

## Week 4: Procurement of Highway Maintenance

**Day 2 - Tuesday 18 June 2002**

### **The Procurement Process**

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# Overview of Partnering and the Procurement Process <sup>1</sup>

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## 1. Overview of Partnering

There are many definitions of partnering and much more ways in which it has been implemented. Essentially it is about creating the right commercial environment to make it beneficial for organisations and their individuals to work more collaboratively together for mutual benefit (win-win) using their skills in a more pro-active way helped by integrating their processes and teams to achieve greater efficiency and effectiveness in a cycle of continuous improvement.

Figure 1a is a Model *for* Partnering used by the author. Next to each high level concept are the process and tools which can be used to implement the concept. The '*for*' in the definition is because it raises questions on how to implement partnering, particularly in a workshop environment. For instance:

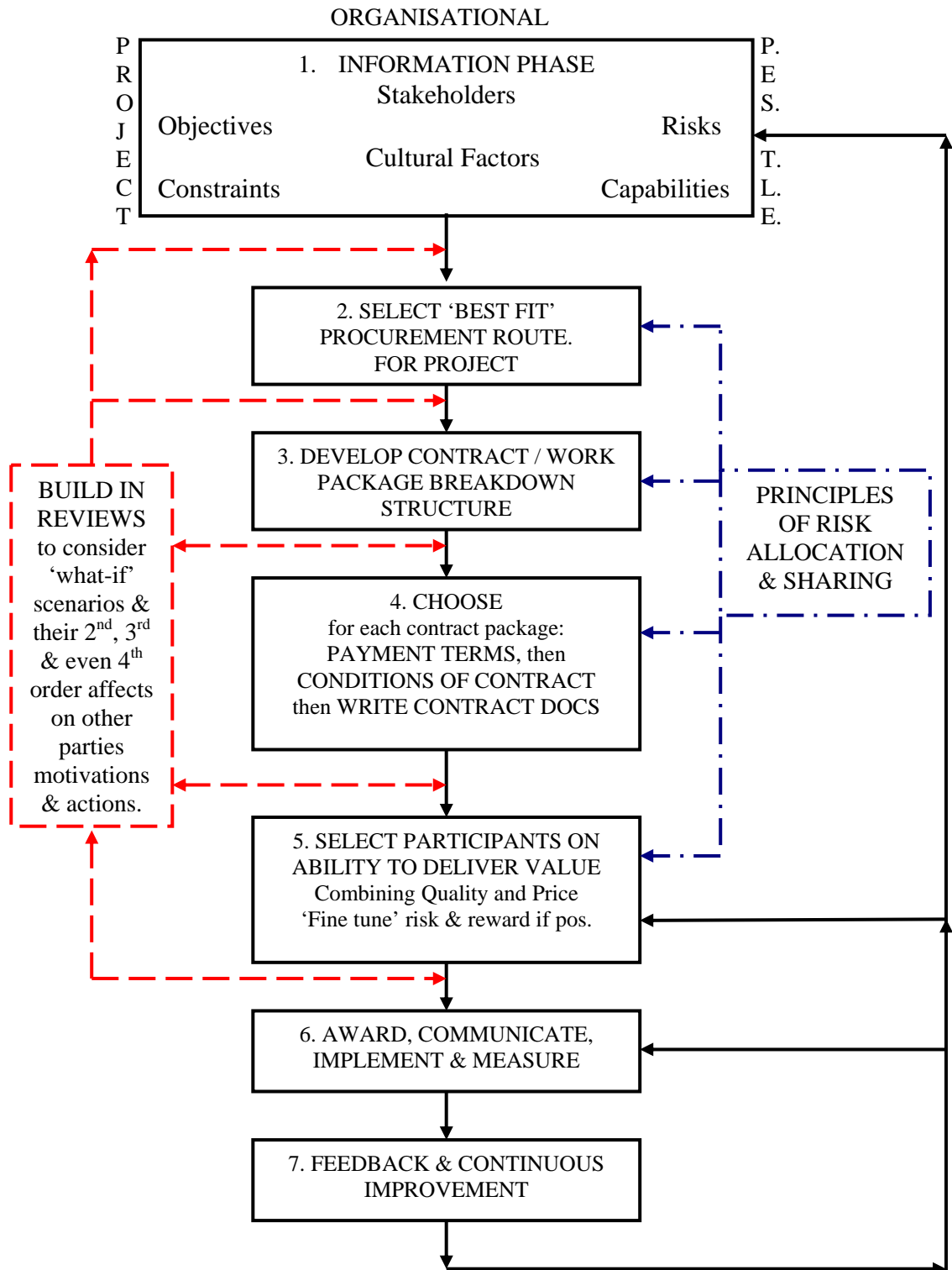
- What are the project teams' different objectives?
- Do we need to alter the commercial terms to further align our objectives?
- What can or could stop us from achieving these objectives?
- How do we wish to work together, in terms of values and behaviours?
- What additional skills do we need to access in order achieve these objectives?
- What processes do we need to put in place to achieve our objectives?
- How can we integrate our processes with each others' to increase efficiency and effectiveness?
- How are we going to measure how well we are doing and continually improve our performance?

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<sup>1</sup> Much of this text is drawn from the author's book on 'Procurement Routes for Partnering: alliances, target cost contracts and the intelligent use of incentives' to be published late summer 2002 by Thomas Telford Ltd. The reader is reminded of copyright on both this and the text in the book.



**Figure 1B: A Model for Developing Procurement Strategy.**



4. *Choose Payment Terms* for each contract package. For instance, will it be a price or cost-based contract? If it is the former, are incentives applicable? If it the latter, is it a target cost or alliance arrangement and how will cost over or under runs be shared?

Having decided this, then *select the 'best-fit' Conditions of Contract*, which may need some amending to fine tune to the project's requirements. Only once the contract package, which includes the extent of Contractor design, and whether outcome / performance specifications, technical or method related specifications are used can the technical brief be written.

5. *Select Participants on their Ability to Deliver Best Value*: This means not just selecting them on lowest tender cost when, for instance, they have a history of making dubious claims and causing delays to other project participants. It means looking at the whole package of cost, technical and financial eligibility and cultural suitability to obtain the best value package for the project. Particularly, when entering into a partnering relationship, some discussion may be appropriate to ensure commercial and cultural alignment.
6. *Award, Communicate, Implement and Measure*: This is the action phase, with the idea being that if the whole project is set up for success from a procurement aspect, then the implementation phase is much more efficient.
7. *Feedback and Continuous Improvement*: This is the closing of the loop, not just back up to the Information phase.

*Build in Reviews and Consider 'what-if' scenarios and their second, third and even fourth order effects on other parties motivations and actions.* This involves generating different scenarios, such as what happens if this risk happens, and then putting yourself into others' shoes and asking yourself what you would do if that risk was allocated to them. Their response, both at tender and during the contract if the risk occurs, can actually undermine your reason for allocating the risk to them in the first place. It can also often undermine the achievement of other objectives. When conducting training on procurement strategy to clients, this is often the biggest eye opener for participants!

A consequence of this is that each successive phase of the procurement process may well have some impact which feeds back up and affects a previous phase, so the process of developing a procurement strategy is very much an iterative process. This is why there are two-way arrows in Figure 1.

*Principles of risk allocation and sharing* apply in all these phase to varying degrees. These are now explored in greater detail. However, before risk can be allocated or shared, it is has to be identified, assessed in terms of likelihood of occurrence and potential impact and some initial thoughts developed on how it can be managed and who is most able to take these actions. Once allocated, the actions need to be developed and implemented. Risk management is a process for doing this.

### 3. Information Phase

This section briefly discusses the meaning behind the words in the Information Phase of the Figure 1b: A Model for Developing Procurement Strategy. On a day's consultancy the author might spend the almost the whole morning exploring and understanding the project and its complexities with the potential participants, before starting to develop the procurement strategy with them. However, once the information has been gained, the subsequent stages are relatively easy.

*Organisational and Project*: The author distinguishes between these two levels because of their interdependency. For instance:

- A project's purpose is to further organisational objectives, so organisational objectives should be defined before a project's. Project objectives should be derived from organisational objectives.
- Organisational constraints and risks may act on a project, whilst some might not and vice versa for project level constraints and risks. If they do, then while a risk might be held at project level, it has organisational consequences which need to be considered.

The reason why 'organisational' is used instead of client is because all parties' issues – client, contractor, consultant – need to be borne in mind at a strategic level.

*P.E.S.T.L.E.* is an acronym for:

Political  
Economic  
Social  
Technical  
Legal  
Environmental

These are broad considerations from which different stakeholder objectives, risks, constraints etc. may originate and impact on a project to varying degrees. For instance political risks, such as the affect a change in government, are far more likely to affect a government agency, than a private company, which is far more likely to be affected by economic risks, such as a downturn in the economy.

*Objectives:*

- **Organisational: If a project or series of projects do not contribute to a businesses long term objectives, why is the business or organisation doing it?** Especially before entering into a strategic arrangement, all parties should be clear about their long-term business objectives and aware of the organisational and cultural changes necessary to move there. Understanding the business context is not only helpful in developing the procurement strategy, but also when working together.
- **Project:** Projects can have many varied and different objectives, with a different emphasis or level of importance attached to them. **Increasingly clients are using the value planning phase of value management to define and weight their objectives and then select the 'best value' outline scheme option. This method, along with the concept of 'value', is explained in Procurement Tool 1: The Concept of Value in Value Management and the Value Planning Process.** The author has used this method in training, straight consultancy and as a facilitator to help clients do this and can testify, by their reaction, the clarity that the process brings to decision making.

One thing that surprises many participants in partnering workshops is just how similar and mutual many general project objectives are for the parties to a project. Figure 3B illustrates this. However, from a procurement viewpoint, do remember that each party does not necessarily attach the same importance to one objective as the another party!

**Figure 1C: Typical Project Objectives for the Parties to a Project**

Client	Contractor / Consultant / Supplier
No health and safety accidents and minimal incidents	No health and safety accidents and minimal incidents
Minimal environmental impact & incidents	Minimal environmental impact & incidents
No negative publicity from above and, if possible, positive publicity leading to enhanced public & corporate image.	No negative publicity from above and, if possible, positive publicity leading to enhanced public & corporate image.
Minimum 'hassle' in terms of unplanned effort and cost to achieve other objectives.	Minimum 'hassle' in terms of unplanned effort and cost to achieve other objectives.
Predictable cash flow.	Positive and predictable cash flow.
A balance between potential for minimum & certainty of time and cost.:	A balance between potential for maximum & certainty of profit.
Quality in terms of: <ul style="list-style-type: none"> <li>• Functionality / Fitness for purpose</li> <li>• Conformance to standards e.g. minimum defects.</li> </ul>	A happy client leading to increased reputation leading to <b>regular repeat order profitable work.</b>
Contractors, consultants and suppliers who want to work for them.	Good publicity leading to an increased client base.
Others?	Others?

Regular repeat order profitable work is in bold because, from talking with contractors, this seems to be their biggest incentive.

Whilst many of these are mutual, others need to be more thoroughly thought through. For instance, what is the balance between the desire for minimum cost and certainty of cost?

*Constraints:* Constraints are what you cannot do or have to do. Constraints can include such things as budget, cash flow, planning consents, procurement legislation, impact on the environment etc. e.g. sub-topics under P.E.S.T.L.E. It is worthwhile identifying and understanding these both before developing the procurement strategy and the technical brief. It is also worthwhile challenging them by asking:

- “What is stopping you from .....?” or “What is making you .....?” which identifies the source of the constraint; and
- “What would happen if you did / did not .....?” which identifies the consequences.

*Risks:* Risks are events or incidents which might stop or hinder you from achieving the defined objectives. At the information stage, we are interested in the principal project P.E.S.T.L.E. risks. Section 1.4. , which follows this section, describes principles of risk allocation and sharing.

*Capabilities* are the strengths and weaknesses of the likely parties to the project. At the Information phase it is likely to be the current capabilities of the industry. The reason for identifying these is that in developing the procurement strategy you want to match the parties’ strengths in managing risks with their responsibility for meeting important objectives. For example, if good public relations have been identified as critical to the achievement of the project objectives, there is little point in selecting a contractor who has little or no experience of managing public relations and then making him responsible for it. Either select one who is or arrange the procurement strategy so that another party manages the public relations interface.

Other strengths and weaknesses could include the experience of the client in construction, whether there is potential for repeat order business, relative financial strengths of the parties, experience of design and build, size and type of job etc. .

*Cultural Factors:* Different companies have different cultures. It could be argued that behaviours are driven by what is held to be important in that company. For instance:

- Over what time scale does the company think e.g. is the managers’ performance judged on short or long term profit on turnover?
- Or is it return on capital invested?
- Are you judged to be a good employee if you follow the rules or challenge them?
- Does the company reward a high visibility reactive all action ‘fire fighting’ approach or a more thoughtful pro-active approach?
- Do they trust others until proven otherwise or start out on the basis of little or no trust?
- Does the company have a risk averse or risk taking culture?

All these factors, and others, affect how decisions are made, both before and during the implementation phase. Often they lie beneath the conscious awareness of organisations, yet drive the individual and therefore the organisation’s behaviour. Sensitivity, awareness and, in some cases, challenging these cultural values affects what procurement strategy a client will feel comfortable with and who they will be comfortable doing business with.

#### **4. Principles of Risk Allocation and Sharing**

There is much detailed literature on risk allocation ♦. This author would argue that not only are these principles ripe for refining, they also need to take account of risk sharing. **Risk sharing is not only**

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♦ See, for instance, references 7, 8 and 9.

**happening more due to the greater use of target cost contracts and project alliances, but also happens in traditional procurement routes under price-based payment mechanisms.** For instance, in traditional contracts:

- if time damages are stated, unless the whole of the cost to the Client of late completion is put on the Contractor, then the financial risk of a time over run due to the Contractor is shared;
- if a clause transferring the risk of, for example, exceptionally adverse weather to the Client is included, then the Contractor has to take the risk up to that threshold. If that threshold is exceeded, then theoretically the Contractor is still taking the consequences of that risk up to that point, whilst the Client is taking the consequences over that point. The greater the overall consequences, the greater the Client's share of the overall risk.

For these reasons, **the principles of risk allocation and sharing are central to procurement strategy.**

**Some quotes on risk allocation:**

Abrahamson, as long ago as 1979, states that both <sup>10</sup> *“the draconian view which seeks to place all risk on the Contractor and the belief that a Contractor should be safeguarded against all risk and in effect guaranteed his costs plus a profit are both an over-simplification. Each risk has to be examined separately and it may be that different solutions are appropriate”*.

Trench's view <sup>11</sup> is that: *“the more risk the employer transfers to other parties, the more he must expect to pay for the privilege. Thus the employer should ensure that risk is wisely transferred as it is in his own financial interests”*.

The American Construction Industry Institute <sup>12</sup> states that: *“project cost benefits can be realised when risk allocation is tailored to the circumstances of the individual project. Owners who routinely force maximum assumption of risk on the contractor are likely to incur higher project costs. Contract preparation that allocates risk with a balanced input from all parties will be most effective”*.

As a consequence, the principles of risk allocation and sharing will be referred to throughout this book and are considered in detail below. However, **before risk can be allocated or shared, it has to be identified, assessed in terms of likelihood of occurrence and potential impact and some initial thoughts developed on how it can be managed and who is most able to take these actions.** Once allocated, the actions need to be developed and implemented. **Risk management is a process for doing this.**

The author's definition of risk is that **risk is a source of uncertainty in achieving defined objectives, with the level of uncertainty associated with an individual risk being a combination of its likelihood and the impact of its occurrence on those objectives.** Note that by this definition, **risk can also be a positive opportunity** where objectives are exceeded. The author's principles of risk allocation and sharing are, in order:

*Principle 1:* The extent to which the consequences of a risk are allocated to a party should bear in mind the overall effect on that party's business, both positive and negative;

*Principle 2:* Risk, both positive and negative, should be allocated to a party to the extent to which they can influence the likelihood of it occurring;

*Principle 3:* Negative risk should be allocated to a party to the extent to which they can minimise the consequences if it does occur, with all things being equal the second principle taking priority; and

*Principle 4:* For minor risks, clarity of allocation should take priority over the other principles, with a tendency towards allocating these risks to the contracting party especially when frequently occurring.

Consider the *first principle*: **the extent to which the consequences of a risk are allocated to a party should bear in mind the overall effect on that party's business, both positive and negative.** The extreme of this principle is the 'rule' not to allocate a risk to a party that would become unable to deal with it if it occurred e.g. through bankruptcy or lack of resources, as it will simply revert back up the contractual

chain.

**Some quotes from other thinkers:**

Stukhart<sup>13</sup> states that when allocating risk “*the relative ability of the parties to protect themselves against the risk must be considered.*”

Ashley, Levitt & Logcher<sup>14</sup> observe that “*the degree of risk aversion exhibited by a decision maker increases as his ability to absorb losses decreases. With contractors and designers undercapitalised relative to the size of the risks they face, the costs ..... of accepting such risks would be higher than to the owner, who is typically less risk averse*”

Barnes in a paper given to a conference in 1991<sup>15</sup> proposes that “*Contractors are typically risk averse and clients are typically risk neutral*”, before going on to say “*if this is true, the client achieves a marginal economy if, other things being equal, a risk is allocated to him. This is one reason why the basic rule of risk allocation leaves risk over which neither party has influence to the client*”.

The overall effect on a parties business is related to the parties turnover, profit on turnover and return on capital invested.

In the civil engineering and building industries, profit on turnover is typically 2-3% with return on capital invested typically being between the ratio of 1 to 6 and 7. Therefore, a 1% change in project construction costs has a 6-7% effect on return on capital invested for a Contractor. For a client, a 1% change in construction costs equals a 1% change in capital costs which maybe insignificant over the operating lifetime of a project. Now assume that the contractor and client have the same turnover. So for an uncontrollable risk over which neither party has any influence, while the consequences of the risk are the same in absolute terms, for whom are the consequences larger in relative terms?

The Contractor. Therefore, who will charge a larger premium for taking that risk?

