Clients: their role in the procurement of infrastructure projects

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Clients : their Role in the Procurement of Infrastructure Projects

A Doctoral Thesis

by

John Harry Pettit
BSc(Hons) DIS MSc CEng MICE MBCS

A thesis submitted in fulfilment of the requirements for the award of the degree of Doctor of Philosophy of Loughborough University.

September 2000

Loughborough University

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It is unwise to pay too much, but it is unwise to pay too little. When you pay too much you lose a little money. That is all. When you pay too little, you sometimes lose everything, because the thing you bought was incapable of doing the thing you bought it to do. The common law of business balance prohibits paying a little and getting a lot. It cannot be done. If you deal with the lowest bidder, it is well to add something for the risk you run. And if you do that, you will have enough to pay for something better."

John Ruskin (1819-1900)
To my late Father
Acknowledgments

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John Pettit
September 2000
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Abstract

This thesis reports on research undertaken into the effectiveness of the procurement activities undertaken by clients within projects for the construction of infrastructure.

Current theory and practice is reviewed by means of a study of the available published literature, documentation and personal views of personnel within various companies. An analysis of the problems encountered by using current methods has suggested that project success is contingent upon a range of factors which are not normally considered and, furthermore, are under the control of the client. This has given rise to a wider view of construction procurement and a variety of new concepts have been identified. This has resulted in the postulation of a unifying theory of procurement and the proposal of better methods of procuring construction projects.

Data has been collected from 24 projects; 12 discrete project programmes within one client and the overall project programmes of 9 client organisations. The data was collected using interviews with a wide range of personnel, interrogation of corporate financial and project management information systems and document analysis. 24 Case Studies of projects are also presented.

A model has been developed that enables the comparison of the procurement activities of a wide range of companies. The model integrates the effects of client programme activities and considers income, costs and risks. This particularly enables the value added by the procurement and other functions to be determined. This has been used to analyse and test the procurement undertaken by several organisations and can be used as a tool for continuing improvement within a client's infrastructure construction programme.
Chapter 1

INTRODUCTION

1.1 BACKGROUND

Until relatively recently, the vast majority of infrastructure has been owned by public bodies, whilst the private sector has mainly been involved in the construction of buildings. The Government privatisation programme of the 1980s and 1990s, together with the current Government intention to involve the private sector in publicly owned infrastructure, has meant that much of the funding of existing and new infrastructure has passed to the private sector. There now exists a range of organisations whose commercial success depends upon the control and maintenance of infrastructure. Many of the issues raised by private development of buildings are now pertinent to infrastructure. It also means that there are a wider range of options available to the new commercially oriented clients, but some significant controls remain - for example, those imposed by European Union legislation. The traditional ways of obtaining new infrastructure are no longer relevant. The industry needs answers to a series of questions, for instance:-

- How can we ensure projects will deliver a financial return over their whole life?
- Who has the most effective control over project success - clients or the construction industry itself?
- How can industry performance be improved?
- Does the research undertaken on building procurement apply to infrastructure?

The purpose of this research is to provide some answers to these questions.
1.2 CONTEXTUAL ISSUES

1.2.1 Evolution of the Construction Industry

Masterman (1992) described how only during the Napoleonic wars (1792-1815) did the concept of competitive tendering for entire projects begin to be used. This occurred because the Government Office of Works sought to improve upon the “Measure and Value” system in use at the time; which often caused disputes between the Client and separate tradesmen.

The quest for significant improvements in construction productivity, as seen by the client, has been most recently addressed by Sir Michael Latham (1994) and Sir John Egan (1998). These have highlighted a possible 30% saving in construction costs, although indications of the route to the achievement of these are rare. Many clients and projects have begun to claim that they are adopting the recommendations of these reports, but as yet no model exists to guarantee the claimed benefits.

1.2.2 Key issues facing the industry

The early part of the research demonstrated that the industry is now facing some real and important issues\(^1\). The increasing internationalisation of the market (winning overseas work or the formation of multi-national groups) means that the market is no longer domestic - it is necessary to compete with the most efficient construction companies throughout the world. If the construction industry must learn to compete world-wide, then their clients are under even greater pressure.

\(^1\) Ibid p 74
Some of the key issues facing the British construction industry were identified as:-

1. The existing accepted practice has not resulted in sufficient improvements in the performance of construction works.

2. There is little acceptance as to what constitutes best practice within the industry. The phrases “horses for courses” and “a professional must be consulted” are often encountered. This suggests that no one has been able to establish what the underlying facts are and that opinion based on experience is the norm.

3. The roles of participants are often unclear and are not the same in each project. Indeed they are often given different titles and have to do different things - is there really such diversity? Why not standardise roles and activities?

4. Most methods of obtaining construction (i.e. Procurement Systems) have been justified as “this is a good idea which is supported by a lot of people” without there being any underlying theory on why this method should be better. Normally, the new method was developed as a fix for a particular problem the industry is facing at that time. This may explain the short period of popularity enjoyed by each Procurement System.

5. The industry suffers from a great deal of inertia and it is very difficult to change it.

6. Little acceptance that the clients - who are the paymasters of construction - are customers in the widest sense and that the “customer is king”.

7. In *Constructing the Team* Latham (1994) set a target 30% reduction in construction prices and a later group has suggested where these may come from. No one knows how these detailed actions will release savings or how we can monitor the detailed success (or otherwise).

8. Training and recruitment is at minimum when spend is low. Maximum demand is out of step with availability of trained labour. This is a classic problem addressed by “industrial dynamics”.

To properly address these issues, and hence bring about the required change, it would be required to:-

- Measure existing performance and activities (Step 1).
- Devise better ways of achieving performance (Step 2).
- Introduce them successfully (Step 3).

This thesis looks at “Step 1”. The possibilities for “Step 2” and “Step 3” are considered at the end of the thesis (Chapter 9).

1.2.3 Principles underlying this research

The research accepted several statements about the industry, its clients and the projects undertaken:-

1. That clients have a significant impact on the performance of construction (as they see it).
2. That clients have a different perspective on the construction industry and projects than those who are traditionally part of it.
3. That it is possible to measure the activities of clients and the impact that they have and compare different clients.
4. That, by the creation of a model which integrates the separate activities/impacts with the processes involved, it is possible to demonstrate how a particular client may improve the process.
5. The use of the model can have a significant impact on improving clients’ construction projects.

It was necessary to accept these principals as true to ensure that the research was focussed on the single aim and did not become too wide. A “back-check” on the impact of these has been made as part of the testing process².

² Broadly, these were found to have been valid and not biased the findings of the research. Ibid p 271.
1.2.4 Definitions

The research addressed various concepts that were in current use within the construction industry. However, it was necessary to define, at the outset, the exact meaning of some of these terms as used in this research. These definitions were reconsidered at the appropriate stage in the thesis to test their validity.

The **Client** is the organisation which:

(a) Has a need for the work at the outset,
(b) Pays for the work, and
(c) Owns the result of the work.

A **Frequent Constructor** is a client who has an annual spend and construction programme that is large enough to be of special interest to the potential contractors and other project participants. An “Infrequent Constructor” does not have this volume of work.

A **Commercial Benefit** is either:

(a) a reduction in cost,
(b) a reduction in the risk of an occurrence, or,
(c) the increase in function,

of the infrastructure, that is of some commercial significance. (Note: (a) and (c) are together the concept of improved value in value analysis, value engineering and value management). The commercial nature of such projects stems from the idea that certain organisations are in the position of owning infrastructure solely to enable them to undertake a commercial activity.

Project **Participants** are those organisations (or parts of organisations), and their staff, who actually undertake the work involved in the project. An Active
Participant is a Project Participant who initiates influences that are of value to the project. A Passive Participant is a Project Participant who merely responds to the requirements of other Project Participants.

Jaselskis (1987) suggested that the four phases in the life cycle of an infrastructure project are:-

1. Appraisal Phase,
2. Acquisition Phase,
3. Operation Phase,
4. Disposal Phase.

The Acquisition Phase (of this “Four Phase Project Life Cycle”) contains the activities involved in getting the infrastructure. This consists of; (1) Development; and (2) Provision. The phase effectively begins when the Client can say "I want it, now get it" and ends when the client can state "I've got it, now I want to use it".

Infrastructure is taken as its current usage, that is, those fixed assets that enable other activities to be undertaken. An Infrastructure Project is, therefore, a project which is undertaken to provide a benefit of improvement in some way to the infrastructure. A Project is an activity with a definite beginning and end.

Procurement is the process which ties all of the above concepts together. It is the process by which a client can influence the project. Procurement signifies a level of knowledge and activities that go beyond the consideration of each project as being entirely a 'one-off' activity. A definition of purchasing was developed that embodied activities of the following types: (a) content and form of supplier agreements; (b) selection of supplier, and (c) management of supply contract.

