.	Is the building highly specialised, technologically advanced or highly serviced.	Does your building need to be technically advanced or highly serviced.	Does your organisation require a technologically advanced or highly specialised building.
Price Competition	**Certainty**	**Competition**	**Price Competition**
Is it important for you to choose your construction team by price competition, so increasing the likelihood of a low price.	In completion on time important? Is completion within budget important.	Do you need to choose your construction team by price competition.	Is it important to select the construction team by competition.
Risk avoidance and responsibility	**Risk**	**Risk Avoidance**	**Risk allocation**
To what extent do you wish one single organisation to be responsible for the project, or to transfer the risks of cost and time slippage.	Is transfer of responsibility for the consequence of slippages important.	Do you want to pay someone to take the risk of cost and time slippage from you.	Does your organisation want to limit the amount of speculative cost and design liability.
	Division of Responsibility	**Management**	**Responsibility**
	Is single point responsibility wanted. Is direct professional responsibility wanted	Can you manage separate consultancies and contractor, or do you want just one firm to be responsible after the briefing stage.	To what extent do you wish one single organisation to be responsible for the project, or to transfer the riks of cost and time slippage.
		Accountability	**Arbitration and Disputes**
		Do you want professional accountability to you from the designers and cost consultants	To what extent does your organisation wish to avoid disputes and arbitration.