Again, the Contractor. Obviously, this ratio of return on capital invested varies between sectors and within sectors: for instance some construction companies own almost no plant while others almost consider construction a down-line activity of their plant or aggregates business where they make their real money. The latter invest far more in capital than the former.

Now let us put value for money and risk aversion into the equation. Imagine you are a small client company with a turnover of £10 million and a profit of £0.5 million per annum. You want a new factory built and are given out turn costs ranging from £4.8 million if no risks occur to £6 million if all the identified risks occur. A risk analysis exercise indicates that the most likely outcome is £5.1 million. A contractor says that he will either build it for £5.25 million taking all the risks or for £4.8 million, but with the Client paying for identified risks as and when they occur. Which, as this client, would you accept?

Most participants on the author’s courses go for the £5.25 million ‘all in’ offer, because the effect that all the risks occurring would have on the business. They go for certainty.

Now imagine you are the same client, but with a turnover of £100 million and a profit of £5 million per annum. How does this affect your decision?

Most participants on the author’s courses re-consider their position and go for the £4.8 million offer, but with risks excluded.

Go back to the scenario where the client has a turnover of £5 million and decides to go for a lump sum contract with all risks taken by the Contractor. There are two contractors who both know the most likely out turn cost is £5.1 million and are equal in every respect. However, one has a turnover of £200 million and a profit of £5 million, whilst the other

has a turnover of £20 million and a profit of £0.5 million. Who is likely to charge the larger 'premium' for taking on the risks?

And therefore who is likely to offer the Client a more competitive tender price and better value for money?

**An example of allocating uncontrollable risk to the financially weaker party.**

One public sector client with a large annual spend across the UK had a policy of allocating the costs of adverse weather – an uncontrollable risk - to contractors, but allowing extensions of time for it. Large time related damages were placed on the Contractor for over running the contractual date for completion. Because they wanted to encourage contractors to minimise the impact of adverse weather when it occurred, they decided to take away the extension of time clause. Depending on the area of the country, tender prices rose overnight by between 20 and 50%. Unsurprisingly, the Client rapidly changed back to the old policy as they were not gaining value for money.

To re-cap, the first principle is: the extent to which the consequences of a risk are allocated to a party should bear in mind the overall effect on that party's business, both positive and negative one. The author hopes that the above questions and example have illustrated the importance of the first principle and why, **whether a risk is controllable or not, the first principle should be the starting point when considering how to allocate and share risk.**

Now let us consider the *second principle*: **risk, both positive and negative, should be allocated to a party to the extent to which they can influence the likelihood of it occurring.** This is often stated in the construction press as "risk should be allocated to the party who can best manage it", but do they mean prevent it or minimise the consequences if it does occur?

**A quote:**

Trench (whilst ignoring the author's other principles) states that <sup>11</sup>: *"each risk has a cost which must ultimately be borne by the employers of an industry if it is to remain profitable and thus survive. The party best able to control the circumstances that could lead to loss will price the risk of that loss the lowest. Therefore to reduce the cost to the employer that party should be allocated the risk"*.

For downside risk, this second principle means that the party who can best prevent it occurring is given a sufficient stake of its consequences to motivate him to prevent it. For positive or upside risk, this means that the rewards for managing it well are commensurate with the expertise and effort put into obtaining the positive result. However, we also need to consider the first principle of risk allocation.

Consider an architectural practice who's base fee totals 2% of the projected project costs on which they make a 25% profit, so the total fee paid to the architect is 2.5% of the forecast project cost. The Client decides to motivate them to produce savings by giving them a 50% share of any savings made through good design compared with the industry standard. This seems fair, doesn't it?

Consequently, the architectural practice invest twice as much time and money in the design and through innovative design and value engineering saves 10% percent on project costs of which the architectural practice receives half i.e. 5%. This would mean that while the architects design costs doubles to 4% of the original project costs, their income goes up to 7.5%, so their profit increases sevenfold from 0.5% of the original project estimate to 3.5%. Does this now seem fair from a client's perspective?

And do you think the architects may be over motivated to reduce costs at the expense of quality?

While this might be a little contrived, what share of any savings on project costs do you think would motivate the architect to spend time on saving costs, yet not over motivate them to reduce quality?

Now take the same cost base of 2% of project costs for doing design, but with the architectural practice taking half of any cost over run compared with projected out turn costs. What risk premium would you, as the principal of an architect add on to the base costs to protect yourself?

The *third principle* is that downside or **negative risk should be allocated to a party to the extent to which they can minimise the consequences if it does occur, with all things being equal the second principle taking priority**. Why should the second principle take priority? Because it encourages a proactive response to risk minimisation rather than a reactive ‘fire fighting’ approach. Ground conditions are a classic example of this: whilst the Contractor controls the resources to minimise the consequences or impact of unexpected ground conditions occurring, the Client typically has far more influence over site location and layout of the asset and is able to reduce the likelihood by good site investigation. Consequently, ground risk above a certain threshold is typically allocated to the Client in civil engineering contracts. If it is not, then a client may pay a high risk premium.

#### **An example of transferring risk and control to the Contractor**

The Scottish Office has often allocated ground conditions risk for road projects to the Contractor, with savings being generated. Suddenly, unusable earth becomes useable! However, Contractors have had far greater early input into the project, being able to do additional site investigations for which they are ultimately reimbursed before signing the contract. Additionally, within the constraints given to them, the Contractor is given greater control of design. He can therefore be far more innovative in design of structures and the earth control techniques used. Lastly, the Contractor is asked for alternative offers, with for instance ground risk being included and excluded. Consequently, the Scottish office sometimes took back the ground risk if it thought the premium being paid did not give value for money.

**Source:** Reference 16.

This principle does say ‘all things being equal’. So if a relatively small amount can be spent by the Contractor to avoid or dramatically reduce the likelihood of the high impact risk occurring that a client would normal take, then it may be worthwhile to allocate that risk to the Contractor. For instance, on one project within an existing tunnel, there was a high likelihood of it flooding if the drains were not regularly cleaned. The costs of doing this were included in the Contractor’s negotiated target and the Contractor took the risk of flooding for normal weather conditions.

### An Example of Poor Risk Allocation?

The Heathrow Express Tunnel collapse was perhaps the biggest civil engineering disaster in then United Kingdom in the nineties. Let us consider the risks:

- the works were tunnelling: traditionally a risky job type where risks are often shared because of the effect on progress of variable ground conditions;
- it involved the use of innovative tunnelling technology for the first time in the UK: the New Austrian Tunnelling Method (NATM). Under this method, while the line, level and internal dimensions of the tunnel are given to the Contractor, the thickness of the tunnel lining and structure is effectively designed as the tunnel progresses depending on the earth encountered and measured displacement around the tunnel;
- the works were under an area particularly sensitive to displacement: Heathrow Airport is one of if not the world's busiest international airports. The impact of a tunnelling risk occurring were high

Additionally, it was decided to let the contract under what was, at the time, a relatively innovative form of contract – the New Engineering Contract first edition – and innovation is always a risk in itself. However, one of the benefits of the family of contracts is the better transparency and control of financial and time management it gives both parties. An advantage to the Client that it is much harder for the Contractor to make up for a low tender or blame time delays on the Client.

The contract was let with tendered price being the predominant attribute and the Contractor chosen apparently tendered approximately £5 million less than the other Contractor on a £60 odd million contract. The option chosen was option A: priced contract with activity schedules. Effectively, this a lump sum contract with the Contractor only being paid when he completes pre-defined activities (⇒ see section 4.4.7. of Chapter 4 for a fuller description of activity schedules). The Contractor was made responsible – and therefore carried the risk - for design and quality assurance as the tunnel progressed. Short of deleting the physical conditions clause for extra payment, the Client could hardly have put more risk onto the Contractor.

What do you think happened when the Contractor started to slip behind on progress and not meet their forecast budgets, but found that they could not make it up through the contract? Could quality and health and safety have suffered and been one of the contributory reasons for the collapse? This was a conclusion of the Health & Safety Executive report. Legally the Contractor was responsible, but who chose the risk allocation and conditions of contract, possibly creating the commercial drivers for poor quality and poor health and safety?

The *fourth principle* is **for minor risks, clarity of allocation should take priority over the other principles, with a tendency towards allocating these risks to the contracting party especially when frequently occurring**. If they are minor risks, then the parties are relatively indifferent about who takes them, so what is not wanted is arguments of ownership. Therefore, clarity takes preference over the other principles. Why should frequently occurring risks be allocated to the Contractor? Two reasons:

- if they are allocated to the client, there will be frequent discussions in agreeing the impact of them and the adjustment to the time the Contractor is allowed and additional price paid by the Client. These transactional costs might be out of all proportion to the impact of the risk; and
- if they are frequently occurring minor risks, then the Contractor can allow for them in his tender. Having allowed for them, he is then motivated to minimise both the likelihood and impact of them occurring.

**Summarising:** The appropriate allocation of risk spreads through all phases of the procurement process and has effects into the implementation phase. It therefore needs to be managed throughout these phases by identifying it, assessing it, and developing responses and then implementing those responses - in other words **risk must be managed**. This is why the author has included Procurement Tool 2: Risk Management in Appendix 1. Part of the response phase is to appropriately allocate or share it. The author hopes that the arguments and examples given in this section make people question the popular mantra of “allocate it to the party best able to manage it”. This is too simplistic. Equally, the author hopes that he has both expressed

more succinctly other authors' principles of risk allocation and extended them to include the concept of risk sharing. In shorthand, the author's four principles for risk allocation and sharing are:

1. Who can best bear it
2. Who can best prevent it
3. Who can best minimise the consequences of it and
4. Clarity over the above for minor risks.

### **Choose the 'best fit' procurement route**

**The procurement route is the broad strategy by which the parties will achieve the project objectives, taking account of the constraints and risks that act on the project, the strengths and weakness of the parties to it and their cultures** i.e. the information gleaned from the Information Phases. **Once this is clear, selecting the 'best fit' procurement route is relatively easy if you have the content knowledge of different procurement routes.** This content knowledge is given in chapter 4 for price-based payment mechanisms and conventional procurement routes and in chapters 7 to 9 for more innovative routes. **In effect, you are deciding the 'best-fit' organisational structure for the project.** Once this is done, we can then start the process of fine tuning each contract package to the project circumstances. Some authors<sup>17</sup> would refer to this as having 'fit for purpose' contractual relationships.

### **Develop Contract / Work Package Breakdown Structure**

**The aim of this phase is match up the capabilities or strengths of potential parties to the project with the various elements and risks of the project.** At this stage of the procurement process, it is a broad brush approach, more to do with evaluating the strengths and weaknesses of the industry as a whole than individual contractors and consultants. This usually means breaking the project down into technical elements and allocating these elements to a party who has the capability to deliver this element. It also means avoiding allocating an obligation or risk to a party who is weak in that area.

Take a process plant. There may be a particular item, which is absolutely critical to the technical success of the project and all other processes etc. feed into it. Obviously one contract package has to include the supply of that particular item. However, are manufacturers also best placed to design it as well?

What about installing it?

If this item is both the critical item technically and the biggest in terms of expenditure, should whichever supplier is selected manage and co-ordinate the other packages in the project?

Or should the client, a consultant or main contractor manage the other packages?

The only realistic answer is that it all depends on the suppliers' and others' capabilities, which is related to their experience of doing design, installing and / or managing other packages.

Balanced against this, **a good principle is to aim to keep the contractual interfaces to a minimum.** Clients should note however that just moving the interfaces down a contractual chain does not necessarily give the best practicable answer!

### **Choose Payment Terms and Select 'best fit' Conditions of Contract for the individual contracts, then write Contract Documentation.**

The **payment terms** in each contract govern how the Contractor is rewarded. For instance:

- Is the Contractor or Consultant paid on the basis of cost or inputs e.g. man-hours, or is it on the basis of the firm price(s) he has tendered to do the work? The funding risk that the Contractor or Consultant takes on is a factor.
- Which risks are allocated within the contract to the Contractor and which are taken by the Client?
- If Client risks occur, how should the Contractor be paid? At cost? With profit? At bill rates?

- Is it appropriate to use incentives, both negative and / or positive? And on what measures of performance should these be placed and how much should the bonus / damage be?

**The choices made at this stage affect individual contractors' motivations' to partner or be confrontational and whether to put more emphasis on pursuing certain objectives compared with others.** As with choosing the 'best fit' procurement route, content knowledge is needed and given in subsequent chapters.

Different conditions of contract have different payment mechanisms and allocate risk in different ways using different language. They also allow for different extents of contractor design and are applicable in different industry sectors. They allow for different and varying degrees of Client control and influence both project management and quality assurance.

#### **Quotes about the impact of contractual language**

Ashley and Workman<sup>18</sup> express the view that: *“The owner sets the stage for the attitude of the contractual relationship through the tone of the language used and incentives included in the contract documents. Clearly, this attitude can impact project performance and the resulting project cost”*.

Dorter<sup>19</sup>, in the Journal of the Institute of Arbitrators, states that *“fundamental and finally fatal”* to partnering *“is the failure to relate the ‘philosophy’, ‘mindset’ and ‘process’ of partnering to the benefits rights and liabilities of the parties under the contract”*.

The author would argue that **the words in the contract should reflect the business objectives and context and risks associated with the project. Consequently, the ‘best fit’ conditions of contract should be chosen after the previous stages have been done. Only then, if necessary should they sparingly ‘fine tuned’ to precisely reflect the project circumstances.**

Yet how often do lawyers, either internal or external, take time to understand the business objectives and context of their client, and the risks associated with the project, before recommending the conditions of contract and writing additional, often unnecessary and defensive clauses?. In the author's experience of reviewing what lawyers have written, very few do. In consultancy terms, the 'diagnosis' phase is left out.

The author is aware of one client who made a decision to enter into strategic relationships with a limited number of Contractors and consultants with the intention that each project was let on a target cost basis under the NEC Engineering and Construction Contract. They asked their law department to comment on it, who passed it onto an external law firm. When the response came back, ten pages of additional clauses had been written without any consultation or understanding of why the client was thinking of using the conditions. Consequently, much of the ethos of the contract was undermined. After three months of negotiations with the internal lawyer, the additional clauses were reduced to about a page and a half.

At a more micro-level, how often do lawyers consult with the people who will actually be running the contract to check that users can firstly understand what is written and secondly apply it? There is little point in having a legally foolproof contract, which is incomprehensible to project participants and / or impracticable, e.g. if the parties do what the work actually requires they will be in breach of contract.

**The author's personal view is that the NEC family of contracts is both the most flexible and integrated family of contracts available. Its other principal objectives of clarity and stimulus to good project management are also compatible with partnering. For this reason, Session 4 considers the NEC family of contracts in detail.** Having said this, the author would not necessarily always recommend it. For instance, if a Client has no desire to partner or is poor at project management it is not the contract for you.

**Select Project Participants on their Ability to Deliver Value.**

This is considered in more detail in Session 3 by this author.

**Build in Reviews to consider ‘what-if’ scenarios and their 2nd, 3rd and even 4th order effects on other parties motivations and actions.**

These reviews could be part of periodic ‘gatepost’ meeting where the next phase of the project is sanctioned. It is strongly suggested that at these reviews, those who sanction the next phase of the project are not the developers of the procurement strategy or the implementers of the project, as they will be ‘trapped’ in their mindset of thinking. Instead, they have to justify their decisions so far to people remote from the day to day development of the project.

A recent CIRIA research report <sup>2</sup> stated that “*there should be clear separation between the roles and responsibilities of the proposer of the scheme and the approving body, such that there is transparency in how the scheme is to be applied and managed*”.

As the arrows in Figure 1B suggest, the results from any review could mean re-visiting earlier phases in the development of the procurement strategy, either to tweak or, in extreme cases, start again.

As previously stated, this involves putting yourself into others’ shoes and asking yourself what you would do if that risk was allocated to them. Alternatively, you can ask them! Their imagined response, both at tender and during the contract if the risk occurs, can actually undermine your reason for allocating the risk to them in the first place. It can also often undermine the achievement of other objectives. When conducting training on procurement strategy to clients, this is often the biggest eye opener for participants!

For instance, allocating a risk, which is predominantly in the control of the Client’s team, to the Contractor will mean the Client’s team is less motivated to manage it. Ignoring the financial strength of the parties, the increased likelihood of it occurring means the ‘premium’ charged by the Contractor in his tender would be greater than the ‘contingency’ allowed by the Client in their budget. The Contractor, as well as allowing a premium in his tender, may also push the risk down the contractual supply chain onto a subcontractor, who also charges a premium. Would you, as a client, wish to pay for premiums on premiums?

Probably not. Are these premiums included at tender likely to cover the Contractor’s and Subcontractor costs if the risk does occur?

Again, probably not. So what will they try to do?

Try to push the reason for the risk occurring back up the contractual chain by saying the Client and / or Contractor are somehow in breach of contract and this has caused the risk to occur. What is the natural reaction of the Client’s team and / or Contractor?

They defend their position. What happens next?

This negative attitude and focus applies not only to the specific risk, but often spreads to other areas of the contract undermining all the potential benefits of co-operation. How often do clients and their advisors consider the full consequences of risk allocation?

Two real life examples illustrate what can happen if issues are not thought through:

**Paying for Defects on the Channel Tunnel Rail Link**

Most of the first stage of the Channel Tunnel Rail Link has been let under the NEC Engineering and Construction Contract Option C: Target contract with activity schedules. The Client wanted to motivate the Contractor to notify and then correct Defects without having to use excessive supervisory staff themselves to check on the contractors. Therefore, an additional Disallowed Cost was added to the conditions which disallowed the Contractor from being reimbursed the cost of correcting a Defect if it was notified as a Defect or discovered by the Client's Supervisor more than forty eight hours after the work was done. This result was that Contractors tended to notify the Supervisor of possible Defects in any work which had been done, leaving it to the Supervisor to find confirm or disregard them. The consequence is that the Supervisor's team has just as much work, if not more, than if this clause was not inserted. With this 'get-out', it is questionable if it improves the Contractor's motivation to produce Defect free work.