---

3 Ibid p 71
Procurement, therefore, was shown to be: (a) purchasing; (b) management of Supplier Base; (c) management of Project Base; (d) Induction of Experience, and; (e) Benefit Maximisation. A distinction has to be made between the Procurement activities of a Client organisation - which are primarily aimed at securing the services of the best available Project Participants - and the Procurement/Purchasing of, say, a contractor which are aimed at the supply of the most basic resources.

1.3 AIMS & OBJECTIVES

1.3.1 A formal statement of the problem under consideration

In order to address these issues, it was necessary to study how procurement currently occurs and identify the weaknesses of this. Ultimately, a system of procurement that both embodied and extended what was considered best practice will be revealed. This model system should be practically useable by all organisations within the defined boundary of the research – i.e. commercial infrastructure clients.

1.3.2 Aim

The aim of this research was to provide the basic understanding of what affects construction performance and enabled clients to make changes that affect performance. This may be formally stated as:-

To collect data that will enable the creation of a tool which uses a suitable measurement system to allow the impact of the client on the performance of a project to be distinguished and optimised.

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4 Ibid p 73
5 Ibid p 5
1.3.3 Objectives

The particular objectives of the research were designed to support the stated aim. These objectives provided the key milestones in the development of the research and its output. The detailed steps required were:

1. Create a suitable methodology to direct and structure the research.
2. Identify the list of factors for which evidence already exists that they may drive the performance of a project.
3. Determine which factors actually drive the performance of a project and are also driven by the client – i.e. the “Client Level Performance Drivers”.
4. Create a qualitative model which structures the Client Level Performance Drivers and explains how they impact on the performance of a project.
5. Produce a quantitative model which can both measure the impact of the client on the performance of a project and demonstrate where this performance can be optimised.
6. Show how the model demonstrates the impact the client has on the performance of various projects.
7. Demonstrate that the model can be used in a variety of organisations within the scope of this research.

1.3.4 Scope

It was necessary to define the scope of the research (and the boundaries to what is considered relevant) so as to ensure that the work remained suitably focused. The decision on the scope of the research was based on the principal constraints that: the work looked at commercial clients who own large amounts of infrastructure and that extensive access was available to two client organisations. The scope of the research is defined more fully by the following statements:

1. The data and ultimate conclusions were to be of relevance to client organisations who own and operate infrastructure for financial gain.
2. Data collection was primarily within organisations concerned with the ownership, construction, maintenance or development of infrastructure. Data collected outside this arena will serve only to draw parallels with the main area of study.

3. Infrastructure was taken as those fixed assets that enable other activities to be undertaken. An Infrastructure Project is, therefore, a project which is undertaken to provide a benefit of improvement in some way to the infrastructure.\(^6\)

1.3.5 **Hypothesis**

The hypothesis to be tested was that:-

> If the impact that a client who is a frequent constructor of infrastructure has on the acquisition phase of a project is optimised then this will lead to an improvement in the performance of infrastructure projects that will lead to commercial benefits for the client.

The terms underlined are defined earlier in this chapter.

1.4 **GUIDE TO THE THESIS**

The following thesis describes the research undertaken and particularly reports the hypotheses drawn, the issues considered and the end result. Its structure generally follows the process used to pursue the research, the methods used to draw theoretical points from practical situations and the design work undertaken to develop a system of practical merit. Figure 1.1 represents the structure of the thesis diagrammatically.

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\(^6\) A Project is defined as an activity with a definite beginning and end; as provided by several authors in the References and Bibliography.
The conclusions will show that the research has achieved the objectives set at the outset of the work by approaching the problem in a structured manner, using a well defined methodology. The imperfections in the data are within the limits set as part of the methodology and the results provide sufficiently strong evidence to allow the research to determine whether or not the hypothesis is supported. The work initially entailed a literature study to investigate the current accepted principles and to evaluate how far existing work was able to confirm, or otherwise, the hypothesis. The research benefited from detailed access to one organisation and this provided a useful source of data about how one client organisation undertook the client role. A comparison of the published practices and processes of the organisation with the actual practices of practitioners within the organisation gave further data on the issues surrounding the client role and how this client actually obtained its infrastructure projects.

This initial work was structured as a pilot study to investigate the organisation and area under consideration. The pilot study also enabled the research to form the definitions, hypothesis, aims and objectives of the main study. In addition, it resulted in the derivation of some new concepts that enabled the work to better describe the client role.

The pilot study also enabled the methodology of the research to be developed by considering the available research techniques, the types of data available and the particular needs of this research. The methodology was designed to provide the best available method of testing the hypothesis bearing in mind the nature of the hypothesis, the data available and the subject being studied. Although the methodology was substantially defined at the outset, each step was reconsidered at the commencement of that stage of the research. This enabled the research methodology to benefit from (and be improved by) the experience and findings of previous steps in the research.
The first stage of the main part of the research was a structured investigation which resulted in the isolation of the key client drivers on the performance of projects. This involved the analysis of 24 case studies of projects within the organisation. A more detailed investigation suggested a qualitative model of the client role and its impact on the performance of the project. This differs from the list of performance drivers created in the previous stage since the model is now a cohesive whole theory.

Significant work was required to develop the quantitative model into a qualitative model and this formed the third part of the main research effort. The qualitative model is based on systems theory and value analysis.

The fourth, and final, part of the main research involved validating that the model could be applied to other organisations by testing it on eight further organisations as well as retesting the model on more modern data from the original organisation.

The current chapter has sought to introduce the research problem and give a general background to the reasons for undertaking the research. It further considers the methodology of how the research will be undertaken and the scope of the work. The merit of the final outcome should also be apparent. The following chapter considers the methodology adopted.

The following two chapters describe theory and practice as it is seen at the current point in time; including the accepted modus operandi and what is considered best practice. Chapter 3 reviews current thinking and practice in the problem domain by a review of the published work of others. Chapter 4 builds upon this by presenting a structured collection and description of practice, primarily in one major organisation.

The differences between the theoretical knowledge and that practiced in the organisation is also considered in Chapter 4. A series of issues and questions are revealed - these need to be addressed by the following stages of the research.
Figure 1.1: Diagram showing Structure of the Thesis and Methodology of the Research
The main body of the new work is reported in three chapters. Chapter 5 investigates, from first principles, the concept of procurement for construction projects and uses this to determine the key drivers of project performance from the client’s point-of-view. A comprehensive case study investigation is used to provide the evidence. Chapter 6, uses the results of the previous chapter and builds on this to produce a model of project performance that can be used to diagnose project problems, predict strengths and weaknesses of proposed projects and measure performance in practice. A hierarchical series of hypotheses is developed which are then examined and tested to underpin the arguments brought forward to justify the proposed system. Chapter 7 shows how this theoretical model can be used with real data. Chapter 8 examines several other organisations, tests the model in their particular situations and serves to generalise the findings of both the hypotheses and the arguments that they support.

The final chapter, Chapter 9, summarises the findings, conclusions drawn and provides a series of recommendations. It demonstrates the contribution of the current work and how it may be of practical use. Various ideas for further work are also summarised.

Key documents and data are reproduced in the Appendices. Appendix A contains the data collection tools used – primarily copies of the questionnaires and structured interview agendas. Appendix B contains summary descriptions of the 24 project case studies.

In addition to the references, a further Bibliography has also been included. This gives sources that were consulted during the research and were relevant to the subject area. The Bibliography was selected to give preference to more recent works (published in the last ten years) and those which first contained important concepts.
Chapter 2

METHODOLOGY

2.1 OVERVIEW

This chapter considers the methodology that was employed by this research. It looks at the major methodological issues and their effects. Initially, the chapter considers the need for a formal structured methodology and the structure of the method developed. The choices available are detailed. The overall structure of the method is designed so as to provide the best match between the methods available and the requirements of the research. The main body of the chapter details the methodology adopted.

At the commencement of the research, there were few published texts on research methodologies in the construction environment. Therefore, research methodologies adopted by others were evaluated with the aim of isolating those issues that were relevant to this research. Material was available from standard texts on case study research - Yin (1984) - and organisation studies – Bryman (1989). Towards the end of the research, other authors published texts on construction research, particularly Fellows and Lui (1997) and Naoum (1998). Since most of the methodology design and data collection was completed prior to the publication of these texts, the methodology described here was checked against the recommendations of these works.
2.2 OBJECTIVES AND PRACTICAL METHODOLOGY OF THE RESEARCH

The methodology was designed to satisfy the following objectives:-

1. Ensure the research takes appropriate account of previous work by others.
2. Ensure that the method can be properly implemented in practice.
3. Use a suitable hypothesis and objectives to direct and focus the work.
4. Recognise the features of the data and potential for bias within the data; its collection and analysis.
5. Produce robust results that are not affected by potential bias.
6. Ensure the research is reportable in a structured manner.