**The Effects of Allocating Ground Risk to the Contractor in Hong Kong.**

In Hong Kong, the Hong Kong Housing Authority (HKHA) had progressively shortened contract durations and imposed higher and higher damages on their Contractors for the delivery of high rise housing blocks. This was because of advances in construction technology and higher returns once the flats were let. Indeed, the damages were set at a level which reflected the HKHA's loss of income. Additionally, no clauses for unforeseen ground conditions were included in the contract so arguably the biggest risk in a construction project in Hong Kong lay with the Contractor. Contractors consequently passed the risk down the contractual chain to their piling subcontractors. The level of competition meant that very little risk premium was included in these tenders, with the level of the damages apparently meaning that the average piling subcontractor would go out of business after 5 to 6 weeks of damages being applied. What did they do when they found they could not complete their subcontract within the subcontract time scale?

Rather than continue down until the piles hit the rock, some bribed the supervisory staff to sign off the piling. When this was discovered several tower blocks had to be pulled down due to being unsafe. The HKHA's initial response was encouraging: they added 5 to 6 weeks onto the contract duration and halved the level of damages, not just on new contracts, but also on current ones.

Both of these examples illustrate how risk allocation affects the motivations and actions of the parties to the contract. The author is aware of numerous other less dramatic examples. **If the reader is involved in setting procurement strategy and you seem to have recurring problems in your contracts, could it be that the way which risk is allocated is partly to blame?** If so, it maybe time to review your procurement strategies taking account 2<sup>nd</sup>, 3<sup>rd</sup> and possibly 4<sup>th</sup> order effects on other participants' motivations and actions.

**4.1 Award, Communicate, Implement and Measure**

Normally, the contract is awarded after the commercial and contractual terms have been agreed and tied down in the contract. When this is not the case, particularly in one-off projects, disagreements and disputes often occur at a later stage. However, any contract can be modified by agreement between the parties to it at any time. As the contract progresses, the business context as well as project circumstances may change and it may be in both parties' interests to modify the contract accordingly.

Previous research, both by this author <sup>21</sup> and others <sup>22</sup> has found that **unless the shift in the contractual framework and conditions of contract are communicated to contract participants, then unsurprisingly they carry on acting in the traditional manner.**

In partnering workshops after the contract has been awarded, this author also encourages understanding of the commercial terms. This has two benefits:

- it means that project participants understand how their commercial objectives are more aligned and it is in their interests to co-operate; and
- in some cases, it results in the commercial terms being adjusted by an agreement to modify the contract. For instance, introducing value engineering clauses and shared saving clauses amongst the principal subcontractors to promote co-operation amongst them and the main Contractor.

By implementation phase, the author is referring to both the design and construction phases. In these phases, apart from the normal financial and programming monitoring and planning processes, two other processes or tools are increasingly being used. Risk management is being used, to varying degrees to increase certainty over project delivery time, cost, quality and safety. As it can be used in each previous phase of the procurement process, if each party to the project is separately using risk management on their contract, then not only is this wasteful of resources, it is also likely to be far less effective. The risk management process is outlined in Procurement Tool 2: Risk Management.

In addition, the value engineering phase of value management is increasingly being used as a process to reduce whole life costs whilst maintaining the functions of the asset as defined in the first phase of value planning (VPI) from which the best option is chosen to fulfil these requirements in the second phase of value planning.

As with risk management, separating design from construction, both in terms of people and information seems inefficient and less effective, and more enlightened clients, consultants and contractors are at the very least passing this information, if not working together with both processes. Further, it could be argued that value engineering identifies and exploits opportunities for decreasing whole life cost, whereas risk management identifies and minimises opportunities for whole life cost increases. As the processes are similar, as many authors have stated, there is scope for integrating the two processes.

Measuring performance can be viewed as monitoring, except the breadth of measurement tends to be wider than just comparing actual time and cost performance against planned. At its most basic, measuring has two purposes:

- it confirms to the project participants and stakeholders that they are on course to achieve the project aims or that corrective action is needed; and
- it can be used to evaluate project teams and / or the individual organisations participating in the project, which is then used to judge whether further work – or what percentage of further work in a strategic relationship – is given to them.

Currently nobody who is anybody in the construction industry measures performance, they 'benchmark'!  
**An additional use of Benchmarks is as the measure of performance upon which the contractor or consultant is rewarded when an incentive scheme is being used to stimulate improved performance.**

## 4.2 Feedback & Continuous Improvement

Note that this is also the last stage of the author's Model for Partnering presented in the previous chapter.

The benefits of measuring performance are limited if they do not result in any improvement. While comparing benchmarks against each other may establish who is 'best' at the time, apart from acting as a spur for improvement, it does not necessarily help other organisations become 'better' as there is no detail behind the numbers. Benchmarking, as opposed to just the use of Benchmarks, looks behind the numbers to find out why there is a difference in performance in order to learn lessons, which can be applied on other projects. These lessons can be then be applied for continuous improvement.

Continuous improvement in procurement arrangements can also occur in order to align motivations more fully, for instance by re-allocating risk to the party best able to manage it, changing payment terms, or fine tuning an incentive scheme etc. This could happen:

- in the pre-contract negotiation stages prior to award;
- at or as a result of a partnering workshop when some commercial misalignment is realised or to enhance it;
- during a project, either if misalignment becomes apparent or if project circumstances change, so that the original premises upon which the procurement strategy are based are no longer valid; or
- in a strategic relationship, where the nature of the relationship has changed.

#### **An example of continuous improvement in procurement relationships**

BAA / AMEC pavement team. AMEC were employed as the Contractor in a five year framework agreement to build runway and taxiways (pavements) at BAA's airports in Southern England, with each project being let under the NEC Engineering and Construction Contract Option C: Target Contract with Activity Schedules. The target for each contract was originally assembled from a schedule of input rates given by the Contractor along with productivities etc. for a typical project. These outputs were benchmarked on each project and each time a benchmark was improved that became the standard to be used for building up the target on the next contract. However, this approach had a number of problems:

- civil engineering works are notoriously method related and airports have many constraints which affect methodology. Therefore methods and productivities alter from one project to another;
- these methods and resulting productivities change during the project as a result of changes in scope and additional constraints imposed at the last moment by the operational side of the airport;
- under a target cost contract, the target still needs to be adjusted when compensation events occur, which was causing some friction;
- there was an additional source of friction: it was not in the AMEC's short term commercial interests to contribute to the scheme until the target was agreed because that way they gained a pre-agreed proportion of any suggested savings compared with the target. However, this would not have please BAA as they would have developed the scheme in consultation with AMEC only for them to suggest ideas for time and cost saving once the contract was signed! It was not in either parties' long term commercial interests to fall out.

As a consequence, after 18 months of the relationship in which a lot of trust had built up, the decision was made to switch to a pure cost reimbursable contract with the benchmarks still in place to ensure continuous improvement. The Contractor received an increased fee percentage on Actual Costs incurred to compensate partly for changing market conditions, but mainly their loss of profit from their share of savings on the target on the individual contracts.

**Source:** Interviews and various presentations.

## 5. Session Summary

The author's opinion of the purpose of procurement strategy is to develop the commercial and contractual framework so that the objectives of the parties to the project are aligned, thus maximising the likelihood of project objectives being achieved in the design and construction phases. Research has shown that procurement arrangements can have as large an effect on project outcomes in terms of time and cost as can technical decisions in terms of quality and fitness for purpose.

This chapter has presented a model for developing procurement strategy which is illustrated in Figure 1D. This is essentially the same diagram as in Figure 1B, except with the Procurement Tools mentioned added and feeding into the process. To the author's knowledge, such a model has not been presented elsewhere in literature, although many procurement professionals will follow a similar process in their head when developing a procurement strategy. This model can not only be used to develop a procurement strategy for ones outlined in this book, but also for Public Finance Initiative and Term Maintenance Contracts. Three issues which the author wishes to particularly highlight are:

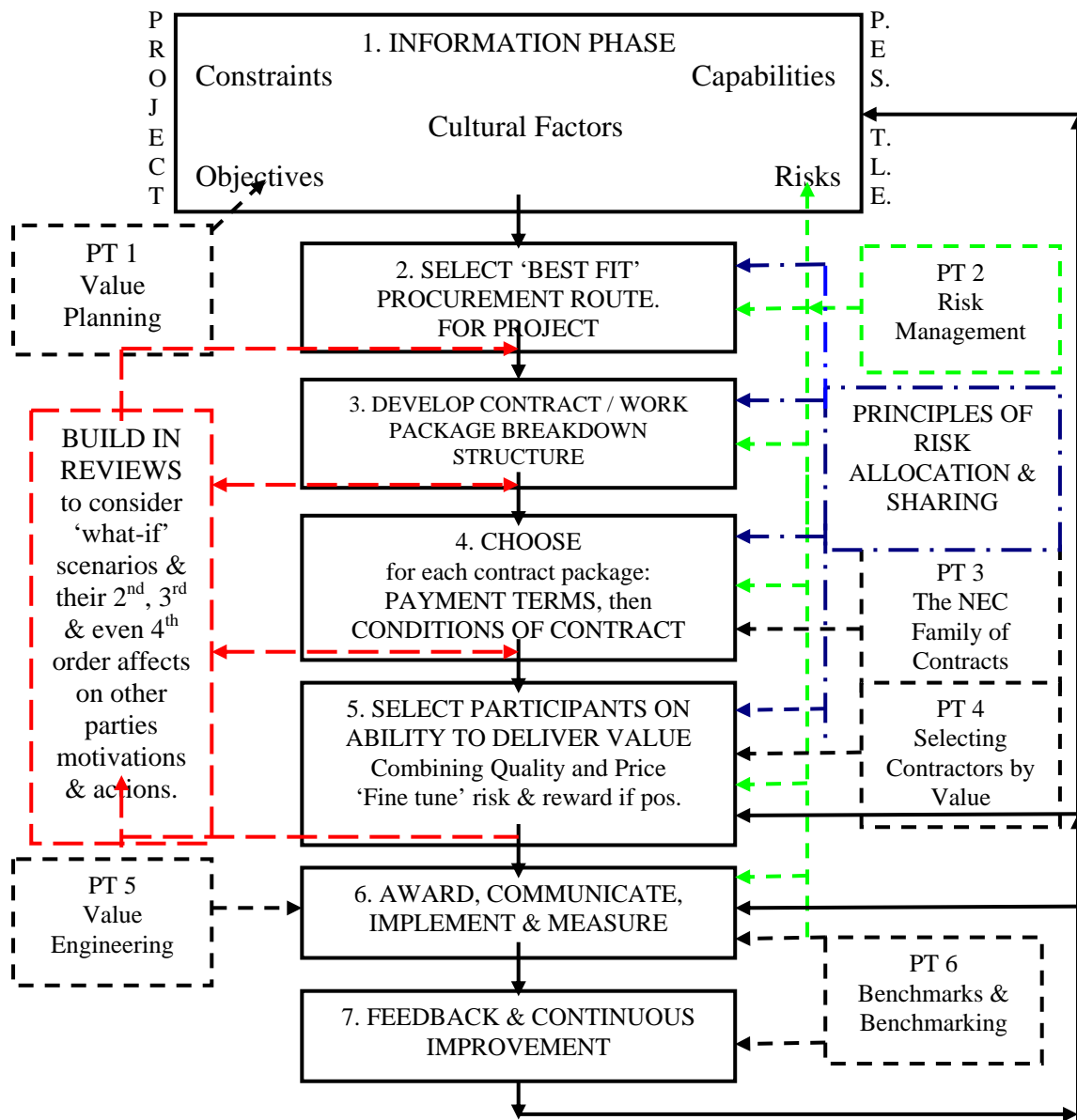
- the need to have content knowledge of different procurement routes, before refining procurement route, its contract packages and finally each contract. This content knowledge is given in other chapters of this book;
- the importance of understanding and applying the principles of risk allocation and sharing at virtually all stages of the procurement process. This is why the author spent some time refining, explaining, illustrating and quoting other authors on the principles of risk allocation and now sharing. These are, in short hand, allocate or share risk in accordance with:
  1. who can best bear it
  2. who can best prevent it
  3. who can best minimise the consequences of it and
  4. clarity over the above for minor risks.

The importance of risk allocation and sharing is reflected in the number of stages at which risk management techniques can be applied.

- the importance of regular reviews as the process is followed and the detail is crystallised. In these reviews, the 'what-if' scenarios need to be considered for the second, third and even fourth order affects on motivations and behaviours. Failure to do this is probably the biggest cause of a breakdown in contractual relationships. It also gives participants the biggest revelation when the author conducts training.

The last comment that the author wishes to offer is this: as with any model, it is only a model of reality and is not reality itself. Use it while it is useful, modify it or abandon it when it ceases to be!

**Figure 1D: A Model for Developing Procurement Strategy With Procurement Tools added.**  
ORGANISATIONAL



Note: PT = Procurement Tool

These Tools, perhaps with the exception of value engineering feed into the procurement process.

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# Contractual Frameworks for Best Value

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## 1. Introduction

The purpose of this session is to give the reader a greater insight and understanding into procurement routes and methods of payments.

This next section of this chapter briefly highlights the fundamental difference between price and cost based contracts. The chapter then has its two main sections:

- the first of which discusses, with their variances, conventional procurement routes, namely the traditional design followed by construction route; Contractor design and management contract routes.
- the second discusses price-based payment mechanisms. This section also highlights their suitability for partnering.

For both procurement routes and price-based payment mechanisms, there is a description of what they are and their advantages and disadvantages are highlighted, so that the reader can understand the reasoning behind the author's conclusions on when to use them.

The order of this follows the process for developing a procurement strategy whereby the 'best-fit' procurement route is selected, followed by contract or work breakdown structure before the payment terms for each contract package are chosen. The next stage in this process is to match payment terms to the conditions of contract. To go into the details of each standard conditions of contract is beyond the scope of this session.

Before we proceed, a note of caution: with all the definitions, the reader should not presume that the definitions are absolutes. They more describe the general meaning of the terms used. This is partly because construction procurement is currently undergoing a rapid evolution so, particularly with more innovative routes, precise definitions do not exist. The descriptions offered here are the authors' own definitions. Another construction procurement professional's descriptions may vary, but hopefully not by too much!

## 2. Price (Output) vs. Cost (Input) Based Contracts

A **fundamental distinction** is drawn between:

- A **priced or output based contract**, is where the basis for paying the contractor is that he achieves or completes an output, typically a milestone of some sort or unit of quantity. In this type of contract, the Client is not directly concerned with what it costs the Contractor to achieve that milestone or produce that quantity as he will only pay what the Contractor offered and he, the Client, accepted on enacting the contract; and
- A **cost or input based contract**, is where the basis for paying the Contractor is that his costs are reimbursed plus some profit or he is paid per unit of input at a pre-agreed rate e.g. per hour of a labourer where the hourly rate has been tendered. What the Contractor is finally paid may vary according to an incentive mechanism.

These different means of paying the contractor have repercussions with the latter being used in the more innovative procurement routes.

## 3. Conventional procurement routes

This section discusses and explains what conventional procurement routes there are and the advantages and disadvantages of each and when it is appropriate to use them. As stated before, by conventional the author means established and commonly used. There are three basic routes, each of which has variances. These are: the traditional design followed by construction route; the Contractor design routes and the management contract based routes. As with all definitions, these are generalisations and how they are implemented

varies in practice, depending on the precise circumstances, conditions of contract used, how the parties to the project are selected etc.

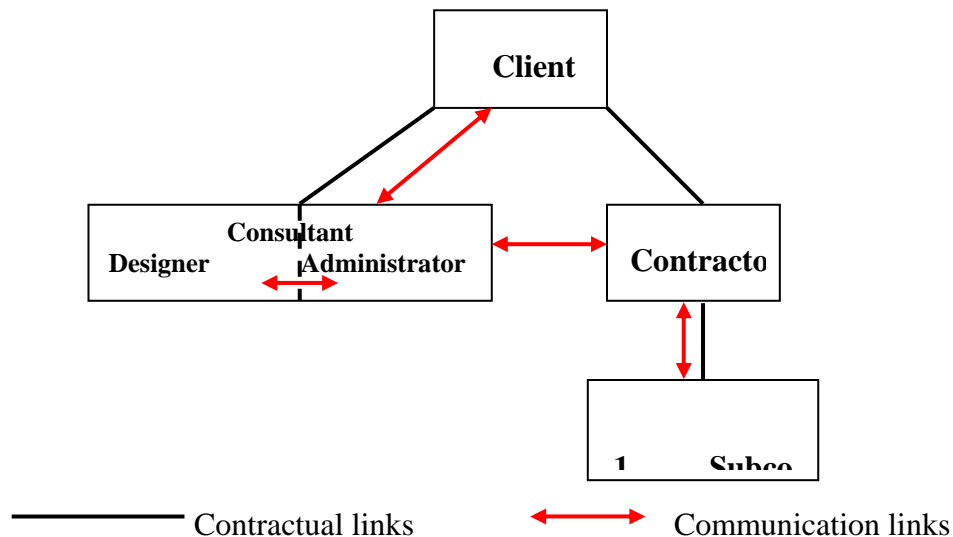
### 3.3 The Traditional Route: Design followed by Construction

*What is it?* When people talk about the traditional approach to construction, they typically mean:

- (a) the Client, either internally or through an consultant, develops a detailed and complete scheme design without consulting any contractor. It will describe through detailed drawings and specifications what the final project will look like and may also contain extensive constraints and descriptions for how the Contractor is to provide it - for instance, at a micro-level, the mix design for concrete, rather than what performance that the concrete is to have, in terms of Newtons per square millimetre;
- (b) while the above is taking place, expressions of interest are asked from contractors, who are then pre-qualified by a combination of basic questions on availability, financial standing, previous experience etc. These expressions of interest are then reduced to normally not more than six contractors who are asked to tender;
- (c) the Client then puts the completed design out to the selected tenderers to price up telling them when the tenders are to be returned by and, if awarded, when they are expected to start by and complete the works by;
- (d) the tendering contractors then price up the scheme and return their tenders within four to six weeks of being issued the tender documents. The contract is normally price based;
- (e) providing a contractor's tender satisfies certain minimum criteria, the contract is usually awarded to the lowest priced tender within another few weeks;
- (f) the organisation which developed the design is normally involved in the administration of the contract to provide continuity.