Initially, the hypothesis and aim were drafted; together with an outline methodology and tentative objectives. It was recognised that there was insufficient information available at this stage to be certain that these were detailed, precise and accurate enough on which to base the entire research project. Therefore, a pilot study was undertaken consisting of research into available literature and investigations within one company. Following this, a methodology was mapped out which consisted of the following five distinct phases:-

1. Outline methodology design and problem formulation
2. Pilot study – including a state of the art review.
3. Detailed methodology design and problem verification.
4. Single company study to look at contingent factors, model design and sample data.
5. Generalising study. To verify and validate the findings.

The detailed design of the methodology was possible after the collection and analysis of the data from the pilot study. The detailed design required the following stages:-

1. Identification of the required and available sources and types of data.
2. Selection of the appropriate data collection methods, together with the design of the tools to be used (such as questionnaires).
3. Selection of the methods of analysis.

4. Development of the formal Hypothesis to be tested and constructing the logic by which this testing would occur.

5. Identification of appropriate modelling methods.

6. Development of the format in which the results would be produced and presented.

The relationship of these elements is depicted in figure 2.1

Detailed research was then undertaken within one company (TransOne) to:-

1. Define key performance drives.

2. Suggest how these relate.

3. Develop quantitative model.

At the end of the study, a complete set of results was available, together with the basic models with which to analyse them. The further work was required to make the research conclusions fully defensible in an academic environment will be identified and be fed forward into the next part of the main study - the General Study.

In the final phase, the Generalising Study looked at 8 other companies and their practices and experience. The purpose of the test was to:-

1. Test the theory with other situations.

2. Externalise the work by drawing data from more than the one organisation.

3. Generalise the findings by making them applicable to the whole group of organisations.

This involved identifying other organisations within the scope of the research and applying the model and the measurement system to them. A Case Study approach was selected to provide the data for the test; for the same reasons as for the main research. A hard data analysis was also undertaken for the data derived from the case study analysis and this will give a hybrid methodology.
2.3 **METHOD USED TO DESIGN THE METHODOLOGY**

*(META-METHODOLOGY)*

2.3.1 **Choices in the Sources of Data**

A key driver on the type and quality of data available was the access available to organisation within the field of study. A wide range of data has been available from one organisation (*TransOne*): project documents, financial records and direct contact with the people involved.

Although this has enabled both qualitative and quantitative data to be collected, the many factors affecting the data meant that a qualitative analysis did not give rise to the information required. A case study driven approach was considered more appropriate than a pure statistical analysis\(^1\). This made fullest use of the data available as well as allowing the findings to be compared with organisations where less access was possible. It also provided several advantages to the research:

1. The organisation was known in detail before work commenced.
2. The large size of the organisation meant that differing areas may undertake similar activities in different ways - so giving us the opportunity to study diversity and options available.
3. The organisation was prepared to give a detailed level of access to the researcher.

*TransOne* was not ideal since it was, at the time of the research, about to go through a privatisation process. There were two significant dysfunctions of this situation. First, the organisation no longer existed by the end of the research. Second, the organisation was not a perfect fit with the intended class of organisations because it was currently publicly owned. However, the organisation was used predominantly as a method of generating the theories. These have been tested with other organisations so as to reach general theories - the results of the research were true for any

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\(^1\) Ibid p12
organisation. However, the new organisation was a commercial company\(^2\). In fact, the change due to privatisation had the advantage that it was possible to study the organisation developed after privatisation and use this to test the theories developed by the research.

### 2.3.2 Choices in the type of research method

Fellows & Lui (1979) describe two fundamentally different approaches available for collecting and analysing data. These are:

1. **Statistical Analysis** of quantitative data collected by survey or from data systems. This is beneficial where the hypothesis is mathematical, or demands a mathematical answer. It is necessary if a quantitative understanding is required. However, data collection must be numerical.

2. **Case Study Analysis** of qualitative data collected by survey, structured interview or documentation. This results in a descriptive analysis of a given situation or set of situations.

Case study analysis may appear less academically rigorous but it was useful if the hypothesis being tested does not have to be expressed in numerical terms. Yin (1984) states that the case study approach should be used:

1. To investigate qualitative issues
2. To investigate complex issues in a bid to form a theory which can be tested by other means at a future date.
3. To provide examples of problems or solutions; that can explain situations.
4. To look in depth at an issue.

Two weaknesses of this approach were also identified. First, formal sampling and statistical tests are not used. Second, opinion of those involved can have a significant bearing on the findings.

\(^2\) The replacement organisation ("TransTwo") is evaluated in Chapter 7.
The power of using a case study approach lay in its ability to allow investigative research where the hypothesis is not known or is poorly defined. Methods of presenting case study research in the construction industry were found to be:

1. Detailed discussion of up to three case studies as self-contained papers or chapters; such as Bresnen and Baker (1991).
2. Summaries which pick out the key issues in a more terse format; such as Nahapiet and Nahapiet (1985).

In this research, the choice of which method to use depended upon: (a) the nature of the hypothesis to be tested; (b) the type of data available; and, (c) the nature of the problem to be solved.

The initial stage of the research was a pathfinding situation where the issues involved were complex, yet did not lend themselves to mathematical solution. The latter objectives required a numerical study involving analysis of the known (or
suspected) relationship. It followed, then, that the research needed to use a case study approach to the initial step and use statistical analysis to calibrate the resultant model.

2.3.3 **Choices in Data Collection Techniques**

It was important to decide whether the data to be collected would be qualitative or quantitative. Qualitative data tends to be "soft" in that if a study would be repeated, then results may be similar but will not be exactly the same. Quantitative data (such as financial information) is normally "hard" in that it can be pinpointed with some precision and is repeatable. Quantitative data is generally easier to handle and there are accepted scientific methods available for its interpretation. For this reason, attempts are often made to quantify qualitative data. Thus, where appropriate, data collection tools used in this research collected data in a quantified manner.

The research was able to make use of a range of collection techniques: document study, verbal or mailed questionnaires, direct measurement and observation, structured, semi-structured and unstructured interviews.

The data collection tools available to the research have mainly been questionnaires, structured interviews and discussion notes. Questionnaires for completion by individuals were used to gather factual overview information where this was not available (or believed to be inaccurate) within the organisations' normal records. Particular care was taken over the design of questions within the questionnaires. The questionnaires used avoided double-barreled questions, ambiguous questions, and leading questions.

Most data was collected using structured interviews. These were found to ensure that the right data was collected (and improved the response rate) as well as allow
any particular issues to be examined in more detail. Discussion notes were produced when the research appeared to have arrived at a significant finding - the discussion note set out the issue and particular individuals were asked to comment.

Data collection involved the getting of raw data from the population under study. Populations are normally too large to collect a given piece of data from each member so it is necessary to construct a sample. The weakness of sampling is that care must be taken to ensure that a sample mirrors the population as a whole and no bias has been introduced. Both the size of the sample and the sampling method used can effect this.

During data collection it was found necessary to ensure that those providing the data are persuaded of its use by being clear about the relevance of the study, the relevance of questions to the study and the relevance of questions to the respondents.

2.3.4 Choices in Data Analysis

The analysis method selected depends upon the types of data source and the use to which the results will be put. It was important that no significant bias was introduced. Such bias may have occurred if:-
1. The sample was too small (it is possible to calculate the size of the sample required to render this type of bias insignificant).
2. The sample selected by the researcher had some bias in some way. An example of this may be surveying political voting intentions by canvassing readers of a particular newspaper. This can be removed by careful examination of the sample.
3. Self-selection of respondents. Those who would be keen to respond to a questionnaire, for instance, may be a different sub-group (with different views) to the population as a whole.
Many accepted analysis methods exist for numerical data, including: Hypothesis tests (Chi-squared, Fishers), Association tests (Phi-coefficient, gamma, Rho), Interval data tests (Pearsons r, least squares, multiple correlation, partial correlation, ANOVA, path analysis, non-response). These proved to not be necessary, although further work could be done to extend the findings of the thesis.

Complex situations require particular care, as statistical analysis tends to test how one factor views with another. The link may not be direct - a third factor may be causing changes to both. The two factors may be influenced by a wide range of other factors. If these relationships are not known, statistical analysis may not be possible or desirable in every situation.

2.3.5 The Use of Models

Models were found to be useful in that they enable the researcher to examine the underlying processes, flows of information and influences rather than opinion and output data. Such opinions and data may be used in the construction of models and the resulting model may also be used to generate expected data and to compare with that actually encountered. Models enable the researcher to bring a scientific approach to the need to critically analyse collected data. They can be used to provide a descriptive, explanatory or predictive tool.

Systems studies are one modelling method often used in organisation analysis. Forrester (1969) shows how systems theory (originally adopted for engineering purposes) can be applied to the field of management and organisations. The systems approach is a conceptual viewpoint. If a problem could be satisfactorily cast into systems terms, then a range of tools become available. As in data collection, there is a range from "hard" systems such as chemical plants to "soft" systems such as political decision making. Anderson & Richardson (1983) stated that;
"Systems Dynamics is problem centred... ...a problem ill defined is a problem mis-understood and probably unsolved."

A particularly powerful analysis tool was found to be the Systems Analysis and Design Technique (SADT) which was developed by SofTech Inc in USA and used by the US Department of Defense throughout the 1970's on aircraft production projects as described by Bryman (1994). The benefits of this technique are:-

1. Accommodates use by, and inputs from, a large and changing team of people; each with different skills and contribution.
2. Provides a validated and comprehensive framework for all stages of the study from the first broad interview to the detailed specific operations.
3. It has been used and advocated, in Britain, by several respected companies: Mars electronics division, Austin Rover, Lucas.
4. Involves structured decomposition which provides an ordered breaking down of a complex subject into its constituent parts. The method of analysis is top down, modular, hierarchical and structured.
5. Provides methods for:-
   - defining & managing inputs, outputs, controls and mechanisms,
   - documenting decisions and their results,
   - recording and representing the results and their analysis,
   - ensuring the completeness, accuracy and consistency of the built models - allowing review.

2.4 PILOT STUDY

2.4.1 Data sources

The processes and procedures that the organisation had defined for itself were predominantly described in three documents:-
1. The *TransOne* Project Management Manual; which was a practical guide for project managers and others involved in the project process, published by the Director of Projects organisation. It is intended to help project practitioners understand and manage their projects and looks at the issue from the perspective of the project team or what might be more accurately termed the "delivery team" - since it includes players who are not strictly part of the project.

2. The *TransOne* Investment Regulations and Rules; which are a set of rules for the investment of funds. They are the only definition of what *TransOne* as a company requires from a business point of view. The document is derived from the need to be publicly accountable and demonstrate some objective means of deciding whether to proceed with a project. Although the new structure of the company is aimed to give business managers more say in how the company is driven, this flexibility is not permitted by the Investment Regulations.

3. The *TransOne* Safety Management Programme; which details safety requirements for projects. This document includes references to a range of subsidiary documents detailing safety processes and rules.

4. Other documents; such as project files, IMPS, memos, procedural notes and general documents that were taken by practitioners as defining the detailed procedures within *TransOne*.

The following weaknesses were revealed in the data sources within *TransOne*:-

1. There was no documentation to help business managers reach commercial (rather than financial) decisions on how to drive their business areas and how to manage project management teams to ensure this happens. The picture given is that the bureaucratic financial processes are mature, the Project Management is still developing but the business management role is very immature. This is perhaps not surprising as the role has been in place less than two years.

2. The details of the resources used should be collected using appropriate tools - such as questionnaires and structures interviews. More detail could be included in corporate processes on resources used. The value added by processes is
partially contained in budget details and project progress reports. Further information can be available in corporate audit reports on particular projects or processes - these can also provide information on how well actual processes match defined procedures. None of these sources was particularly powerful at providing data and it would be necessary to record financial and value data in another structure to readily allow analysis.

3. Very little data was collected by TransOne on how well the processes are operated. One useful source was the audit teams who undertook validation of the processes applied by TransOne in general. Other data will need to be collected from the practitioners involved.

4. The primary legislation and statutory instruments which set up the nationalised industry provided the aims and objectives of TransOne, but provided no direct data for this research.

2.4.2 Procedure

The purpose of this part of the research was to collect the views of staff undertaking client duties within TransOne; so as to: (a) determine what occurs in practice; and, (b) validate whether the defined processes were used. In order to achieve this, the following methodology was adopted:-

1. The types of staff undertaking client duties were identified and a sample was selected. The sample selection was not random, as the author was aiming to focus on the locations where particular issues would be most clearly in evidence. This does have the potential to introduce bias into the results, but the bias would involve the removal of "middling" projects and staff. This pragmatic selection does not prejudice the objectives of the research.

2. A series of structured interviews were undertaken with senior practitioners. A structured interview questionnaire was produced (Appendix A) and interviews performed with a representative sample of Project Managers, business managers and others in the project activity. The objectives of the process were:-
a. Obtain a description of how they managed projects.
b. Review how this differs from the defined processes.
c. Seek views on the reasons for the deviation.
d. Solicit opinions on the success or otherwise of the project processes.
e. Collect suggestions for possible improvements.

The staff that provided information (i.e. the “respondents”) are referred to by code numbers. These code numbers are referenced in Appendix B\(^3\). Broadly, codes beginning in “C” are client side staff whilst “M” denotes project managers.

The 32 Managers and Project Managers within TransOne (selected as described above) were interviewed using a semi-structured interview technique following the format in the “Pilot Study Semi-structured Interview Sheet”\(^4\). It was found to be necessary to use some latitude in the interview as the research, at this stage, was seeking to scope the major issues in order to enable the design of the research methodology and indicate which data should be collected at later stages. The questions were initially produced from the findings of the Literature Study, but this interview sheet was developed during the pilot study as new issues were revealed.

2.5 METHODOLOGY OF THE SINGLE COMPANY STUDY

2.5.1 Selection of Projects for use as Case Studies

Since there were over 1000 projects within the field of study, some form of sampling is required. The target sample was 24 projects, since this was shown to be a statistically defensible size. A process was defined to ensure that the case studies were selected without bias to the results but with a representative sample that would cover the types of projects within the bounds of the study. This process is depicted in the flow chart in figure 2.2.

\(^{2}\) Ibid pp 371 to 374.
\(^{4}\) Ibid p 293.
The pragmatic sampling method was based on the projects where necessary data exists and can be accessed; but is also a defensible representation of the population. It involved:

1. Suggestion, by the New Works Managers (NWMs), of the projects that they feel able to let the researcher examine and where they feel the best information may lie.

2. Analysis (by the researcher) of both these suggested projects and those not suggested, to ensure that issues are not being hidden.

Comparison of key data from the sample and the population to account for bias.

The quality of the data collected was of prime importance and this can be improved by looking at projects that are currently under way or have recently finished. The population was divided into the following categories:-

1. Completed too long ago.
2. Start/completion within specified time frame.
(3) Insufficiently developed at the current time.
(4) Not undergoing active development at current time.

Category (2) contained projects that are of most use to the research. Initial discussions were undertaken with the relevant New Works Managers (NWM) to determine whether the projects in Category (2) are felt to be:

(1) Successful,
(2) Unsuccessful,
(3) Middling.

The process proved to be a good pre-selection tool that ensured that the final sample did not contain too many projects of one type. Prior to producing the final sample, a questionnaire is sent to the project manager to provide information that confirms the details derived from the management information systems and provides a "thumbnail" sketch of the project. Any further details required can be followed up with the Project Manager on an individual basis. Final selection of the projects to be investigated can now be made.

2.5.2 Case Studies for Contingent Factors

To prove the hypothesis, it was necessary to answer the following questions:

1. Does the factor have an impact on the performance of the project? If so, is it positive (serves to improve the project) or negative (serves to detract from the project).
2. What level of impact does the factor have? Importantly, is it significant?
3. Is the factor a client level driver or should it be classified as project level (or elsewhere)?

The method adopted to undertake this was:

1. Look at each contingent factor to see its impact on performance. If those relating to the model were true then the model was partially proven\(^5\).

\(^5\) Ibid p154
2. Score client role in scale of 1-10 to see if it correlated with present performance\(^6\).

3. Apply the value formula to projects\(^7\).

Key data regarding possible projects on which to undertake a Case Study was collected using this questionnaire. Since potential projects were identified during the Pilot Study, the data collected by this questionnaire was used to determine which projects would actually be studies. Its purpose was to validate key data available from the corporate projects database; provide additional details where required and collect contact details for the project team. Respondents were given three weeks to return the questionnaire with reminder notes sent at two weeks and four weeks. Respondents were contacted prior to sending the questionnaire and reminder telephone calls were made around the same time that reminders were sent. In 6 cases the questionnaire was completed by the author during an interview with a member of the project or client team. The questionnaire is 4 pages in length and contains 20 questions. It was sent to 97 respondents in 89 projects throughout the organisation. The response rate was 91%; rising to 98% following visits/interviews with the remaining projects. One project was discounted and no response was forthcoming.

Respondents in each project studied by case study were asked to rate the strength of the link between Contingent Factor and project performance using the Contingent Factors Rating Sheet. The sheet is one page in length although instructions were attached on how to complete the ratings. It was estimated that the questions could be answered in around 10 minutes. 53 questionnaires were sent out and 49 were completed – the high response rate was due to individual contact between the researcher and the respondent.