The outline contractual and communication links for a consultant designed and administrated route is illustrated below.

**Figure 2A: Contractual and communications links for the traditional design followed by construction route.**



*Advantages and disadvantages:* The **advantages** of this approach should be that:

- i. the selection process uses competition to achieve the minimum price for the work;
- ii. once certain minimum criteria are met, price becomes the only basis for selection and the winner is very easy to determine: it is therefore very auditable as the final selection process involves little subjectivity;
- iii. the Client, having had full responsibility for the design, has built exactly what it is he or she wanted to be built;
- iv. providing the Client has specified exactly what it is that he or she wants built, it gives the Client certainty of financial outcome.

However, this approach has some **disadvantages**, the first three of which result from the assumption that the Client has specified exactly what it is that he wanted down to almost the last detail before the scheme is awarded:

- i. if this assumption is not true – and it will almost certainly not be to some extent - then a change results which may lead to an increase in the price paid to the contractor and / or an extension of time;
- ii. as there is no contractor involvement in the design stage, the design may lack ‘buildability’ and be overly expensive to construct or, in extreme cases, impossible to construct. Consequently, the Client is forced to make changes which increase the price paid to the Contractor;
- iii. contractors, particularly in times of depression, may have tendered their price at or below their estimated costs and then have used changes due to poor design and / or administration by the Client and his consultants combined with the subjectivity of traditional conditions of contracts to push up the Prices and recover costs.

The author is aware in the past that some contractors have had two teams working on the tender for a contract: one to work out how much it will cost to build and the other to work out the potential for claims. They have then subtracted the latter from the former to give their tender price and, having won the contract, mercilessly engineered scenarios to increase the price paid to them.

Alternatively, circumstances do not arise that allow the contractor to claim and / or the contract is too tight for the contractor to make up for his low bid, so quality and health and safety are cut back. This has been hinted at as one of the main reasons behind what was described as the biggest UK civil engineering disaster of the last decade: the collapse of the Heathrow Express Tunnel in 1995.

This and the previous two points may mean cost and time certainty for the Client are undermined.

Providing the contractor has past certain criteria at pre-qualification and that his tender bid satisfies certain minimum criteria, then the cheapest tender wins. Therefore:

- iv. as one senior estimator for a contractor said to the author: “as an estimator, you have probably got your estimate about right when you come in second or third. When it is the lowest you have probably missed something out or made a mistake somewhere”. The result is that, having won the contract, the site team is almost pushed into displaying the type of behaviour stated in the previous bullet (c);
- v. the quality of the contractor is not taken into account in the final selection process;
- vi. as there is no design and construction overlap, this form is unlikely to be suitable for clients with a fast track or time dominated projects (as opposed to minimum time for construction); and
- vii. in terms of procurement routes for partnering, there is no partnering prior to the construction contract being awarded as the contractor has had no involvement in the design prior to this point. Secondly, because the contract has been won under tight price competition which takes little or no account of the contractor’s partnering experience and ethos, there is little incentive to partner: indeed, in order to maximise income to make up for a low tender, the contractor’s motivation might be quite the opposite.

However, a number of **refinements to the traditional route** are possible which partially overcome some

of the disadvantages:

- a contractor or ex-contractor is employed as an adviser during the design phases both check the completeness of design and so that 'buildability' is designed in (partially overcoming disadvantage (ii) and to a lesser extent (i)). However, particularly in the public sector, this would tend to exclude a contractor from tendering for the construction contract as it would give him an uncompetitive advantage;
- contractors are allowed to submit alternative bids in addition to the bid for doing the work as per the tender documents. In effect, they offer a price reduction to the Client for achieving the same result in a different way e.g. a different bridge design, but which is still able to carry two way traffic (overcoming disadvantage (ii) for major items);
- detailed design is left to the Contractor (overcoming disadvantage (ii) at a more detailed level). However, design interfaces then have to be stated clearly and under a bill of quantities approach, the standard methods of measurement do not allow for this. Additionally, with the exception of the NEC Engineering and Construction Contract, most conditions tend towards either full Contractor design or full Client / consultant design with little in between;
- asking for programmes, resources and assumptions to assess the realism of contractors' tenders. Tenders that are believed to be unrealistic are discarded (attempting to overcome disadvantage (iii)) although, in practice, the temptation to accept a low tender seems to be rarely resisted;
- modern forms of contract, such as the NEC Engineering and Construction Contract, have might tighter definitions of risk and of roles and responsibilities and more rigorous methods of assessing entitlements to additional time and cost. This means there is a less scope for contractual 'gamesmanship' (reducing the extent of deliberate under pricing in disadvantage (iv), but potentially increasing the likelihood of poor health and safety and quality if this has been the contractor's tendering policy);
- in order to overcome disadvantage (v), contractors are selected partially on quality or on the added value to which they can bring to the project;
- in order to promote partnering once the contract is let, a partnering workshop is held at the start of the construction contract to promote consensus over the project objectives, processes to achieve them and teamwork (attempting to overcome disadvantage (vii)). A capital expenditure or value engineering clause can also be added to the contract to promote a joint search for cost savings.

The last two bullet points i.e. holding a partnering workshop combined with the 'Selecting Contractors by Value' approach, could be labelled first generation partnering. However, while it may reduce the likelihood of adversarial behaviour breaking out, the reality is that most of the commercial pressures that push the parties into acting in certain ways are not addressed.

*When to use the traditional route:* The traditional route lends itself to projects where:

- the project, from inception to the end of construction / start of operation, is not time driven. This is both because design and construction do not overlap and because the consultant needs time to develop and complete the design before putting it out to tender;
- however, the project may be time driven once the construction operations start. For instance, the exact time of a year that a motorway resurfacing job starts is often not critical, but once let, it becomes very time driven in order to minimise disruption to the travelling public;
- the Client knows what he wants or is very particular about what he wants e.g. prestige buildings;
- either the Client or his consultants have the greater expertise to design it compared with the contracting side of the industry;
- the project is a one off using mature technology and / or the Client / consultants cannot (perhaps due to a short contract time scale) or do not want to have substantial input in the construction phase. For instance, an occasional client wanting a factory extension where cost certainty is a priority. Consequently, 'best value' is obtained through competitive tender, not through working with the Contractor to achieve cost or time reductions; and
- the works are *not* likely to be subject to a high degree of change e.g. due to risks occurring, the Client

changing their mind, consultants not having time to complete the design, innovative technology or extensive interface problems of a technical or planning nature outside the contract. This is because of the relative lack of cost transparency under price-based contracts and the consequent difficulty in evaluating change.

### 3.4 Contractor designed procurement routes.

*What is the Contractor design route?* Contractor design procurement routes using price-based contracts are called a number of things depending on the industry sector:

- in the power, process and heavy engineering industries, Turnkey Contracting;
- in the civil engineering sector, Design and Construct ; and
- in the building sector, Design and Build.

Another variant is the Package Deal. The nuances of these definitions are discussed below.

**Turnkey Contracting** tends to use **performance specifications**, where the level of performance can be quantified e.g. the power station will produce X megawatts at Y percent efficiency using this type of fuel, satisfy all existing regulatory requirements and be built in this place. The 'turnkey' refers to the Client 'turning a key' to switch the plant on at the end of construction. These procurement routes usually involve testing and commissioning phases once everything is in place

**Design and Build / Construct** tend to use more **functional specifications** where the Client develops an outline design to varying degrees of detail and states the functional requirements that the assets have to meet: although often mechanical and electrical requirements in buildings are stated as performance specifications.

**Package deals** are also used to describe contracts where the Contractor does the majority of the design. The nuance is that the extent of the Contractor's duties can extend to finding the most suitable site, obtaining planning permissions and even financing it until hand-over. I.e. The scope of his duties covers the whole 'package'. The name tends to apply more to contracts in the power, process and heavy engineering industries. Where the Contractor has more extensive duties in the building and civil engineering industries, it is sometimes called **Develop and Build / Construct**.

The approach taken under the Contractor design route is similar to the traditional route, except:

- the Client or his consultants do not develop a full design. The extent to which the design is developed varies. For instance, one major clients design and construct conditions are often colloquially referred to as to as 'refine and construct' because the look of the finished asset is virtually defined by the time the Contractor starts to do detailed design;
- fewer contractors are typically asked to tender because the costs of tender are proportionally higher compared with a fully designed contract. This is because contractors have to do some outline design to accurately price the scheme;
- as a result of the above, the time allowed for contractors to return their tenders is longer than with traditional contracts: normally six to eight weeks;
- the payment mechanism is milestone, lump sum or activity based compared with the traditional route which tends to be Bill of Quantities based;

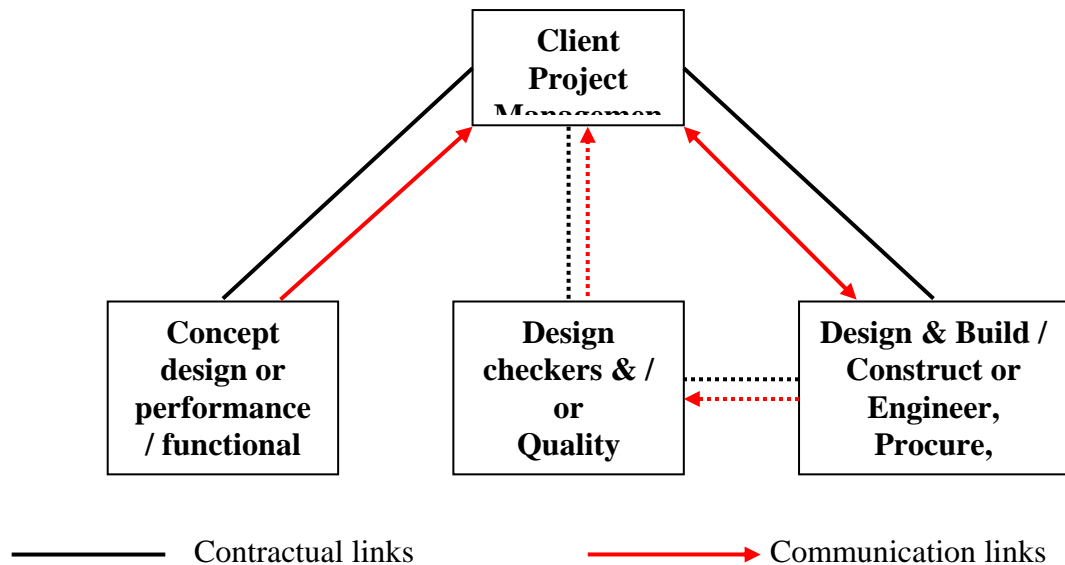
Sometimes, the Client's design team is novated to the Contractor. This reduces the learning curve and can provide continuity of the design ethos. From a Contractor's perspective, a risk (which will be priced) is that the design team still think they are reporting to the Client!

The organisation is illustrated below in Figure 2B. In the past, the design and quality checking functions were in contract with and communicated directly with the Client. Increasingly, Contractors are asked to self-certify both for design and quality of the physical work, with the certificates being passed onto the Client. The Client's or Consultant's role is reduced to auditing the checkers. The arrows indicate the general flow of information.

*Advantages and disadvantages:* The **advantages** of Contractor design are that:

- i. project time scales are reduced as, although there is a longer period for tender, detailed design can overlap with construction. In commercial terms, this means the Client can be gaining a return on their investment earlier;
- ii. the design and build foundation claim that, on like for like buildings, design and build is cheaper. This is probably for two reasons: the Contractor will have a much stronger input into the design improving 'buildability' and there is less interaction between the two parties thus saving on administration costs;

**Figure 2B: Typical Contractual and Communication Links for the Contractor designed Procurement Route**



- iii. the Contractor is supplying goods which have to be fit for purpose. Services carry a lesser level of liability, that of reasonable skill and care, so under the traditional route, the materials and workmanship of the contractor have to be fit for purpose, while the design services of the consultant are to a level of 'reasonable skill and care'. Consequently, under the traditional route, providing the design consultant exercised reasonable skill and care, the Client is left with the liability for the under performing asset due to design. Under the Contractor design route, if the works are not fit for purpose for any reason, then
  - a) there is a much reduced likelihood of argument over who the lack of performance is due to; and
  - b) the level of liability for the whole works is fitness for purpose and it falls on the Contractor ..... providing the Client has specified the purpose or it can be reasonable inferred.
- iv. risk generally, and in particular the programming design / construction interface risk, is transferred to the Contractor. I.e. if design is late, then this is now a contractor risk. Again, this gives the Client greater price certainty;

However there are certain **disadvantages**:

- i. the Client has to be able to give the contractor a clear statement of the function and / or performance required of the asset. He cannot watch the contractor develop the design and then say "No, that is not what I want" because .....
- ii. if the Client does initiate or is contractually responsible for changes after the contract is let, it will cost him dear. This is because:
  - it is hard to evaluate the change in costs from possibly a performance specification with no design to a revised detailed design for construction;
  - construction follows design very quickly. Consequently, if the Client wants to change the

Contractor's detailed design, he has to act quickly to avoid a knock on effect on the construction programme; and

- lump sums and milestone payments give little transparency of cost anyway.

Birkby<sup>4</sup>, a specialist lawyer in construction procurement, writes "*The cost of a variation under this form of contracting is likely to be more expensive than under other forms, as the client has very little knowledge or control over the contractor's methods of operation.*"

For these reasons, the Contractor not only has legitimate reasons to ask for comparatively large uplifts to the prices, but is also able to use the subjectivity to increase it beyond the real effect. All the literature that the author has read says **do not use Contractor design priced-based contracts if the Client is unsure of what he wants and is likely to change his mind!**

- iii. consequently, the Client is advised to have minimal involvement once the contract is signed, with his or his consultant's role being limited to that of quality assurance.
- iv. the *quid pro quo* for the Contractor having fit for purpose liability for the design (see advantages) is that the Client needs to ensure that the Contractor is proficient in managing the design / build interface and their professional designers. A client wants a fit for purpose asset, not to be fighting a legal battle because it is not! Because contractors find it difficult, if not impossible, to obtain 'fit for purpose' insurance for design, contractors bear the liability directly and will therefore fight not to pay it.

#### Some Best Practice Tips

A common complaint under design and build / construct from designers is that the Contractor does not understand the iterative process of design and consequently asks for design modifications too late. Meanwhile, contractors complain that the consultant does not appreciate the lead in time necessary for ordering and the resulting delay and disruption costs from late or changed design. There is some truth on both sides.

Equally, there is a change in culture: some contractors may not be able to change their approach to managing design subconsultants as professionals, whilst some designers do not like being beneath the Contractor contractually and having to take orders from them.

What this implies is that, when evaluating the quality bids from Contractors, it is desirable to take into account the Contractor's experience of managing the design / build interface as well as their design consultant's experience of working under this procurement route.

*When to use Contractor design price based contracts:* The main reasons for using Contractor design price-based contracts are that:

- the project time scale is tight;
- the Client wants a high price certainty and /or
- the Contractor is better placed to do and / or manage the design.

However, before using this procurement strategy, it is advised that:

- the Client knows what he wants and will not initiate changes once the contract is let;
- the Client can express what he wants as an outline design and / or performance or functional specification; and
- the contract is not likely to be affected by significant changes outside of the Contractor's control. If it is, the Client should consider either transferring these to the Contractor for which he will pay a premium or adopting a different route.

From a partnering viewpoint, the Client, Contractor and his subcontractors and design consultants can work together to develop the design and ensure that the Client has the end asset that is wanted in the pre-detailed design and construction contract stages. However, from a contractual aspect the Client and his Consultants are best advised to adopt a more 'hands off' approach once the contract is signed.

### 3.5 The Preferred Contractor approach to Design and Build / Construct:

*What is it?* A comparatively recent development, although a not uncommon practice now, is that tendering contractors offer their outline design and prices in the normal way, except that the Client's brief and the Contractor's outline design are both less defined than in a straight Design and Build contract. The Preferred Contractor is selected on a combination of price and quality, with quality including his proposed outline scheme design. Prior to the full design and build / construct contract being signed, the Contractor and his principal subcontractors develop the design with the Client and his consultants' input. This can either be on a consultancy basis or for the prize of winning the construction contract. Changes in requirements, which result in cost variances from the original prices, are agreed as the design is developed. When the design is sufficiently complete for the Client to know what the end asset will look like and how it will function, the final contract price is agreed.

*Advantages and disadvantages:* The **additional advantages** of this approach, **compared with the normal design and build / construct approach, are:**

- i. there is less consultant input at the start;
- ii. tendering contractors have less work to develop the design prior to becoming the preferred contractor. Industry overheads are therefore decreased;
- iii. clients have more input into and better knowledge of what their end asset will look like, how it will function, the materials that will be used and whole life costs as the design is more tied down at the signing of the contract;
- iv. consequently, there is a reduced likelihood of changes; and if there are ....
- v. the Client has more insight, due to the pre-contract negotiations, into the Contractor's cost base, which reduce problems in quantifying the effects of any changes.

The **potential disadvantages** are that

- i. the Client has to have the expertise to input into the design;
- ii. to gain the benefits, the design has to be more complete prior to signing the contract. This reduces its applicability in time driven projects; and
- iii. as time progresses the Client becomes more locked into using the Preferred Contractor, which gives the Contractor a negotiating advantage. It is advisable, therefore from a client's viewpoint, to intend to sign the contract sometime before construction is programmed to start in order to reduce this leverage. If the Contractor then starts to play games escalating the Price, a replacement can then be brought in. Again, this does not suit time driven projects.

*When to Use the Preferred Contractor approach?* In the same circumstances as the Contractor designed route, but where:

- the Client wants to and is able to develop the design with the Contractor to ensure the end asset is more precisely what is wanted. This could be because the Client wants to continue a successful relationship from a previous project;
- greater price certainty once the contract is signed is desired, as changes during the contract are less likely; and
- the project is not as time driven.