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\(^6\) Ibid p127  
\(^7\) Ibid p172
2.5.3 **Theory Development**

The method adopted to determine the correct formula to be used was as follows:

1. Generate potential formula using logical arguments.
2. Determine the value of Whole Value at known points.
3. Test the hypothesis that the equation is correct by calculating the Whole Value at the known points using the formula.
4. Select the formula which gives the correct answer at all points.
5. Validate this formula by inspection of the final results.

2.5.4 **Sample Data**

The case studies investigated in the previous chapter provide the source of the data to be used in this stage of the testing process. This provided a test that confirmed (or otherwise) the model for the single organisation. Further work will be required to determine if the model has a wider applicability - this occurs in Chapter 7.

This stage of the research required a large amount of data to be collected. Whilst the most important data came from project documents and observation, there was a need to gain initial data and to establish a relationship with the respondent. The Project Case Study Structured Interview Sheet\(^8\) was written to solicit the answers to information required to address the contingent factors - the answers to the interviews could have been used to determine whether the hypotheses were true (or otherwise) but supporting evidence was required (and was collected using the techniques mentioned above). The sheet contained 56 questions and was used 33 times on the 24 projects. Where necessary, other issues were explored at the end of the interview.

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\(^8\) Ibid p303
The qualitative data collected for all case studies was examined and the data required to input to the qualitative model extracted. Where data was not available from the original case study, the author returned to the project team and collected further data as appropriate. This information was extracted from financial and progress reporting or contract files.

A data collection summary sheet - Whole Value Data Collection Sheet was constructed. During the quantitative analysis of both projects in TransOne and in the other companies used for validation; it was necessary to structure the collection of numerical data. This enabled the “missing” data to be identified and collection arranged. One master sheet was completed for each project and portfolio evaluated. It was completed from source documents located in project files. Where source documents were not available; respondents were asked to estimate date values and these were cross correlated with data that was more readily available.

After searching for and collecting the further data, some projects did not have sufficient data available to allow the Whole Value to be calculated at relevant places within the process. The Whole Value plots for these projects (11 in all) have not been reproduced in this thesis. They have, however, contributed to the characteristics noted elsewhere. Since the various business groups ran their project portfolios independently, it was also possible to collect portfolio data. Sufficient data was available from three of the portfolios.

2.5.5 Analysis and presentation of results

The data calculated in the method explained above allowed the determination of the following information for each step along main flow for each portfolio and project:-

- Absolute Whole value.
• Whole Value change.
• Activity Cost.
• Absolute WV/ACTIVITY COST.
• Activity WV/ACTIVITY COST.

This data has been used to produce the following graphs:-
• Bar chart of whole value change for example project and portfolio against average for organisation.
• Line chart of whole value for all projects and portfolios.
• Line chart of whole value/activity cost for all projects and portfolios.
• Bar chart of whole value change/activity cost for example project and portfolio against average for organisation.

2.6 VALIDATION AND TESTING

2.6.1 Selection of organisations for the test

The purpose of the test was to determine whether the results obtained from the original organisation hold true for other similar organisations. This involved identifying other organisations within the scope of the research and applying the model and the measurement system to them. A case study based approach was selected to provide the data for the test; for the same reasons as from the main research:-

1. There is not a ready availability of data.
2. Many of the issues are driven by qualitative factors.
3. The views of those involved are important.

A hard data analysis was undertaken for the data derived from the case study analysis and this will give a hybrid methodology.
In order to locate companies that were prepared to allow a reasonably detailed investigation into their businesses, use was made of industry contacts provided by the European Construction Institute (ECI) at Loughborough University. The selection criteria from organisations to be involved in the measurement were:

1. Willing to be involved - recommendation and preliminary discussion.
2. Position in market within that defined as scope of research.

The selection process is not random and bias may be introduced. An analysis of the potential bias that may be introduced was undertaken and concluded that any bias did not impact significantly on the conclusions drawn.

2.6.2 Data Collection

Structured interviews were undertaken with identified members of each organisation drawn from the project management and client management parts of the business. The structured interview sheet is similar to that used for projects; as discussed above\(^9\). It was modified from the project interview sheet to: (a) make it suitable for the external companies; (b) make it applicable to portfolios rather than specific projects; and, (c) add improvements gained from the Project Case Studies. Again, it proved a useful tool to both gain initial data and to establish a relationship with the respondent. The sheet is 5 pages in length containing 66 questions. The sheet was used 15 times with 8 organisations. In some cases the interview was given to two or more people in the organisation - especially where no one individual felt competent to fully answer all questions.

More detailed information was, where possible, drawn from source documents. However, the level of access provided into the organisation utilised in the text was very much less.

\(^9\) Ibid p308.
Although, the majority of the data was provided by interviewees, there was no evidence that this introduced significant bias or inaccuracy into the results. This was especially true when the results were being used to validate the abilities of the measurement tool in support of the main hypothesis.

2.6.3 Results and Analysis

The same method of analysis and presentation of the results was used as in the single company study.

2.7 REVIEW

This chapter described the significant amount of work required to identify and decide upon the overall methodology to be employed and the detailed tools available.

Although it was necessary to design the methodology at the outset, a major requirement was that the methodology had to be able to be flexible enough to change during the research. This was required because the discovery of new information provided the opportunity of better ways of tackling the problem. Such changes need to be beneficial as there is the risk of a large amount of change resulting in a loss of structure. This flexibility, then, must allow detailed changes of direction; but be strict enough to prevent drift or hide lack of progress.

A review of the methodology showed that it provided a good framework for the research and enabled the strengths of the data to be used to produce the end result; whilst minimising any weaknesses.
Chapter 3

A BACKGROUND TO CLIENTS, PROCUREMENT & PERFORMANCE IN THE CONSTRUCTION INDUSTRY

3.1 OVERVIEW

This chapter provides a consideration of the background to the research. It does this by reviewing the current accepted thinking on clients, their construction projects and how these projects were procured. In particular, the analysis looks for clues as to what issues affect the success of a project and how clients can influence this. Inevitably, a critical analysis of current thinking gives rise to a series of questions that challenge whether current practice reflects current thinking.

In Chapter 1, it was noted that there have been various Government sponsored reviews into the construction industry. In this chapter, these reports are considered in more detail. The available procurement methods and methods of selecting project participants are reviewed and their contribution to the performance of projects analysed. The role of the client is considered; including a search for the key features of the client role; the activities that need to be performed and the impact that the client can have on the project. The section on client role also reviews weaknesses in the theories advanced in these published sources.

A critical issue is that of how project performance is defined and measured. The final section of the chapter considers this and notes some tools that are available to measure project performance.
3.2 IMPROVING CONSTRUCTION - FROM BANWELL TO EGAN

3.2.1 Early reports

Following the end of the Second World War, Britain instigated a major construction programme and contractor designed projects were used to meet the ambitious targets set by the Government. At the same time, a series of government reports were instigated to examine how construction might be improved. The conventional procurement system remained predominant yet Simon (1944) found serious weaknesses in the traditional methods. It was recommended that, where appropriate, selected and limited lists of tenderers should be used together with negotiation, but this report had limited practical effect on the overall method in use and the "conventional" method remained the choice for the vast majority of projects. Emmerson (1962) concluded that ways needed to be found of improving co-ordination and co-operation between the client, consultants, contractors and sub-contractors, and suggested that the system for placing contracts and managing projects should be comprehensively reviewed. Banwell (1964) suggested that the majority of the various members of the industry were felt to have been reactionary to new ideas and processes and there was an urgent need for the separate factions to come together and think and act as a whole, particularly in the 'letting, form and management of contracts'.

The earliest serious considerations of the problems with the British construction industry and how they might be alleviated date back to the end of the Second World War. The issues surrounding the placing and management of contracts were considered by Simon (1944). It was suggested that the main-contractor should be in full control of construction and should particularly control all sub-contractors as if they were his own employees. Improvements in the tendering procedure (which at the time were mainly by open competition) were also investigated by a further committee, some ten years later, by Howard-Robertson (1954). The problems of sub-contracting were also noted in the same report.
The Study of the Problems before the Construction Industry, Emmerson (1962), sought to "focus on those problems that are most significant for increased efficiency". It found that there was no statistical measure of efficiency within the industry. Organisation and Practices for Building and Civil Engineering, Younger (1964), considered the management of the demand placed on the construction industry. This picked up on many of the same themes as the earlier reports - principally because most of the recognised difficulties were being aggravated by large variations in demand placed on the industry. The role played by clients was also noted in this report:

"We stress the part to be played by the Clients in achieving this improvement is of the utmost importance"

The most comprehensive review, at the time, was The Placing and Management of Contracts for Building and Civil Engineering Work, Banwell (1964). This looked at a wide range of issues and gave recommendations covering the following areas:

- The team in design and construction.
- Appointment of the contractor and tendering procedure.
- Conditions of contract.
- Bills of quantities.
- Sub-contractors.
- Price mechanisms; including payments, retentions and incentives.
- Client activities.

Banwell (1964) pointed to a series of client created issues which cause the industry problems. Firstly, planning and the definition of client requirements seemed to need improving:

"Those who spend money on construction seldom give enough attention at the start to defining their own requirement and preparing a programme of events for meeting them. Insufficient regard is paid to the importance of time and its proper use." (Recommendation 2a)
Secondly, delays in getting approval were noted; especially amongst public sector projects:

"Where public funds are concerned, approval to proceed should be given at the earliest possible stage, and reference back to the government departments should not be required except where estimates are exceeded by a given percentage. Similarly, funds for public projects must be made available on the basis of a programme over a series of years."

(Recommendation 4g)

as, thirdly, was the temptation to seek prices before projects were fully defined:

"Schemes must be settled in their critical details before firm price, fixed period quotations are sought". (Recommendation 8a).

Fourthly, even after funds were allocated, and the works commenced, many clients did not apply the required sense of urgency to paying for work done:

Valuation, certification and payments during progress of the work are sometimes late, and these delays are commonly passed on to subcontractors; contract conditions should be scrupulously honoured. We suggest improvements which may assist the flow of money".

(Recommendation 9a)

Fifthly, clients still seemed reluctant to provide incentive bonus payments to contractors, and Banwell added to the findings of previous reports:

"We see no reason to oppose the use of direct bonuses; the loss of a bonus is a more effective penalty than a liquidated damage clause".

(Recommendation 9f)

It was noted that such schemes can be difficult to operate, but suggested no way of improving the situation.

The committee identified three factors that should be taken into account in choosing the method of appointment:-

- Efficiency of selection - appointing the most suitable Contractor for the job, obtaining value for money and ensuring economy in the tendering process.
• The possibility, in appropriate cases, of early selection of the contractor so that he can participate in the design process.
• The provision of continuity of work for the Contractor, aimed at producing savings in which the client could share.

The National Economic Development Office, NEDO (1967), published a report on contract strategy that looked at the impact of the Institution of Civil Engineers (ICE) Conditions of Contract. The increasing complexity of construction projects had led these standard contract conditions to apportion risk partly to the employer - as opposed to mainly the contractor as had traditionally been the case. The theory behind the division of the risks was that they should be apportioned to the party best able to manage them. However, the form of contract was felt to encourage claims because of this division of risks. The report provided several suggestions on how the situation should be managed:
  • The level of claims should be included in the consideration for future contracts.
  • The level of risk should be subject to investigation and mitigation prior to construction. The importance of soil investigations as a way of mitigating risks from unforeseen ground conditions was particularly noted.
  • Parties should adhere "to the spirit as well as the letter of the contract".

The Organisation of Demand, NEDO (1969), looked at how demand can be organised to produce benefits for clients by producing conditions in which professions and the industry can work together with greater efficiency. It was based on data collected from projects in the water/sewerage industries and hospital building. Many similarities were found between Civil Engineering and Building. Its conclusions included a recommendation that the client should be of adequate size and experienced enough to both cope with the project and properly perform its role.

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1 The ICE Conditions of Contract were first introduced in 1945. This report looked at the 3rd edition, issued in 1951. The current version, the 6th Edition, was published in 1993.
The *Public Client and the Construction Industries*, Wood (1975), looked at the letting of contracts and their management. Again, continuity of work was a key theme. The concept of “value-for-money” was also considered. The suggestion was made that it is not possible to define value-for-money in purely monetary terms. Public clients were also criticised for seeking value-for-money in the wrong place - with the prevailing policy to select least construction cost options as opposed to maximising benefits over life of a project.

*Faster Building for Industry*, NEDO (1983), considered improving delivery times for projects. When interviewed, representatives of key industry organisations believed that faster construction cost money. The report, however, refuted this perception finding that speed of construction was driven by the quality of the planning and the will of all parties to build quickly.

A particular feature apparent in each of these relatively old reports is that many weaknesses (and their solutions) were revealed at an early stage but progress to address these has been relatively slow. It is not clear from the reports themselves why this should be true, but more recent research within the industry has been directed at providing a greater focus on how improvements should be implemented in practice.

### 3.2.2 Recent Reviews by Latham and Egan

*Constructing the Team*, Latham (1994), and *Rethinking Construction*, Egan (1998), provide the most recent detailed consideration of how the performance of the construction industry should be improved.

*Constructing the Team* was based on information that was collected from a wide range of sources by Sir Michael Latham and a team of people drawn, on a
volunteer basis, from the industry. The review made 30 recommendations over a wide range of construction issues. These covered:

1. A selection of recommendations aimed at bringing Government processes into line with best-practice industry clients.
2. Detailed recommendations for private clients.
3. Suggestion to undertake benchmarking processes within other industries.
4. Methods to help design processes give better results.
5. Particular guidelines on the management of contractors.
6. A call for legislation on some key contractual issues².
7. The setting of a target 30% improvement in construction costs.
8. A recognition that closer working relationships (such as Partnering) would be needed to deliver the improvements³.
9. A set of rules that a modern contract should fulfil.

Latham (1994) is interesting in that issues which had appeared almost as footnotes in reports dating back to 1945 - issues such as the client role, relationships, target price improvements - were now central themes. The review also looked at the industry from a client point-of-view - involving client bodies such as the British Property Federation (BPF) and the Chartered Institute of Purchasing and Supply (CIPS) as well as several client organisations directly.

Major recommendations on the future of construction contracts included the formulation of a set of rules on which a modern contract should be based. It was recommended that a complete family of contract documents should be formulated in line with these guidelines [Recommendation No.9] and the New Engineering Contract⁴ was singled out as being the nearest existing form of contract to satisfy these guidelines.

³ Objections to partnering by parties are considered later. Ibid p44.
⁴ The New Engineering Contract (NEC) was first published by the ICE in 1992. Latham made recommendations for improving the NEC and many of these were included when the form of contract was re-issued as the New Engineering and Construction Contract in 1996.
A challenging "headline" target for a real cost reduction of 30% was made a core part of the recommendation, reflecting the aspirations of clients [Recommendation 24] -

"This target of 30 per cent real cost reduction by the year 2000 should be accepted by Ministers and the industry, and it should be the duty of the Implementation Forum to encourage, assist and monitor progress towards its achievement. This will involve early agreement on a benchmarking system."

The main contribution, apart from stimulating the debate once again, came from the legislative changes brought about in the Housing Grants, Construction and Regeneration Act (1996). This involved the following main legislative obligations:-

1. Prevention of defined unfair contract terms.
2. Establishing the right of dispute resolution by adjudication, in all contracts.

The concept of "partnering" was also recommended - although many clients, especially public ones, were wary of the concept fearing it would provide too "cosy" relationships. Latham (1994) quoted the particularly forceful statement in the submission provided by CIPS:-

"Partnering includes the concepts of teamwork between supplier and client, and of total continuous improvement. It requires openness between the parties, ready acceptance of new ideas, trust and perceived mutual benefit. Partnering can only be successful with the commitment of the Chief Executives of the organisations involved, and by the selection of individuals with a determination to work together. We are confident that partnering can bring significant benefits by improving quality and timeliness of completion whilst reducing costs. It can be applied to the construction industries through longer term agreements or option contracts."
An indication on how public clients could involve themselves in partnering arrangements [Recommendation 8] were provided.

<table>
<thead>
<tr>
<th>Table 3.1</th>
<th>Rethinking Construction – The Scope for Sustained Improvements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indicator</td>
<td>Description</td>
</tr>
<tr>
<td>Capital Cost</td>
<td>All costs excluding land and finance.</td>
</tr>
<tr>
<td>Construction Time</td>
<td>Time from client approval to practical completion.</td>
</tr>
<tr>
<td>Predictability</td>
<td>Number of projects completed on time within budget.</td>
</tr>
<tr>
<td>Defects</td>
<td>Reduction in number of defects at handover.</td>
</tr>
<tr>
<td>Accidents</td>
<td>Reduction in the number of reportable accidents.</td>
</tr>
<tr>
<td>Productivity</td>
<td>Increase in value added per head.</td>
</tr>
<tr>
<td>Turnover and Profits</td>
<td>Turnover and profits of construction firms.</td>
</tr>
</tbody>
</table>

Egan (1998) sought to achieve the same objectives as Constructing the Team and benefited from the experience of Sir John Egan whilst Chief Executive of BAA plc, the airports operator. The report re-iterated that the construction industry was “under-achieving” – evidenced by the fact that it has low profitability; invests too little in capital, training, research and development; and importantly, many of the industries’ clients are dissatisfied with its performance. [Paragraphs 4 to 6]. The “key drivers of change” (committed leadership; a focus on the customer; integrated processes and teams; a quality driven agenda; and commitment to people) were held to be the ways in which improvements could occur [Paragraph 17].