### 3.6 Management Contract Routes

*What are they?* Management contracts are where the Client employs a contractor as a management professional on a fee basis to manage on his behalf the different work packages, which make up a project, with:

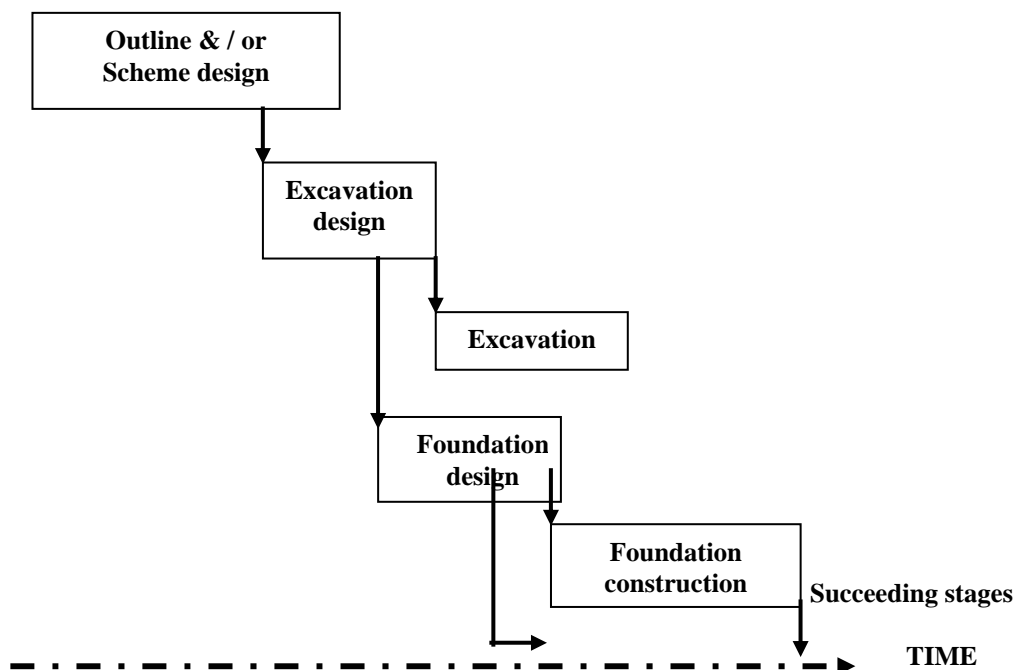
- the Contractor doing very little, if any, of the physical works himself;
- the physical work packages normally being let under priced-based lump sum or bills of quantities based contracts, although the author is aware more recently of them being let under target and occasionally even cost reimbursable contracts; and

- the designers are either subcontracted to the contractor or, whilst under the contract to the client, report to the contractor.

*When are they used?* Management contracts are normally used when a combination of the following factors are present:

- the project is complex involving numerous different specialist contractors and therefore numerous programming and technical interfaces. This can include external interfaces which have not been tied down at the start of the contract, but will be by the time the affected work package is let. The approach allows flexibility in implementation to allow for changing circumstances;
- the Client either does not have sufficient resources and / or sufficient expertise to manage the project himself;
- the Client does not have a steady workload. The management contractor's staff are employed in the peaks; and
- the **project is time driven with the Client unable to express his requirements clearly at the start. This is a prime reason for using this approach compared with Contractor designed price-based contracts.** This enables the outline design to be developed, and then detailed design on say the excavations to be commenced. Once this is complete, the excavation package can be let; the foundation design is commenced as the outline design for the excavations is completed and then let. Each successive phase overlaps the previous phase both for design and construction. This is illustrated below in Figure 4C.

**Figure 2C: Illustration of how design and works packages are let under a management contract arrangement**



*Advantages and disadvantages:* The main **advantages** are that it can be used in the circumstances described above, when other previously described procurement routes are unsuitable. Other advantages are that:

- early contractor design and programming input, which leads to a more collaborative 'partnering' approach;
- compared with the Contractor designed priced contracts, the risk when each construction package is let is less as they are much more defined both in terms of scope and the external interfaces. Overall less risk is therefore passed to the contracting industry, so the Client should pay a smaller risk premium for the project overall;

- iii. each works contract can be let using a procurement route and payment mechanism best suited to its circumstances, rather under an umbrella main contract which assumes the same characteristics for all types of work involved in that project. Again this is likely to reduce the risk premium paid by the client.

The main **disadvantages** arise mainly from the circumstances of the project, not from the type of contract. These include:

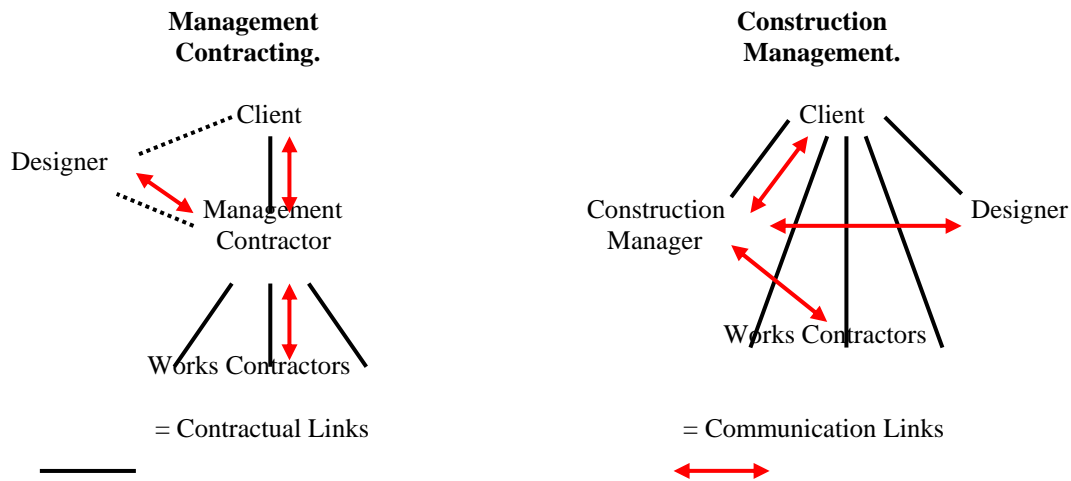
- i. there is likely to be some over design in the early work packages, because the final detailed design for later packages has not yet been finalised. E.g. the exact amount of weight that the foundations of a building have to support cannot be determined until the structure has been designed in detail. In the traditional approach, the design can be fine tuned;
- ii. there may be re-work or changes required on early work, again because the requirements for later packages are not finalised. E.g. the voids in the structure for mechanical and electrical services are not sufficient because the requirements had not been fully defined when the structural package was let;
- iii. there is no price certainty for the Client when construction commences as only the first work package will have been finalised. Consequently, the Client is at risk of a more expensive project than originally thought. However, he may also save money compared with what was expected!
- iv. the literature consistently highlights duplication of roles and therefore bureaucracy as a problem, because the Client's project managers check on the managing contractor who in turns checks the work of the works contractors. This can be reduced by:
  - selecting a Contractor that is trustworthy and professional;
  - clarifying roles and responsibilities
  - deciding on the appropriate level and degree of checks.
- v. the benefits from early completion and the size of the project have to be sufficiently large to justify the increased management overhead. Consequently, they are rarely used for small to medium projects (say less than £5 million).

Management contracts take two forms:

- the **Management Contracting approach**: where the managing contractor sits contractually in between the Client and specialist contractors. The contractor is reimbursed the costs of the specialist work packages and some of his stated costs, plus a fee. This fee can be a percentage of costs or a fixed sum (⇒ see below for a brief discussion and section 7.4.3. in Chapter 7 for a more detailed discussion on fees).
- The **Construction Management approach**: where the managing contractor is employed as a consultant to manage the specialist contractors on the Client's behalf. The specialist contractors, who would normally be subcontractors, are contracted direct to the Client.

These two approaches are illustrated below:

**Figure 2D: Contractual and Communication links for Management Contracting and Construction Management**



Under the management contracting approach, the dotted black line indicates that the contractual link is sometimes between the designer and client, and sometimes between the designer and contractor. Contractors prefer the latter as otherwise designers can tend to communicate through the Client. This diffuses and confuses responsibility inhibiting effective management of the project. A variant on this theme is that the Contractor designs the work internally, when it is often referred to as **design and manage**.

The brief or scope of services that the construction manager is to provide can vary enormously depending on the experience of the Client and balance of the Client's / Contractor's team. For instance, it could be that the Client's project manager literally just signs what the Construction Manager puts in front of him or, at the other extreme, the Client's project manager leads an integrated team consisting of his own and the construction manager's team.

In the management contracting approach, the Contractor's own costs are sometimes paid for as a percentage of the works subcontract packages; sometimes as a lump sum; sometimes on an agreed hourly rate basis plus other defined costs; and sometimes as a combination. For instance, a lump sum for elements of physical work, hourly rates for people costs, plus rent and rates of the hired facility and a percentage for contribution to head office overheads and profit.

In the construction management route, the Contractor is sometimes reimbursed on an hourly rate basis plus other defined costs, sometimes on a lump sum basis and sometimes by a combination. Whichever option is chosen, how the contractor is paid in order to recover his costs depends on the project circumstances and obviously affects motivations. For instance, on a lump sum fee any savings in management costs equals more profit for the contractor, but less effort put into the project. On an hourly fee basis, the Contractor may want to put in hours which are not strictly needed.

#### **Management Contracting vs. Construction Management:**

Management contracting became very popular in the mid-eighties but started to decline in the early nineties. The main reasons for its reduced usage were:

- the Management Contractor has a contractual position to defend if the works subcontractor does not perform. As the Contractor is liable both for the performance of the asset – as he is supplying goods, he has a 'fitness for purpose' liability - and delivery time. Consequently, management contractors tend to pass these risks down the supply chain and onto the works subcontractors, who include a risk premium in their tenders. This is not helped by some clients putting high damages onto the management contractor.

The author heard of one project where the Management Contractor's delay damages were £20,000 per

week. The roofing was on the critical path and the small specialist subcontractor had a 3 week contract worth £60,000 with the same time damages on it. If this subcontractor had not completed the work on time, he would very rapidly ceased trading.

Additionally, works subcontractors are usually liable for potentially large contra-charges if a delay caused by them has knock on effects on other works subcontractors. Again, works subcontractors allow a premium for this which is ultimately passed onto the Client. Note: clauses of these nature can also be written into the contracts for the works contractors under the construction management approach with the same results;

- the contractual position of the Management Contractor means that when the Client changes something or does not do something which he should have done under the contract e.g. provide access, the Contractor's main concern can be to extend the timescale allowed under their contract in order to escape damages and / or increase the project budget, rather than solving the problem with minimum impact. This also happens when a works subcontractor does not perform. There is a clear lesson here: contractual considerations and risk allocation do influence behaviour and therefore results;
- regardless of the previous points, some contractor's staff were unable to make the attitudinal and cultural change from working 'against' the Client to acting 'for' him and in his best interests.

As a result of the above, Construction Management grew in popularity from the early eighties to mid-nineties. The main reasons for this were:

- the lack of ambiguity between the construction manager's professional role and his contractual and commercial position. He therefore acts in a more professional manner representing the Client, so that fewer checks are needed to ensure he is performing. It is also much easier for the Client to terminate the construction management contractor at any time if he is not performing, as the works contracts are direct with the Client and not through the management contractor!
- the ability of the Client to have more involvement and say in how the contract is run and works packages are let;
- direct contractual links between the Client and works contractors mean payment is generally quicker and more secure. This will be reflected in works contractors prices; and
- more direct lines of communications with the Client can help specialist contractors input into the project.

To take advantage of the last two points though, clients have to be willing and have the expertise to be actively involved in the project i.e. they are an intelligent experienced client. From talking to Contractors, a danger of this is that:

- communication routes are not properly established or complied with. Consequently, the works contractors and Client cut the Construction Manager out of the communication loop which, as with designers contracting directly with the Client under the management contracting approach, diffuses and confuses responsibility; and
- the Client is willing, but is not intelligent, and makes ill advised decisions!

Both problems undermine effective management and consequently construction management now tends to be used by more experienced clients, who have a working knowledge of the industry and technology.

### **An Innovative use of Construction Management**

The Highways Agency traditionally procured its bridge refurbishment projects by asking their term consultants for a particular area to do the scheme design and let it by the traditional route to a main contractor under a bill of quantities contract. Once let, the contract was managed by the term consultants. The problems with this approach are:

- there is no involvement at an early stage in the project cycle of both the main contractor and the specialist contractors who do the physical work;
- five contractors and an unknown number of subcontractors incur tender costs for the same contract. This results in excessive cost to the industry which the repeat order client ultimately pays for;
- during the contract, when things change as they inevitably do in a refurbishment project, the main contractor is between the people doing the work – the works subcontractors - and the client's consultants who authorise extra work and agree payment. This meant:
  - the works contractors would defend their contractual position against the main contractor who in turn would defend theirs against the Client. This inhibited communication and often meant decisions were made based on second hand information;
  - when delays occurred, the Client was paying for both the main contractor's and works contractor's delay and disruption.

The Highways Agency, with their consultant's – W S Atkins Transportation Engineering Ltd office in Tamworth - full support and involvement decided to do something different in order to overcome these disadvantages. Namely:

- bring in an experienced construction manager from elsewhere in the W S Atkins Group;
- appoint on a one year term basis eight works contractors from the main trades which made up a typical bridge refurbishment project. These are:
  - Traffic Management
  - Bridge Deck Waterproofing
  - Safety Fencing
  - Cathodic Protection

Some of these works contractors covered two or more trades.

- on appointment each work contractor was paid a £1,000 retainer so that a contract was formed i.e. consideration had been exchanged;
- involve these works contractors early on in the design of the each project so that buildability was improved, cost driven down and programming requirements could be fleshed out. Depending on the extent of their involvement, this could be reimbursed on a hourly rate basis;
- ask only one works contractor from each trade to price up their part of the scheme. This reduced their overheads. This price is submitted together with the calculations, assumptions etc to the consultant who would go through it in detail. Justification was asked for any unexplained costs or low efficiencies . In reality, because all parties had built up an understanding of the work involved and an element of trust, there is generally not too much discussion etc.
- once the details were finalised, the contract for each trade was let on an activity schedule basis as a compensation event under an amended NEC Engineering and Construction Contract;
- if changes occurred, the consequences were discussed and agreed directly between the consultant and works contractor without the defensive posturing associated with normal price based contracts. This is partly to do with the form of contract, but mainly because the Consultant had a thorough understanding of how the works contractor's cost were built up and what they included for;
- the works contractors now know that, to some extent, the amount of work put their way depends upon how well they are judged to have contributed in the preparation phase and performed in the implementation phase. There is therefore a motivation to contribute and perform.

**The trial has been sufficiently successful for it to be extended to other areas of the network on a 3 year term. Additionally, the whole scheme is benchmarked to ensure value for money is being achieved.**

However, management contracting does have some advantages over construction management in that it enables a harder edged contract arising from the Contractor's 'fitness for purpose' liability rather than 'reasonable skill and care' under construction management. Therefore, if the asset does not perform, the Management Contractor can be held liable. The *quid pro quo* is that the Client:

- has to be able to specify what the performance or functional requirements are at the time of signing the contract for this liability to be effective; and
- has to have a more 'hands off' approach and not substantially change these requirements during the contract as, otherwise, the Contractor may put his efforts into defending his contractual position rather than solving problems.

Therefore, if the performance or functional requirements are not well defined, a client would be well advised to adopt the construction management approach certainly until the requirements are sufficiently well defined. At this point, they may choose to switch either to the management contracting approach or, if they are willing to pay the risk premium and lose much of their ability to intervene, a Contractor design route.

#### **Use of Management Contracting in the Telecommunications Industry**

Until its recent recession, the telecommunications industry was driven by speed to market due to the pace of change, with the global clients, often developers, sometimes commissioning large one-off projects in different countries. They therefore had little construction expertise, particularly in a single country and, being developers, have little desire to become involved in the day to day management of construction activities.

'Switches' are essentially large electronic information exchanges where information comes in and is distributed out through the World Wide Web. An Internet Hotel / Data Centre is similar except that organisations rent an area in which computerised data is held and stored. These areas and the data held in them is connected with the renting organisations again by the World Wide Web. Both types of building are technologically complex involving many disciplines and therefore interfaces, but have similarities in layout, structural requirements and non-IT mechanical and electrical requirements i.e. extensive cooling and back-up power supplies. They can also be described in terms of performance requirements.

One such £100 million + project started as a Switch and had all of the above characteristics. It therefore lent itself to a Management Contracting approach: a large complex project described through a performance specification; a demanding client who did not have the capability or desire to manage the project on a day to day basis, yet wanted 'fit for purpose' liability; high likelihood of change with minimum time as a primary objective. As an example of the last point, piling began on-site prior to the roof, on which the coolers sit, being designed. The Client still desired a close relationship with the management contractor and selected, in agreement with Contractor, the NEC Engineering and Construction Contract Option F: management contract to help facilitate this. Partly because of the high likelihood of change, the contract was amended so that the management contractor's people cost were reimbursed on an input basis, rather than be included in their fee.

The management contractor naturally wanted to be as 'back-to-back' contractually as possible and have a similar close relationships with the works subcontractors. They therefore decided to let their subcontracts under the NEC Engineering and Construction Subcontract, predominantly under option A: priced contract with activity schedule, rather than bill of quantities. This was to save on measurement costs and allow for elements of subcontract design. These subcontract work packages were let progressively often with, prior to the contract being signed, extensive subcontractor involvement in design and risk management. In addition, damages were specified in the conditions in proportion to the size of the contract with no contra-charging allowable. In this sense, much risk of the reduced risk was taken out of each contract with the Client, via the Management Contractor, taking a large share of the risk profile. The aim, which materialised, was to free up minds and attitudes to work with others as rapid progress was essential to the success of the project. The project management procedures within the NEC also helped in this respect.

Due to changed business context i.e. the global and, in particular, telecommunications slow down, the Switch changed into an Internet Hotel / Data Centre during the project. Despite this, the project, at the time of writing is almost complete, on time and on budget. It is expected that the final accounts of the works subcontractors and of the management contractor will be virtually complete on the contractual Completion of the project.

**Summary of management contracts:** Management contracts are used when:

- the project is complex involving numerous different specialist contractors and therefore numerous programming and technical interfaces;
- the client either does not have sufficient resources and / or sufficient expertise to manage the project himself;
- the project is time driven with the Client being unable to express his requirements clearly at its start.

There are two variants: the management contracting approach - where the works contracts are let through the Management Contractor – and the construction management approach - where the Construction Manager has a more professional role with works contracts let directly with the Client. The headline advantage of the former is that there is a greater contractual onus for the Management Contractor to perform in terms of time and fitness for purpose. This means the project requirements or purpose has to be more defined. The disadvantage is less flexibility for the Client once the implementation phase starts and the Management Contractor possibly adopting a more ‘defensive’ contractual position rather than a ‘can do’ attitude when circumstances change. This has obvious implications for partnering, although overall both routes encourage a partnering approach compared with the traditional and contractor design routes.

### **3.7 Engineer, Procure and Construct (EPC);**

Engineer, Procure & Construct contracts are similar to the management contracting approach outlined in the previous section. The differences are

- i. the terminology tends to refer to heavy engineering projects. The ‘procure’ part of the EPC title is because much of the value of the work is carried out in factories and then brought in on a ‘supply only’ or ‘supply and install’ basis to the construction area;
- ii. it has tended to be used for high value projects e.g. North Sea oil fields;
- iii. because of the size and complexity of these projects, the ‘management of management’ becomes an issue; and
- iv. as a result, the management contractor tends to be integrated into the client’s project management team in the way the construction management contractor can be. However, the same contractual and commercial pressures still apply as with management contracting: that is to focus on defending their contractual position when a risk occurred, rather than minimise the impact. This is perhaps why the ‘alliancing’ concept came in from the North Sea Oil Industry.

### **3.8 Section Summary.**

The established procurement routes of the traditional approach (design followed by construction); Contractor design (turnkey; design and build; design and construct; and package deal); and management (management contracting, construction management and Engineer, Procure and Construct) have been discussed. In each case, what they were, their advantages and disadvantages and when to use them was described, together with some brief comments on their suitability for partnering.

The previous session gave a framework for the process of developing a procurement route. The first stage is to understand the project characteristics (stakeholders, objectives, risks, constraints, etc). Having done this, the next stage is to choose the ‘best fit’ or most appropriate procurement route. This section has given the reader the content knowledge of conventional procurement routes to do this.

## **4. Price Based Payment Mechanisms**

Having decided upon the ‘best-fit’ procurement route and the contract / work breakdown structure, the next stage in the process is to choose the most appropriate payment terms for the individual contract. This could be at main contract level or subcontract level. This would normally be under priced or output based contracts.

This section clarifies what is meant by various commonly used terms for priced or output based contracts,

before discussing their advantages and disadvantages, and when to use them. It should be noted that the exact way in which each payment mechanism is used depends on the conditions of contract under which the contract is let. It follows this section has necessarily to deal in generalisations.

#### 4.9 Bills of quantities

*What are they?* A Bill of Quantities (BoQ) is where the Client or his consultant has taken off quantities from the drawings and specifications and structured the overall format and description of each item in a way which normally matches an industry standard. In civil engineering this is normally the Civil Engineering Standard Method of Measurement 3 (or CESMM3 for short) and in building, the Standard Method of Measurement 7 (or SMM7 for short). This bill is distributed with the contract documents to the tendering contractors, who put a price against each unit item. Each unit price is then multiplied out by the expected quantities and the sums of these multiplications are added together to give the tender price, which is used to compare the tenders of different contractors. At each assessment during the contract, the contractor is paid for the quantity of work completed since the last assessment.

Two distinct advantages of Bills of Quantities is the simplicity of the concept (price = quantity multiplied by rate) and their familiarity. The remainder of this sub-section draws heavily on a paper written by Hoare and this author and published in Journal of Construction Procurement <sup>2</sup>. For the full references, readers should refer to this paper, although the immediately following text drew heavily on the work of Potts <sup>3</sup>. It draws attention to some commonly held beliefs about Bills of Quantities (BoQs), which while they all contain some truth, are equally certainly not true in all situations:

- (i) *BoQs presume that design is complete at tender and therefore prompt the design team to finalise the design before the bill can be prepared.*

True but if, as often happens, it turns out not to be true, it can cost the Client dear. This is not only because the quantities may change, but also because most contracts allow the rates to be adjusted if there is a change in the character of work or the conditions in which it is carried out. If design cannot be complete at tender, a more appropriate contract strategy should be used. Further, it can be argued that with the increasing specialisation and subcontracting within the construction and heavy engineering industries, the best people to do detailed design are these specialist subcontractors. Best practice therefore suggests that design should be incomplete at tender! However, BoQs, written in accordance with their standard method of measurement, do not allow for this.

- (ii) *A BoQs avoids the need for all contractors to measure the works themselves before bidding, and avoids duplication of effort with the resultant increase in contractor's overheads which are eventually passed on to clients.*

Whilst fundamentally true, the widely accepted Pareto principle indicates that 80% of the cost is covered in 20% of the items. Most contractors will, at the very least, re-calculate the quantities for the major items in order to check their accuracy and hence suitability for the 'games' outlined in the next myth. There is evidence that the USA system, where contractors prepare their own quick quantities, is in fact more efficient and cheaper overall than the traditional full BoQ's system used in the United Kingdom.

- (iii) *A BoQ provides a commonality in tenders thus providing the opportunity for realistic tender evaluation.*

It is true that the items and quantities on which contractors base their tenders are the same. However, the legitimate 'games' that contractors can play, intended to improve their ultimate return and cash flow, complicates tender evaluation on a pure comparison of rates basis. These games include non-uniform allocation of overheads across bill items, 'rate spotting' of items that are likely to increase or decrease in quantity, 'front-end loading' of rates and spotting the ambiguity or inconsistency between and within the various contract documents. Because the BoQs is an additional document to the drawings and specifications, there is an increased likelihood of ambiguities and inconsistencies. Because the Client or his consultant prepares them, legally the risk of ambiguities or inconsistencies is more likely to fall on the client (the legal *contra preferentum* rule).

It is more true to say that a BoQ provides a convenient way of evaluating tenders.

- (iv) *The unique coding system identified in many Methods of Measurement against each item in a BoQ enables contractors to utilise computers efficiently for estimating.*

Again, whilst essentially true, the cost factors contributing to apparently similar work in different locations may make the use of standardised codes of dubious value. This is even more true in civil engineering where costs are much more method, as opposed to quantity, related. For instance, one foundation excavation may be in firm ground enabling steep sided excavation, whilst another is in softer ground requiring sheet pile support, whilst another requires pumps to remove water. Despite widely varying costs per unit quantity, the item coverage of a rate may well cover all three operations..

(v) *The BoQ can be used as a basis for monthly interim valuations.*

This is true, and the monthly valuation's main purpose is to maintain a regular and steady cash flow to the contractor. However, it is arguable if the time and effort spent in determining how much of every item has been performed each month is worthwhile, as it does not actually add any value to the construction process.

This author worked as an engineer for a Contractor on a confrontational site in the early 90's. At the end of each month, the engineers on both sides of the contractual fence were distracted from their engineering duties for a week by the need to measure things, which included quite detailed surveys of earth moved etc. Each sides' engineers, having done a survey, would submit the figures to their quantity surveyors, who would then collate them in their own intermediate BoQs, before disagreeing. Consequently, the engineers would quite often go out and do a joint survey. The process would then be repeated the following month. How were we 'adding value' to the construction process?

(vi) *BoQ can assist the parties in the control and financial management of the works*

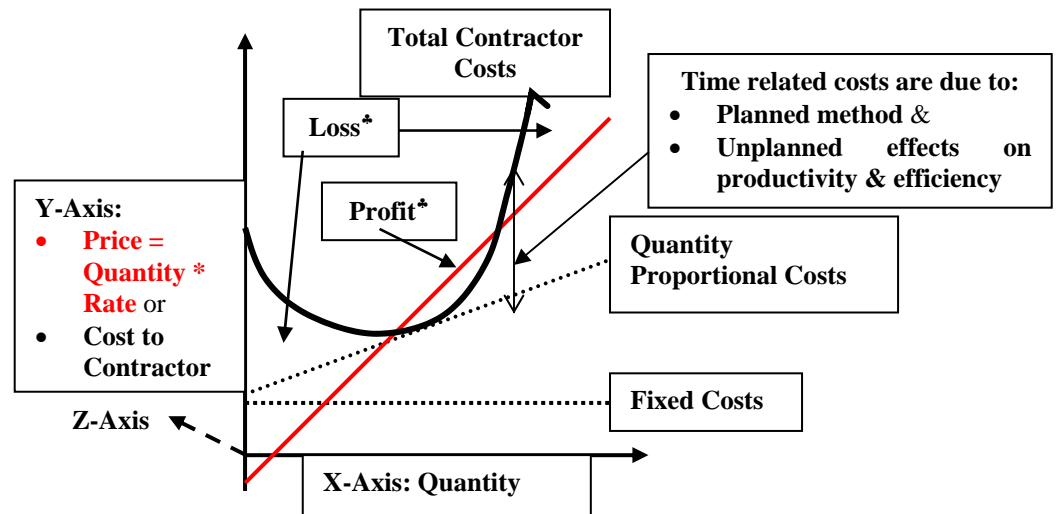
The extent to which this is true depends on several factors. These include how closely the BoQ is based upon the costs of undertaking the item of work. As outlined below, often the Contractor will have evaluated his true cost of undertaking the work, and will then have back calculated the unit rate to insert in the BoQ. Another factor is the accuracy of the quantities stated in the BoQ. Additionally, if the cost and resulting impact on the price paid by the Client for variations and change are not evaluated until after the changed work has been completed or until the entire contract work has been completed, then the value for financial management is negligible. There are better systems.

(vii) *Rates contained in BoQs can be used as a basis for the valuation of variations.*

**This may appear to be true, but often the rates are inapplicable due to**

- changed circumstances: the work is of a different nature and / or character;
- it not representing the Contractor's cost base due to the 'contractual games' referred to in (iii);
- the item coverage of the rate applying across a number of construction activities, which have different productivities and costs bases as in the example given in (vi); and / or
- the rate does not or only partially covers the Contractor's indirect costs and assumes efficient planned working. This is illustrated below.

**Fig. 2E: Illustration of the Mismatch between how the Contractor is paid under Bills of Quantities and how the Contractor incurs Cost.**



\*The difference vertical between the thick black line and red line is the Contractor's profit or loss.

As illustrated by Figure 2E, straight Bills of Quantities, where the price paid is directly proportional to the quantity:

- ignores the fixed costs, and time related costs. Indeed, it could be argued that the above diagram should have a Z-Axis for the time-related costs. In a claim, these time related costs come under the heading of delay and disruption; and
- the Contractor has a comparatively small area in which to make any profit, which is largely affected by time related costs. With profit margins typically only 2 to 3% in the building and civil engineering industries, it is critical for the Contractor to achieve his planned efficiencies.

#### The real cost of changes

A survey in Canada <sup>4</sup>, which looked at over 1 billion Canadian dollars of construction at tender, found that the typical cost escalation on these projects averaged 33.5%. Of this:

- 11.4% was in the direct costs of doing the work, which would have been incurred if included in the contract at tender;
- 8.9% due to the extended duration of the contract;
- 1.7% due to the need to accelerate the work; and
- 11.5% due to loss of productivity / disruption

What is implied from this? That **when a change is instigated after a contract is let, it costs the Contractor and therefore the Client approximately *THREE* times as much as if the work was in the original contract documents!** This delay and disruption cost is not covered by assessing the change using BoQ rates. Hence much of the argument at the end of contracts.

What is implied from all of the above points about bill rates? That they, while providing some cash flow relief to a contractor for variations, are unlikely to accurately reflect how he incurs costs and therefore **bill rates will only accurately reimburse the Contractor his costs on the smallest of variations. The typical result is tension during the contract as the Contractor focuses his attention on building up a claim and the Client on defending it. This is not conducive to partnering!**

*When to use Bill of Quantities?* As a result of the flaws with straight BoQs, the author would suggest that they are only used on all but the simplest contracts and / or when the contracting party is not sophisticated enough to understand his cost base. For example, a to a build a simple brick wall, where the subcontractor

is a specialist is building walls. The subcontractor knows that if he charges a certain rate per square metre he wins work and makes a profit on it. He is not interested in how that profit is made up.

#### 4.10 Bill of Approximate Quantities

A Bill of Approximate Quantities is where approximate quantities where the Contractor is supplied with approximate quantities because the detailed design information is not available. They might also be used on the Preferred Contractor approach to Design and Build Contracts as the starting point for negotiation prior to signing the contract, but after further design development. This enables a Contractor to be appointed early, and gives the Client some knowledge of the likely out turn price. However, this has all the disadvantages of Bills of Quantities, and in particular the exclusion of method related costs, with the added complication that programming and therefore pricing is difficult for contractors. Consequently, there are likely to be discussions on the suitability of rates from the outset of the contract. This again is not conducive to partnering. In summary, they bring few advantages and additional problems!

#### 4.11 Method related Bills of Quantities

*What are they?* In a method-related bill, contractors are allowed to tender lump sums for one-off activities e.g. setting up site office, and time related activities e.g. weekly on-site costs of maintaining that site establishment. The idea is that the bill more closely resembles how the contractors' costs are built up and there is more transparency of this cost, so when changes in quantity occur or there is a claim, there is less dispute of what is a fair amount.

*Advantages and disadvantages:* Method-related BoQs try to overcome some of the deficiencies of straight bills (⇒ highlighted in section 2.4.1 (vii) of this session) by allowing the contractor to price separately for fixed and time related costs e.g. setting up site and a weekly on-site cost. The idea is that with greater transparency of the Contractor's costs in the pricing document, the agreement of additional costs is easier. This is also relevant to point (iv) in section 4.4.1. Additionally, if the Contractor is to complete the design of something, then both the design activity and construction activity can become a lump sum, thus overcoming the disadvantage highlighted in the previous section. However, note that:

- the use of method related bills does not address at all some of the other inherent problems of Bills of Quantities outlined above in (ii), (v) and (vi) of section 2.4.1;
- without detailed planning information, there will still be little insight into the effects on productivity and efficiency due to unplanned events, which are one component of a claim. It could also be argued that traditional conditions of contracts do not facilitate this. They therefore do not fully address the problem highlighted in (vii) of section 2.4.1;
- because it is the Contractor who specifies what the lump sum method related charges are, it further undermines the advantage stated in 2.4.1 (iii) for providing commonality in assessing tenders and allows greater opportunities for loading rates and method related charges; and
- method related BoQs therefore rely upon the Contractor being open and matching the estimated costs he will incur if he wins the contract to how he prices the method-related bill. If the Contractor has priced the contract below his costs, this could not be to his advantage.

Therefore, **method-related bills only partially overcome the disadvantages of straight Bills of Quantities.**

*When to use method-related Bill of Quantities? Wherever possible instead of straight Bills of Quantities provided the sophistication of the Contractor allows for it.* I.e. he understands his cost base so can price the method-related bill meaningfully. Generally, the author much prefers the activity schedule approach (⇒ see following section 2.4.7 of chapter). However, he would move towards recommending method-related bills for:

- building work, where costs can be much more proportional to quantity;
- for refurbishment and renovation work, where it is much easier to re-measure the quantity of work done compared with calculating the costs of the additional work; and
- where the Client or industry is changing over to a new form of contract and using the normal payment

method on the first contracts reduces the level of innovation and therefore risk.

The author acted as trainer and consultant for the Northern Ireland Road Service, when introducing the NEC family of contracts in the Province. On the initial lower value contracts, it was accepted that the Contractors - and Client's staff - would have enough on their plate gaining familiarity with the NEC Engineering and Construction Contract and its operation. To minimise the risk, Option B: priced contract with bills of quantities was chosen for the first contracts. An additional factor was that some schemes had already had a BoQ prepared for them.

However, in all three cases, it has to be accepted that, even **under method related BoQs, if the degree of change is high, at some point re-measuring will still break down as an accurate means of reimbursing the Contractor his costs.** This is because it does not take account of the loss of productivity / efficiency aspects due to disruption. **Consequently, they are only suitable where the likely changes in quantity means that changes in the Contractor's cost are approximately equal to the change in quantity multiplied by rate.** They are not suitable for where the type of work is not defined.

#### 4.12 Schedule of Rates

*What are they?* A schedule of rates is similar in concept to a bill of quantities in that tendering contractors puts a rate against each item. However, there are two main differences:

- while the work type may be defined for each item, the estimated quantity is not specified. They therefore tend to be used for term maintenance contracts, where an item is called off when needed, or for refurbishment and scheduled maintenance projects, where the quantity of work needed is uncertain until the existing facility is uncovered. Examples of the latter can range from renovating historic houses to shutdowns of boilers in power stations;
- a schedule of rates often includes input prices as well. These can be hourly rates of labourers, designers and / or construction plant. They therefore tend to be used for service related contracts and / or where the both the type and quantity of work is unknown. For instance, one government agency has a term services contract for preparation and supervision of major construction schemes, where hourly rates for different categories of designers and supervisory staff have been tendered.

Sometimes contracts include a section for hourly rates of labour which is known as dayworks.

*Advantages and disadvantages:* Many if not all the criticisms applied to straight Bill of Quantities also apply to the use of schedule of rates. Indeed, because the Contractor may not even be given indicative quantities of work that he is to carry out, they could apply even more so. A method-related schedule of rates, where setting up and time related costs are paid separately, will transfer much of the risk, both positive and negative, from the contractor to the Client for variations in the expected quantities of work ordered.