Egan (1998) set targets for defined improvement indicators – see table 3.1 – and stated that effective use of performance data was essential to deliver improvement. The report asserted that the targets could be met by “integrating project processes around the four key elements of product development, project implementation, partnering the supply chain and production of components”. Outline suggestions were made about areas where practical changes could be made [Chapter 3] but
great reliance was placed on clients being able to undertake “Demonstration Projects” which presumably would develop the best practice.

3.3 THE CONTRACTING PROCESS

3.3.1 Available Procurement Routes

A range of “procurement routes” of contracting arrangements were available for a construction project. Masterman (1992) classified these into four groups – see table 3.2.

<table>
<thead>
<tr>
<th>Type</th>
<th>Contracting Arrangement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Separate Procurement Systems</td>
<td>Conventional method</td>
</tr>
<tr>
<td>Co-operative Procurement Systems</td>
<td>Cost reimbursable methods, Joint ventures, Partnering and Alliances</td>
</tr>
<tr>
<td>Integrated Procurement Systems</td>
<td>Design and Build</td>
</tr>
<tr>
<td>Management orientated Procurement Systems</td>
<td>Management Contracting</td>
</tr>
</tbody>
</table>

In addition, advances in contract management and funding practice have given rise to new arrangements. Joint Ventures have been encountered for some time but the Government Public/Private Finance Initiative has sought to bring private capital and construction expertise more deeply into public infrastructure. These arrangements usually involved the contractor taking over the assets for a period of time and undertaking construction, maintenance and, very often, operation of the assets. These “Facilities Management” arrangements were beginning to be encountered in road bridge, prison and hospital schemes. Guides by the ICE (1998), Mumford (1998) and Adair (1998) consider the issues involved.

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5 A critical issue is how these impact on the performance of the project and the satisfaction of the client’s objectives. Ibid p115
6 We will also see, in Chapter 8, that these types of arrangements are being used by TransTwo.
Partnering is beginning to occur in construction projects, as encouraged by Latham (1994) and Egan (1998). Stephenson (1996) and Baden-Hellard (1995), among others, provide guidance on how to implement workable partnering processes. These issues provide an enhancement to the basic contracting arrangements already noted, rather than defining totally new arrangements.

3.3.2 Selection of Procurement Route

The choice of method to use was not straightforward since:

1. There were a large range of potential methods.
2. Many methods are very similar.
3. Each method has its own distinct advantages and drawbacks.
4. Particular firms tend to favour particular methods.
5. There is no single accepted method for selecting the procurement route.
6. The industry and its experts disagree and the relative merits of methods.

Masterman (1992) described where each type of contracting arrangement may be suitable.\(^7\)

Franks (1990) rated various contracting arrangements in terms of their ability to satisfy seven basic requirements common to the majority of clients. The rating relates to a scale of 1 to 5 where 1 is the minimum and 5 is the maximum in terms of the individual system’s ability to satisfy the listed requirements, and these are of course subjective.

The Building Economic Development Council’s booklet *Thinking about Building*, NEDO (1985), contained a chart that related the characteristics of the most commonly used procurement systems to a list of nine client’s priorities or needs for his project, which were framed as questions. By simply answering the questions

\(^7\) These were based on the building sector but there was evidence to support the view that these were also applicable to infrastructure contracts.
that are posed, the most apparently appropriate procurement systems could be identified and given further consideration. The guide was useful in terms of eliminating unsuitable procurement systems from all of the available alternatives but was insufficiently sophisticated to enable a final decision to be taken as to the most appropriate method of designing and constructing the project being examined.

Skitmore and Marsden (1988) report a multi-attribute selection technique based on the NEDO procurement-path decision chart which includes a greater quantity of potential contracting arrangements and allows the user to rate the importance of the input criteria. This was achieved indicating the relative utility of each procurement path against each criterion on a numerical scale enabling a set of utility factors to be established for use in the decision chart the procurement-path decision chart, incorporating the various utility factors.

Bennett (1985) used the *Thinking about Building* guide and the work by Skitmore and Marsden to tabulate the strengths and weaknesses of the various procurement systems. The table produced provides an opportunity for clients to “weight and rate” the various criteria in order to reflect their priorities.

The above mentioned selection techniques do not address all the factors affecting the choice of contracting arrangement because:-

1. Birrell (1991) noted that the selection of procurement route depends upon a wider definition of client’s objectives, the nature of the client and marketplace issues.
2. The procurement routes identified are only stereotypes; in that those actually employed are normally more complex and often involve a hybrid of several methods.
3. There was no "best" procurement route as the one selected should be the best fit with a range of factors - the characteristics of the project, the requirements of the client, the previous experience of all participants etc.
4. Even selecting the "best" procurement route for a given situation would not guarantee success. Much depends upon the way the project is managed; other pressures on the participants; motivation, abilities and personalities of people involved.

5. Some problems occurred due to the nature of the type of project - for instance, ground conditions in a tunnelling project - and the procurement route selected can only mitigate the effects of these problems.

Clearly, then, merely considering these procurement routes did not address every influence on a project. Neither did it consider the role to be played by a client. Selecting the procurement routes only addressed the arrangement of standard types of organisation within the construction industry - clients, consultants, contractors etc. There was a need to look for evidence of other influences on the success of a project and the particular role of a Client.

3.3.3 Methods for selecting participants

A variety of methods are available for selecting participants in the project\(^8\) (primarily contractors). These generally are:-

- Open tendering
- Selective tendering
- Negotiation
- Framework contracts

The method of "open tendering" allows a relatively unsophisticated client to find out who is interested in undertaking a particular project. The client, or their professional adviser, would place an advertisement in the press including the key details of the scheme. Interested contractors are invited to apply for the full tender documentation.

\(^8\) A critical issue is how these impact on project performance and the satisfaction of the client's project objectives.
Although the initial stages of the process are relatively straightforward, the bid analysis phase is difficult since any investigation into bidders' competence needs to be undertaken. This method may appear to give relatively open and free competition for work but it does mean that bids may be received from a great number of tenderers, some of whom may be totally unsuitable. This results in a great deal of wasted effort being expended by both tenderers and clients. Open tendering has been, for the most part, abandoned because contractors chosen using this method proved to be the source of problems.

In selective tendering, the client invites tenders from firms who are selected for the purpose. A list may be drawn up with a particular contract in mind: this is called "ad hoc" or invited list procedure. Alternatively the client may have a standing list of approved firms from which a short list is drawn for each contract. In order to improve upon the shortcomings of an Open Tendering environment, single stage selective tendering was developed which is outlined in a guide by the NJCC (1997). It is a widely accepted method of ensuring fairness in the bidding process. The method embodies the creation of a select list from which a tender list for any particular project may be drawn. Any firm may apply for entry into the select list, but the client would undertake a vetting process to ensure that only firms competent enough to undertake work remain on the list. The two-stage procedure is used where it is desired that the contractor should join the design team at an early stage. The first stage consists of preliminary competition based on outline drawings in which the offers of selected firms are considered in the light of such factors as management and plant capacity, and the basis of their labour rates, prices and overheads. In the second stage the chosen contractor works as a member of the team while details are developed and bills of quantities drawn up and at the end of this time he submits a more detailed price which if satisfactory becomes the formal contract sum.

Negotiation of contracts can take several forms. One procedure is for the client to discuss the outline terms of the contract with a small number of firms and then
finally negotiate the job with a single contractor. Alternatively the contract may be negotiated directly with a single contractor without preliminary competition. A special form of negotiated contract is the `package deal' where the chosen firm (selected either by preliminary competition or direct negotiation) takes responsibility for the design and construction of the scheme from beginning to end. It is possible to appoint a contractor by negotiation by: assessing the experience, management expertise and competitiveness of a small number of appropriate contractors; or, on the basis of past performance and competitiveness of a single contractor; or, repetitious geographically adjacent projects probably carried out for the same client.

Framework contracts are a form of standing offer whereby a contractor undertakes to enter into a series of separate contracts in accordance with the terms and conditions of the standing offer. There is a firm commitment when the standing offer is accepted to order work to a minimum value subject to satisfactory performance. Serial contracting, on the other hand, is a contract for a single project but which, in addition, makes provision for a series of specified additional projects to be executed under the same contract. It is similar to serial tendering but the commitment to a series of projects after the first is firmer, being based on a contract rather than on the acceptance of a standing offer. Serial contracts can consist of a number of projects either with individual start and finish dates or arranged with flexible timing to give continuity of work. Parallel working on different projects is quite common and has obvious advantages in terms of savings in cost and time. Either type is useful as it may be opportune to group a number of projects with similar characteristics into a formal programme. The programme may be awarded to a single contractor following receipt of competitive tenders based upon a master bill of quantities. Although forming part of the same programme, each project is administered by means of a separate contract with the contact sum for each being calculated by using the rates priced in the master bill and the quantities appropriate to each project.
3.4 THE ROLE OF THE CLIENT

3.4.1 Defining the Client

Few literature sources sought to define what was meant by the "client". Clients, or more accurately Client Organisations, appeared to be varied and, more often than not, complex. It was rare for a client to be a single individual (although in a later chapter we will research an organisation that is as close to this situation as appears possible). Usually a client is a single, relatively mature organisation, which has some fairly defined objective that the construction project will satisfy or contribute to the achievement of. The complication here is that this type of client is made up of individuals who all have different agendas, objectives, motivation and interrelations that should (but are by no means always) supportive of the objectives of the client organisation. Interesting questions arise about how such complex organisations may discharge a client role, what they do and how they form objectives. The problems of managing a project in this type of organisation were all too apparent in the practices of the organisation. It was important for the research to answer these questions.