However, much of a contractor's costs will be related to having a smooth workload in order to keep his resources fully employed (and no more and no less) and, under an output based schedule, to the efficiency with which he can do the operations. It should be noted that, **under a Schedule of Rates there is no direct motivation for Client to help the contractor balance his resources:** the Client just pays the tendered rate. To counter the efficiency point, often the rate the Contractor is paid is banded depending on the quantity called off at the same time and / or location. The greater the quantity called off, the greater the efficiency so the less the rate (This is sometimes referred to as a **Schedule of Prices**). However, by calling off a large quantity at any one time, the rate for a particular item may enter a different band which is cheaper to the Client, but more expensive to the Contractor has to bring in more expensive and / or less efficient workers and construction plant.

*When to use Schedule of Rates?* As previously stated, price-based Schedule of Rates tend to be used for standard maintenance, where an item is called off when needed, or for refurbishment and scheduled maintenance projects, where the quantity of work needed is uncertain until the existing facility is uncovered. For input based rates, it is where the quantity and type of work is uncertain.

In terms of partnering, the flaw is that for items covered by the schedule of *output* rates e.g. cleaning out a drainage gully, the Client is not interested in the Contractor's cost as he pays the tendered rate regardless. However, where the work is not covered by an output rate, the Contractor will be paid by *input* rate e.g.

price per unit man-hour. The Contractor therefore has little interest in decreasing the number of hours worked per resource. If the input rates are good for the contractor and the output rates are poor, the Contractor will be constantly claiming that the work he is being asked to do is not covered by an output rate. This has been observed in practice by the author on a number of occasions. This argument is not conducive to partnering.

#### 4.13 Lump Sum contracts

*What are they?* Lump sum contracts are where the Contractor tenders a lump sum for the whole of the works or, much more commonly, breaks the contract down into a series of operations for which he gives a series of lump sums. These lump sums are derived from a bill of quantities type document called the 'Pricing Document', which is usually given to the Client for use in evaluating variations and claims. The Pricing Document is sometimes prepared by the Client and, in its preamble, states that quantities are indicative only and that the Contractor must satisfy himself of their accuracy and that no claim will be entertained for any inaccuracy. Despite these disclaimers, there is still a danger of misrepresentation, so the onus for preparing the Pricing Document is put on the Contractor. The Contractor is not, however, paid for a completed operation which ties in with the lump sum tendered, but is paid at each assessment date according to the percentage of work completed on the corresponding operation.

*Advantages and disadvantages:* Lump sum contracts have **advantages** over quantity related payment mechanisms, in that

- i. they can accommodate method-related charges for both fixed and time related costs, as well as non-measurable activities and finished construction operations. They are therefore more suitable for contracts where there is a large element of contractor design;
- ii. if it is the contractor who prepares the BoQ and takes off the quantities, then the Contractor is legally responsible any errors in them, so price certainty for the Client is higher;
- iii. if the Contractor has priced up a BoQ, then the evaluation of simple variations and claims is, on the face of it, much easier compared with milestone payments or activity schedules (see below), as they can be valued using the BoQ.

In terms of **disadvantages**:

- i. while agreement over payment is easier compared with BoQs, arguments still happen over what percentage is complete. For instance, whether the Contractor should be paid for work with Defects in it.
- ii. while there may be a BoQ in place to evaluate the direct costs of changes and variations, the advantage of this method breaks down for all but the simplest changes as they fail to take account of the method and / or time-related costs of a variation or claim i.e. delay and disruption (⇒ see section 4.4.1 of this chapter for further discussion on this point).
- iii. evaluation of claims and variations for delay and disruption is hard for two reasons:
  - because the Contractor is paid according to the percent of the operation completed, the 'lump sum' operation tends to be a fairly broadly described, so when trying to agree the cost of the change there is little detailed pricing information to go on. This is not helped by .....
  - traditional conditions of contract which use lump sums not requiring detailed programmes.
 There is therefore comparatively little transparency of costs when delay and disruption occurs.

*When to use lump sum contracts:* The principal advantages of lump sums is that it is the Contractor who draws up the series of operations which are then priced as lump sums. This means that, providing the contract allows for it, the specification can also be expressed as

- a performance specification in the heavy engineering and process industries;
- a functional specification in the building and civil engineering industries;
- detailed and complete designs of what the contractor is to build; or

- as a combination of the above ♣.

**This lends themselves to technically quite complex projects, but only where the interfaces of responsibilities and expertise require little transaction.** I.e. where clients can clearly define what they want and there is little need to work together. This suggests that for partnering purposes, Client involvement is limited to being helpful to the Contractor rather than changing his requirements or developing how these are put into effect during the contract. As with all priced contracts, the Client does not see any direct monetary benefit from savings made by the Contractor, unless there are clauses sharing savings written into the contract.

#### 4.14 Milestone payments.

*What are they?* Milestones are where the works have to achieve specified states along the road to completion of the project in order to be paid. It is normally the Client who specifies the milestones that the Contractor has to achieve. In extreme circumstances, the milestone is completion.

*Advantages and disadvantages:* Three **advantages** spring from the use of milestones compared with lump sums:

- i. because the Client specifies them, there are usually relatively few, so the financial administration of the contract is fairly simple. Little administration is therefore needed;
- ii. once a programme is in place, the cash flow requirements become visible; and
- iii. once into the contract, the Contractor is motivated to work to achieve the milestones to gain payment.

However, there are **disadvantages**, most of which spring from the Client specifying them, because **the value of each milestone tends to be a high proportion of the total contract size and payment milestones may have very little to do with the construction activities.** The consequences are:

- i. there is even less cost transparency than the lump sum approach, which means that when a variation or claim event occurs, it becomes very hard to evaluate the effects. They are therefore unsuitable when a high or even reasonable degree of change is expected e.g. where the Client may want to add in additional work;
- ii. the payment milestones may describe a temporary state of completion that does not match what the Contractor would or sometimes can achieve on the way to completion of the whole of the works. Consequently, the Contractor modifies his construction method to gain cash flow at the expense of the least cost;
- iii. the Contractor is having to finance the works much more. Typically, contractors are less financially strong than clients, so the cost of a loan or overdraft is higher to the Contractor. This cost is passed onto the Client; and
- iv. if there is an ambiguity in the description of the milestone, on the balance of probability, it will be interpreted in the light most favourable to the Contractor as the Client proposed it (the legal *contra preferentem* rule).

Because of these disadvantages, it tends to lend itself to a “hands-off” approach by the Client. There is therefore an inconsistency between the commercial motivations and a partnering approach.

*When to use Milestone Payments:* Milestones lend themselves to projects which are well defined by the Client. Note, this does not necessarily mean fully designed, rather that the Client has defined the scope of the contract so that the completed asset will perform the function required, perhaps leaving the design to the Contractor. Because the Client is defining the milestones, it suggests that the project will either be:

- simple in nature, so that there can only be one construction sequence for the Client defined milestone payments to relate to; or
- the Client anticipates little if any change to his requirements once the contract is let as these become

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♣ However, the only form of contract, which allows this full flexibility, to the author’s knowledge, is the NEC Engineering and Construction Contract.

extremely hard to evaluate.

This of course presumes that the Client is prepared to live with the disadvantages and does not want to adopt a partnering approach once the contract is let.

#### 4.15 Activity Schedules

*What are they?* The term ‘activity schedule’ was introduced by the Institution of Civil Engineers in their NEC family of contracts (⇒ see Session 4 Notes). Activity schedules are similar in concept to a series of lump sums in that the contractor breaks down the construction operations into activities for payment purposes. The differences are these:

- the Contractor is not expected to produce a bill of quantities which is then given to the Client to evaluate variations and claims. In reality though, the Contractor will take off the principal quantities and divide the quantities up into construction operations, which are perhaps merged with other items to form an activity for payment purposes. These activities are then shown in an activity schedule, a simplified one of which is shown below.

**Figure 2F: A simplified example of an activity schedule.**

Activity No.	Activity Description	Price
001	Set Up Site Offices	£2000-00p
002	Dig out foundation	£2500-00p
003	Pour foundation	£3500-00p
.	.	.
.	.	.
00n	De-mobilise and remove everything from site	£1000-00p
	<b>4.16 The total of the Prices =</b>	<b>£25,000-00p</b>

Some clients specify that an extra column is added on the right, which states the expected monthly out goings. In this sense, **the activity schedule is as much a cash flow document as a pricing document.**

- these activities have to be completed without Defects which delay or are covered by following work for the Contractor in order to be paid;
- in the NEC Engineering and Construction Contract, these activities have to be shown in the programme, which also has to show methods and resources for each operation;
- claims and variations – or compensation events in NEC terminology – are assessed by costing up the changed methods and resources due to the compensation event plus a fee percentage which is applied to the change in costs. This fee percentage is for offsite overheads and profit.

*Advantages and disadvantages:* Because the activities and other information is shown in the programme, with method statements and resources attached, there is much greater transparency of how the Contractor’s costs are built up. Because of this and of the way in which additional costs are calculated, the calculation of the change in the Prices is more rigorous, less subjective and takes account of time related costs. **Other advantages** are:

- any significant level of contractor design is easily accommodated, because design does not have to be complete for the Contractor to price an activity: the detail can be left to the Contractor or Subcontractors. Any substantial design becomes an activity in itself. Like lump sum contracts, they therefore accommodate performance and functional specifications;
- because the Contractor takes off quantities, the Client is not leaving himself open to ambiguities and inconsistencies both within the Bill of Quantities and with other documents;
- because, unlike lump sums, the Contractor is not paid for an incomplete activity, contractors tend to plan the job more thoroughly before they prepare their activity schedule, which links into their cash flow. They therefore tend to have greater confidence in their tendered total of the Prices;

- iv. cash flow requirements for both parties are more visible;
- v. in order to receive payment as planned, the Contractor has to complete an activity by the assessment date, which is normally every four weeks or monthly. Consequently, he is motivated not only to programme realistically, but also to keep to that programme during construction;
- vi. the assessment of the amount due to the Contractor and monitoring become one and the same action. Payment and programming become more integrated generally;
- vii. the risk of quantity change is transferred to the Contractor, unless an instruction changing the original specification is issued. However, certainly in projects where the quantity of work is uncertain, clients will pay a premium for this privilege.
- viii. assessment of the amounts due to the Contractor with an activity schedule is easier and involves many less person hours than with a Bill of Quantities: typically a half to quarter hour walk round site once a month. This saves labour costs, because there is not the need to repeatedly re-measure;
- ix. because the Contractor has to complete the activity to be paid, an operation is broken down into smaller activities. This, together with the NEC Engineering and Construction Contracts programming clauses, gives much greater information and less subjectivity when evaluating claims and variations (or compensation events in NEC terminology).

They therefore overcome many of the disadvantages that milestone payments and lump sums have.

However, there are some **disadvantages** compared with both straight and method-related bills of quantities:

- i. taking off a Bill of Quantities can be a very good check on the quality of the specifications and drawings and, having identified the deficiencies, allows you to do something about them. Not doing so exposes a Client to the possibility of claims / compensation events for small 'niggly' things;
- ii. not supplying any quantities does give tendering contractors more work compared with clients supplying quantities. This increases the man-hours needed to prepare a tender. Consequently, clients may wish to put potential work out to fewer tenderers, in order not to push up the overheads of the industry, which they ultimately pay for;
- iii. bill rates do not exist and therefore cannot be used for simple changes where there are no time related costs. While the author questions how often this is the case, it can mean that the time needed to evaluate minor claims / compensation events is out of all proportion to their value. If there are a large number of small changes, then this disadvantage can outweigh the advantage of not having to constantly re-measure the quantity of work done resulting in increased man-hours for contract administration;
- iv. some contractors have tended to over break down the activity schedule into too many activities, in the Client's opinion, in order to ensure cash flow during the contract. This not only means very long, complicated and unwieldy programmes, it also means that considerable time has to be spent agreeing which activities are complete for payment purposes which tends to lead to reverting to the Bill of Quantities approach of measuring everything. Consequently, some clients have started limiting the number of activities in the activity schedule or specifying a minimum duration or price per activity to avoid long and complex programmes.

*When to use activity schedules:* As a result of the flexibility of activity schedules – and of the NEC Engineering and Construction Contract with which they are used – they can be used from simple projects to complex projects and with full client design or contractor design or anywhere in between.

As with milestone and lump sum contracts, providing the Client does not issue a variation (or change the Works Information in NEC terminology), the risk of changed quantities lies with the Contractor. Consequently, the Client will pay a premium for this risk transfer if quantities are uncertain, and so may be better advised to use method-related Bills of Quantities or a schedule of rates for this type of project.

#### **An Amalgamated Approach for Highways Maintenance.**

This author was asked in 1998, with a team from W S Atkins Transportation Engineering Ltd, to write a contract based on the NEC Engineering and Construction Contract (ECC) for term maintenance of the motorways and trunk roads around Bristol for the Highways Agency. In its unamended form, the contract is

mainly used for new build and/or refurbishment contracts. Option A: priced contract with activity schedules was used as the base option. Activity schedules were used to cover two types of work:

- method-related activities, where the Contractor had to carry out certain operations at certain times of the year according to a prescribed method e.g. cleaning gullies out by the Highways Agency standard method at the start of winter; and
- performance based activities, where the Contractor had to maintain a level of measurable performance throughout the year e.g. visibility of signs from a certain distance, length of grass within a certain distance of the motorway.

For each of these activities, the site was divided into sixteen sub-areas for payment purposes. The idea was to transfer to the Contractor responsibility for things which had to be done, so the amount of work was known and the Contractor could therefore estimate the cost. By being in control of these things, he could plan the use of his resources more efficiently.

For the method related activities, the Contractor is not be paid until an inspection has confirmed that the work is done satisfactorily. For the performance based activities, if the level of performance was not maintained within the sub-area for that month, the Contractors was not paid for the maintenance operations within that priced activity.

Additionally, an additional compensation event was inserted whereby the Client via their consultant, W S Atkins, could call off items from a tendered schedule of rates. This could be used for minor improvement and refurbishment works, as well as emergency works ranging from traffic management if an accident occurred on the network to re-cleaning a gully out which had become blocked before its scheduled clean. Lastly, operations not covered by the activities or schedule of rates were assessed using the normal procedure for assessing compensation events under the ECC.

The contract also had more extensive programming requirements written in and has since been adapted by the author for other term maintenance and service contracts e.g. maintaining reception and security services.

#### 4.17 Section Conclusion.

This section has discussed different price-based payment mechanisms: what they are, their advantages and disadvantages, and when to use them. If using a priced based contract, where there is a *tolerable* level of uncertainty over quantities, the author would tend towards a method-related bills or method related schedule of rates depending on the circumstances. By tolerable, the author means the payment mechanism does not break down as a means of accurately reimbursing the contractor his costs. For other contracts, the author would tend towards activity schedules. The note of caution stated in the introduction is worth repeating: what has been discussed are general definitions etc. which will vary depending on the precise wording of the contract.

However, **with all price-based contracts, there are two principal disadvantages from a partnering viewpoint:**

- to varying degrees, the Client is always second guessing how the Contractor's prices are built up as he does not have direct access to the cost build up. Consequently, when variations, claims or compensation events occur, disagreement over the additional costs are likely to occur to varying degrees. This is the biggest cause of dispute in the building industry, so if this can 'cracked' a major pressure against partnering is nullified and price-based contracts to varying degrees do not help in this respect;
- from a client's point of view, once the contract is signed there are only indirect incentives to minimise construction costs, or the unit costs under the schedule of rates. Motivations are therefore not directly aligned.

The focus from the Client's viewpoint under price-based contracts tends therefore to be on restricting

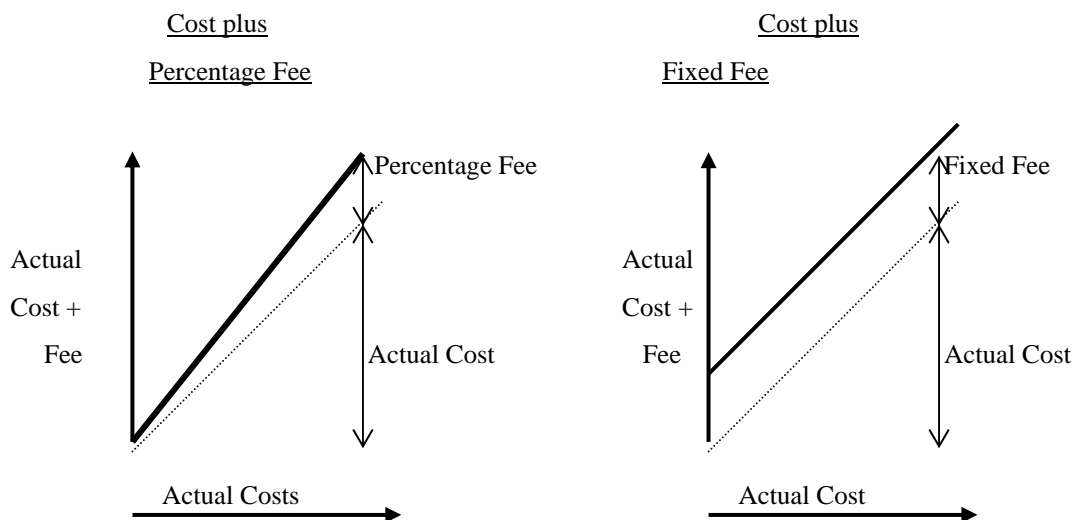
increases in the *prices*, rather than helping to reduce the Contractor's *costs*. The Contractor's focus tends to be on increasing the prices to cover his *costs*, plus desired contribution to head office overheads and profit. Therefore, a generalised conclusion is that **the fundamental flaw of Price-based payment mechanisms with respect to partnering is that they do not create alignment of financial objectives.**

## 5. Cost based contracts

### 5.18 Cost reimbursable contracts

*What are they?* A cost reimbursable contract is where the Contractor is reimbursed defined costs, plus a fee for all other costs that are not directly reimbursable e.g. profit and head office overheads. This fee can take the form of fixed fee or percentage fee as illustrated below in Figure 2G.

**Figure 2G: Diagrams illustrating the difference between Cost plus percentage Fee and Cost plus Fixed Fee Approaches.**



*Advantages & Disadvantages:* Under a pure cost reimbursable contract, the Contractor is reimbursed his costs incurred on that project plus a fee. There are two principal **disadvantages** of cost reimbursable contracts:

- i. there is no direct motivation on the Contractor to direct his attention towards reducing cost incurred. Indeed, under a percentage fee it can be argued that there is a direct motivation to do the opposite. Some surveys in the defence and petro-chemical industries put this lack of motivation as costing the client up to 10% extra when compared with price based contracts<sup>6,7,8</sup>. However, these comparisons are unfair for two reasons: firstly, why was a cost reimbursable contract used in the first place and the answer is probably because the work was time driven, ill defined and /or subject to high risk. Secondly, these comparisons ignored post contract commercial costs, which are likely to be have been significantly higher if price based contracts were used in those circumstances; and
- ii. the Contractor's accounts have to be auditable and transparent, so a system and people need to be in place to audit the accounts on an on-going basis, so that the Contractor is reimbursed his costs incurred as the contract progresses;

However, from the first two of these potential disadvantages spring two **advantages**, if properly used in the right circumstances, namely:

- i. it is suitable for use when least cost is not a priority to the Client e.g. time and / or quality are; and
- ii. many benefits can spring from having cost transparency.

Taking the second advantage, more specifically, the **benefits of open book accounting** between the Client and Contractor, can include:

- (a) Risk contingencies, to varying degrees, can be separated from the basic costs of construction and engineering and become more visible to the client. An immediate benefit of this is that clients realise how much they are paying contractors to take on risk. When this is spread down the supply chain, clients often realise they are paying a premium on a premium i.e. a contractor's risk premium on subcontractors' prices, which also include a premium. All parties are therefore more likely to take a more collaborative approach to risk management and more informed approach to risk allocation.
- (b) A contractor, subcontractor or supplier is generally more aware of market rates than clients or their consultants and is also more aware of the programming implications of different design approaches, which in turn impact on cost. Therefore, with earlier involvement of these organisations, it becomes possible to design to a client's budget as opposed to pricing what has been designed.

In a value engineering context, 'value' equals functionality over whole life costs, and whole life costs equal capital costs plus operating costs. If a contractor is hiding his true costs to protect or maximise his contractual position, as he often is under a price based contract, the effectiveness of value engineering in reducing costs will be undermined. Under a cost reimbursable approach, a contractor has to show his costs to be reimbursed, so there is a big incentive to reveal them!

- (c) Various approaches can be taken in estimating out turn costs depending on the state of project definition, known risks, existing relationship between the parties and proposed incentive mechanism. For instance:

- applying a cost per unit output based on historical data for a similar size and type of project. The unit could be, for example, per square foot of rentable space for an office building or per cubic metre/second of sewage through a treatment plant;
- applying a multiplication factor – based on historical data - to the cost of principal components. For instance, to the tendered costs of generators, turbines and other principal mechanical and electrical components for a power station;
- elemental costing, where the scheme is progressively broken down into smaller elements which can be progressively costed more accurately;
- bill of approximate quantities;
- open book tendering, where the contractor reveals all his assumptions, assumed productivities and subcontractor and supplier quotations;
- negotiated ; or
- competitive bidding.

Under a pure cost reimbursable contract, it is important to note, if not somewhat obvious, that whatever estimating method is used, the Client pays the Contractor's costs plus fee i.e. the estimate has no contractual significance. Therefore, the last two estimating methods are inappropriate where there is no incentive mechanism. The other approaches lend themselves to a two stage selection process where the Contractor is initially selected on a combination of his fee level and various criteria designed to test his potential to 'add value' to the project process and end asset.

- (d) Many good contractors now have the software and expertise to track, on an activity by activity basis, forecast cost and progress against actual cost incurred and progress i.e. earned value analysis to an individual operation or subcontract package level. The reconciliation of forecast against planned cost and progress is often done on a weekly basis. The advantage of this is that as soon as a deviation is detected, then the cause can be investigated and steps instigated to bring them back in line with each other. The deviation could be caused by an identified risk in which case previously developed risk mitigation strategies can be put in place.

The advantage of using a cost based payment mechanism is that the Client also has access to this, so if risks do or do not occur or if greater than expected value engineering opportunities arise, then the project can be adjusted or re-structured to come in on budget.

One Housing Association was having seven sets of flats refurbished under a target cost arrangement. Early on, value engineering identified savings which could be made and the residents were asked what
--

they would like done with this money. The response was a community centre, which was then designed and built to this budget.

Compare this approach to the traditional approach, where, while the Client might be aware of potential claims coming in, until it is submitted they often have little idea of the contractual reasoning and quantum of the claim and it maybe several years before this is agreed and paid. The author asks the reader: **“How can a project manager effectively project manage when there is no transparency of cost?”**

- (e) The advantages of the different methods of pricing the work, the transparency of open book payment and the more up to date monitoring of costs is a much more pro-active and co-operative approach to cost management. Compare this with the more reactive, confrontational “contain the contractor’s claim / maximise the claim” flavour under price based contracts.
- (f) If there is mechanism to motivate the contractor, e.g. a target, then any adjustment to it is relatively easy to make compared with a price-based contract. This is because the Client and / or his advisors understand the Contractor’s initial cost plan much better and so know what is and is not included and therefore what is extra. This adjustment can be done either before the work is done on an agreed estimate or costed up after the work is done using records. If it is done before the work is done, and the Contractor consistently exaggerates the upward adjustment to the target, he is much more likely to be found out.
- (g) Lastly, cost or input based payment mechanisms tend to be more appropriate for the use of intermediate performance incentives and process incentives.

These advantages are summarised in a table below. Taken together, **not only does using a cost-based payment mechanism lend itself to be used in a partnering environment, but can significantly reinforce the partnering culture and ways of working, leading to dramatically improved project results.**

**Figure 2H. Table summarising Advantages of Cost Based vs. Price Based Payment Mechanisms.**

Attribute	Open Book / Cost Based Payment Mechanisms	Traditional Price Based Payment Mechanisms
Cost visibility	Transparent	Little transparency to Client
Risk	Separate from Cost	Hidden
Design	Design to Cost	Cost the Design
Pricing Structure	Various Approaches	Predominantly Competitive
Monitoring / Forecasting	More up to date.	Wait for ‘claim’
Management Approach	Pro-active cost reduction	Re-active cost containment
Agreeing adjustment to target / contract price	6. High transparency = relatively easy	Little transparency = relatively difficult
Incentives	7. As appropriate	No real consideration

Developed from Reference 9

However, **all these advantages are lost if there is a poor financial forecasting and monitoring system and if there is not the expertise to administer it.** Indeed, in these circumstances, using cost based contracts can be a positive disadvantage as, not only will *all* the advantages be lost, but **the administration of the contract will also become an expensive and bureaucratic quagmire.** So a **Key Implementation Point under cost based contracts is for the Client to select consultants and Contractors with these systems and expertise, otherwise there is little point in proceeding down this route.** Characteristics of this system are discussed later in this chapter in section 7.6.4. of this chapter.

**Some quotes from other research:**

Schneider <sup>6</sup>, a Swiss lawyer in his draft PhD stated, that: “*The flexibility and frankness in communication which can result from cost reimbursement contracts is likely to have made a major contribution to the success of these projects*”.

Ibbs and Ashley <sup>10</sup>, from America, were of the opinion that: “*Cost reimbursable contracts substantially reduce the adversarial relationship between the owner and contractor compared to fixed price contracts*”.

The Construction Industry Institute Partnering Task Force <sup>11</sup> of the USA found that “*many (participants) feel that projects done on a cost reimbursable basis allow parties to establish a much better working relationship at the beginning of the partnering arrangement*”.

*When to Use a Cost Reimbursable Contract?* Cost reimbursable contracts were traditionally (and still are) suitable for use in four generic situations:

- when the time or performance / quality objectives outweigh the cost objective. Time driven projects could include emergency or commercial projects where the benefits of early start and completion outweigh the lack of direct incentive and / or working in a less planned and therefore efficient manner. Quality driven projects could include prestige projects – where there might also be a time deadline - or nuclear projects where the cost of getting it wrong far outweighs the cost of getting it right.
- in projects subject to greater than usual uncertainty where the scope or sequence of work is unknown. This can be subdivided into more specific circumstances:
  - the *initial* state of the site is unknown, so whilst the desired end state is known, the scope of the works is not defined e.g. unknown or highly polluted ground conditions;
  - the *end* state of the works is unknown, so once again, the scope of the works is not defined e.g. perhaps in combination with a time driven project;
  - the *process* of delivery is subject to risk and uncertainty e.g. due to interfaces with other contracts or work.

In all three cases, it means that the amount and / or sequence of work to be done is unknown and the Contractor is unable to price the works with any degree of accuracy.

- in buoyant market conditions or where supply is limited. In this case, the Contractor might charge a high premium to take risk which may not eventuate and the Client does not wish to pay this high premium;
- there is an existing relationship of trust. For instance, the Contractor has worked successfully with the Client before over a number of projects and wants to again. Because of the unique circumstances of the project – one of the reasons above – the trusted Contractor is the one selected.

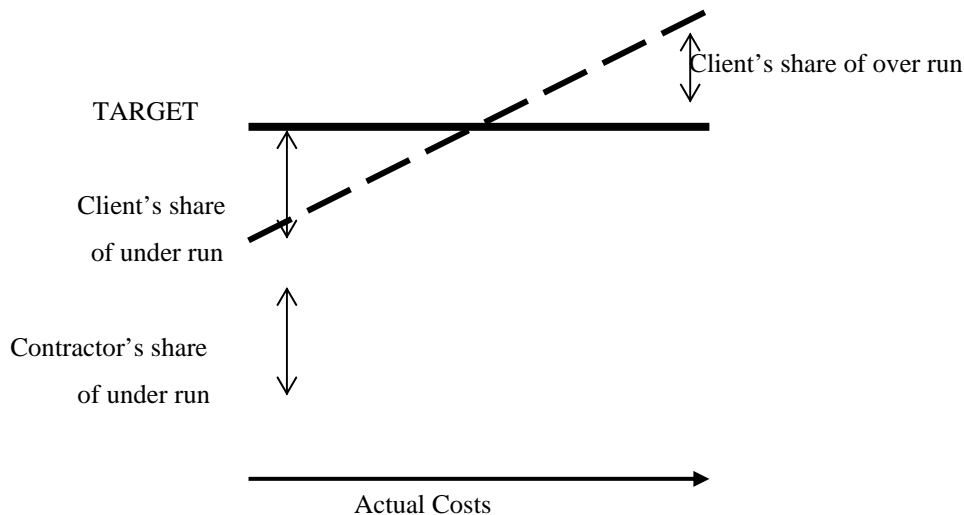
**7.19 Target Cost Contracts ♦.**

*What are they?* Target Contracts are a development of cost reimbursable contracts. The development is that a Target is agreed and any over run or under run compared with this Target is split in a pre-agreed ratio. This is illustrated below:

**Figure 2I: Diagram showing Pain / Gain under a Target Cost Contract.**



♦ From this point on notes are a very much a condensed version of those in ‘Procurement Routes for Partnering: Alliances, target cost contracts and the intelligent use of incentives’ as each has its own chapter.



To find the Total Paid by Client go up from the horizontal Actual Cost axis to the intermittent line and then across to the vertical axis. This intermittent line need not be a 50: 50 share or linear – it can vary depending on the level of risk and opportunity within the Target which can be managed by the Contractor, the Client's financial strength and risk aversion etc.

*Advantages and Disadvantages:* Target cost contracts have all the advantages of cost reimbursable contracts and:

- there is commercial motivation to co-operate or partner, providing each party has been allocated a big enough share of any over or under run in any given financial situation.

Likewise, the same disadvantages exist as for a cost reimbursable contract, with the major exception of the Contractor now being directly financially motivated to perform. Two other principal disadvantages exist compared with cost reimbursable contracts:

- the scope and quality of the works have to be sufficiently defined and the risks within the target sufficiently understood for the Contractor to price the works. However, by comparison with price based contracts, the level of uncertainty accommodated is much increased.
- The Target still needs adjustment for any changes in much the same way that the Contract Price is adjusted under price based contracts. However, as the basis for payment is the what the Contractor has spent, the Contractor has to have 'open book' accounting otherwise he will not be paid. Consequently, **providing a good financial management system is in place**, for auditing, monitoring and forecasting, **the adjustment is much easier than price based contracts due to the increased transparency.**

*When to Use Target Cost Contracts:* Target cost contracts were traditionally used in less extreme circumstances to that of pure cost reimbursable contracts i.e. where the scope and risks within the contract, whilst not as defined as a price based contract, were sufficiently certain for the Contractor to price. The twin advantages of greater financial transparency spreading to other areas of administration and interaction and the joint incentive to co-operate for each others advantage has now led them to be the most common contractual framework which underpins a partnering relationship. However, this presupposes that the both parties – and the Client in particular - has the technical and cultural capability, as well as desire, to partner. If not, and the Client can express their needs fully, then they may well be better off letting their projects under a price based.

## 7.20 Project Alliances

*What are they?* A project alliance is a combination of the construction management approach and target cost contract approach in that:

- they are used in multi-contract projects, where the individual design, construction and management contracts are direct with the Client, but ....
- a multi-party contract binds the fortunes of the principal players to the success of the overall project rather than the success of their individual contracts, perhaps to the expense of the project. This performance target is usually based around the total project expense, including client's expenses, with savings and any over run shared in pre-determined proportions.

Usually, but not always the individual contracts are let as cost based contracts with an individual performance target e.g. a target cost contract for the construction contracts and a schedule of rates for professionals with a time target in terms of number of hours. However, sometimes they are pure cost reimbursable or input based e.g. where this would normally be the case or price based e.g. for a major supplier whose costs are all factory based, but whose flexibility and performance is essential to the successful performance of the overall project.

An additional feature is the use of a steering group drawn from senior personnel of the principal participants. This steering group, whilst led by the Client, decides by consensus on strategic direction, on any investments in research and development and is the ultimate arbiter of any disputes which have not been settled at a lower level.

Often before the detailed design and construction is signed, the parties will have worked together to develop the scope and outline design of the project. This is both to agree the individual and alliance targets and as the 'engagement' before the 'marriage'

*Advantages and disadvantages:* the principal advantage is that they do tie the fortunes of the principal participants to the success of the project, rather than their individual contracts. This means there is an incentive to co-operate and work together (cultural change), integrate processes and teams and allocate work to the party best suited to do it. This increases efficiency and effectiveness.

The principal disadvantage is the cost of setting up an alliance, both:

- at the pre-contract stage in terms of selecting the right cultural fit, gaining top-level commitment and agreeing shares of any savings etc. , and
- once the contract is signed in terms of breaking down cultural barriers and creating the integrated process for the whole team to function.

*When to use them:* Project alliances are suitable for large complex projects where the management based contracts would normally be used and there is sufficient opportunity for the parties to work together. The project has to be sufficiently 'large' to justify the investment needed to set up a project alliance properly. The 'sufficient opportunity' is firstly in the scope and nature of the project, where either risks can be jointly risk managed out and / or opportunities are value engineered together. If the scope of the project is too well defined and all major risks eliminated, then why not just use price based approach.

## 7.21 Strategic alliances

*What are they?* A strategic alliance is where the Client selects a contractor or contractors to work on a series of similar projects over a period of time. However, at the start of the alliance period, these projects cannot be defined. As the alliance period progresses, the scope of each project is jointly defined, costed up and often let as an individual target cost contracts. For complex projects, where the Client has a number of strategic partners, it may be let as project alliance. The lessons learnt from one contract are often included in the next contract.

A client usually has up to three alliance partners for the same type of work and manages competition so that the best performer gains a greater share of the workload while a lesser performer gains less. There is always a proviso in the agreements to either terminate or just not award any more work to a poorly performing contractor or consultant. Like project alliances, there are often steering groups to make strategic decisions and investments, which may not pay off on a single project, but would over a series of projects.

*Advantages and disadvantages:* the main advantage of strategic alliances is that lessons learnt from one project can be incorporated into subsequent projects. Thus each successive project should be quicker, cheaper and / or better.

The disadvantage is, as with project alliances, the high investment needed to start them up and maintain them successfully. The anticipated scale of work has to justify this. In addition, the transparency of the

pricing mechanisms, the way in which they are administered, the measures of success and the way in which participants are rewarded all have to be robust enough to maintain the motivation to continuously improve throughout the alliance duration. Complacency can creep in.

*When to use them?* When there is an anticipated workload of future projects of a similar type which make it worthwhile to invest in setting up and administering a strategic alliance. As with project alliances, there has to be sufficient scope for the parties to make savings i.e. they cannot be too constrained by existing ways of doing things.

## 8. Session Conclusion

All the different procurement routes have their advantages and disadvantages and consequently are appropriate in different circumstances: it is therefore a question of selecting the most appropriate procurement route to fit the circumstances of the project. None will be perfect, but once the main procurement route is selected, it can be made an even better by fine tuning the risk allocation and reward structure.

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**Profile of Dr Jon Broome**

Dr Jon Broome BEng PhD MAPM graduated as a civil engineer in 1990 and is an ex-contractor, turned academic turned independent consultant. As an academic, he gained his doctorate from the University of Birmingham in early 1998 from applied research into the use of the New Engineering Contract (NEC) and has had numerous papers and articles published on the topic, as well as a book 'The NEC Engineering and Construction Contract: A User's Guide'. His contributions to the second edition, the Engineering and Construction Contract, and the Short Contract are acknowledged in the contract documents. He continued part time in academia for two years as an industrially funded Research Fellow and this, together with his consultancy experience, has resulted in his second book 'Procurement Routes for Partnering: alliances, target cost contracts and the intelligent use of incentives', due to be published in late 2002.

He started his own consultancy, *JB Project Consulting Ltd*, which initially specialised in training and consultancy services in procurement strategy and in implementing the NEC Engineering and Construction Contract. While he has advised on the occasional dispute he much prefers to be involved at the front end, preparing the contract strategy and fine tuning the contract to the circumstances e.g. for use as a term maintenance contract. He has expanded his capabilities to include facilitation of various types – partnering, risk and value management, and business strategy and change workshops – and process consultancy, which is done both independently and in partnership with other companies.

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