If clients such as the organisation were complex and difficult entities to understand, an even more complex client has been noted. Some clients were formed (perhaps as a Joint Venture - JV) with the sole purpose of promoting the project - a prime example is the channel tunnel project as described by Stannard (1990). This appeared to add another level of complication as the various members of the client organisation may have widely differing objectives and perspectives on the project. The channel tunnel client organisation included banks and contractors for whom the successful completion of the project was one (but one may suspect not the only) means of satisfying their objectives. Stannard (1990) noted the weaknesses of this organisation prior to its re-organisation under a new person\(^9\) able to become the client and drive the project through to completion.

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9 Alistair Morton
There seems, then, to be a spectrum of style of client ranging from the extremes of the individual person to a joint venture formed solely to construct one project. The question should be asked; what do all three types of organisation have in common. It is suggested at this stage that the client is the organisation which:-

(a) Has a need for the work at the outset,
(b) Pays for the work, and
(c) Owns the result of the work.

This definition will be used as the working definition throughout the thesis. However, the research will need to test whether this hypothesis is true, and if there are any other features that should be included in the definition.

3.4.2 Key Features of the Client Role

Most of the studies which have reflected on the client role are fundamentally aimed at improving the productivity of a construction project. They tend, almost entirely, to view the role of the client from the point of view of those participating in the project which tends to result in desired roles being framed in terms of what the client can do to improve the project rather than what the client needs to do to ensure the project meets its objectives.\textsuperscript{10}

A report by NEDO (1975) aimed at improving the way construction projects are obtained seeks to define the role of the client in five main areas:-

1. Select the method of procurement.
2. Select the personnel (consultants, designers, contractors) using criteria such as: size of firm; relevant experience; work load; quality of senior people in charge; business efficiency; employment practices; location and, quality of work.

\textsuperscript{10} Most of the data on which the information was based was derived from the building industry and is not certain if the role necessary will also be required in Civil Engineering or similar works. Ibid p 74.
3. Prepare the brief and agree the scheme. This would typically include: list of activities; budget for the project; programme for project; and, description of control procedures.

4. Monitor the progress.

5. Pay for the work done.

These factors ignore the work that must be undertaken prior to the decision to build. Such feasibility studies are the natural responsibility of the client and are based around providing answers as to whether the project is actually required how it should be best obtained. They involve a scooping of the work required, the risks involved and likely costs. In essence, the underlying questions about the potential infrastructure that are pertinent at this early stage are:-

(a) Do I need it?

(b) How can I best obtain it?

(c) What organisation will I need to build?

Previously in this chapter, the wide range of contractual arrangements for use as vehicle to obtain a construction project were highlighted\(^{11}\).

It was implicit from the evidence already revealed that the core participants in the project need to be brought together at the outset and until this is done, the client is the only member. As in NEDO (1983), the client itself may have very little involvement in this process, especially if it regularly pursues construction projects. It was usual for the client to retain consultants who understand the industry and there were often in-house specialists (such as project managers). It could be argued that it is likely that these people will pursue each project in the same way as previous projects irrespective of any difference in objectives of the client. Furthermore, first time clients would have the additional task of locating the appropriate consultants and other staff.

\(^{11}\) It was noted that it will be the client's choice which route to use but the decision which one is best suited to a particular situation is complex. As has been considered, guidance is available on this choice - Bresnen (1991) demonstrates that the final decision is often based on past experience and guidance from advisers.
Nahapet and Nahapet (1985) showed that, to be successful, a client should be clear about what it requires from the project and formulate clear and understandable objectives. A key tool in defining what the client requires and communicating this requirement to the participant was held to be the brief. A report by the CIOB (1980) shows how this document can satisfy a variety of functions, including:

1. Channel of instruction.
2. Means of structuring communication and discussion.
3. Record of decision.
4. Tool for evaluation.
5. Basis for estimating resource requirements.

Wood (1975) provided the essential requirements of the client's brief, which are given as:

1. A statement of the purpose of the project, its scope and content and any necessary background information.
2. A social brief indicating how and by whom the project is to be used.
3. A statement of the desired activities and functions, and the relationship between them.
4. A statement of the required timing of the project and an assessment of the consequences of failure to meet time targets.
5. A statement of the expected budget restraints, which in many public projects are likely to be determined by cost limits.

Also, Wood (1975) stated that the definition of user requirements is the most crucial client responsibility and it is the prime responsibility of the client representative to see that all the parameters of the project are set out at the earliest stage. Faster Building For Industry, NEDO (1983), concurred with this and extended the conclusion by revealing that these requirements may change during the project giving rise to variations which inevitably impede progress on the project. Darnell (1987)
recommends that the client should be able to review design drawings throughout the detailed design stage to see if the requirements are being met. The author’s analysis is that the absence of a clear client’s brief from the outset of a project often places the designer and client in the role of surrogate client. Wood (1975) supported this by describing how the dual role of designer and client is unsatisfactory for the designer.

Faster Building for Industry, NEDO (1985), also perceived a need for clients to have their buildings constructed more quickly and the role of the client in achieving this was summarised:

"The customer must want it [high productivity] and must choose a building team which will understand and share this objective. Responsibilities within a team must be clearly defined and in particular the customer must be clear who is the team leader".

Morrison (1986) described how the client has an important input into the construction phase. A particular example is that, as owner of the site, the client has a duty to provide the site on time as well as such details as ensuring that planning permission has been obtained.

Project finance has been shown to be important to the client in two aspects. Cox and Dale (1987) indicated the need to secure funding from the relevant source. The Role Of The Client In The Design Of Buildings, CIOB (1990), described the importance of arranging to make payments to the participants when they are due, albeit in a reactive manner:

[The client should] "arrange to pay the contractor at the necessary stages. The main duty is to honour certificates."

The Role Of The Client In The Design Of Buildings, CIOB (1990), also counselled that the client should be required to remain involved throughout the project to provide a range of information required by the project team and give direction and
guidance - especially in the event of unforeseen circumstances. The client would be, in this sense, one of the participants and should:

"become geared to provide information, make decisions and act upon them with the necessary urgency to maintain programme".

### 3.4.3 Client Objectives

Masterman (1992), looked at building projects and pointed to several reasons why a client will wish to promote construction:

1. For their own use as a facility to undertake part of their business.
2. On behalf of an existing client, for sale or lease.
3. To produce a building as a speculative product to be sold or leased at profit.

These proposals have parallels in the infrastructure sector.

Clearly, clients who undertake projects for different reasons will have different objectives. For instance, a public utility will wish an installation to have a long and relatively maintenance free life. More speculative projects will need to be attractive to potential purchasers (or lease holders) and will need to achieve a payback over a relatively short time.

### 3.4.4 Discharging the Client Role

The previous section considered the client role from the point of view of what the client needs to do - this section considers how the client can properly discharge these responsibilities\(^\text{12}\). Wood (1975) gave the key client responsibilities in this area as:

- The nomination of an individual to co-ordinate client requirements.
- The provision of a clear brief to the design team.

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\(^{12}\) This section draws heavily from Wood (1978). Although a relatively old report, the findings provided a rich source of thinking on the good basic activities a client should undertake.
* Monitoring the progress of the design and construction teams and involvement of the client representative in any major strategic decisions that may be required during the course of the design and construction process.

The same report stressed the importance of the ability of the client to continue to exercise strategic control. The key areas of strategic control were defined as:-

1. Selecting the design team and in conjunction with the designers and cost advisers, selecting the construction team and nominated subcontractors.

2. Agreeing with the design team key dates.

3. Collaborating with the design team over the development of the brief into firm design proposals to be agreed by the sponsor department or committee.

4. Monitoring against an agreed programme, the progress of the design and construction phases.

5. Meeting the design team leader to discuss progress and outstanding problems and ensuring that, if required, any remedial action is taken.

6. Restricting client initiation of major alterations to a minimum, and ensuring that any essential variations introduced after the letting of the contract are priced when issued and paid for at the time of execution.

Wood (1975) also demonstrated that many successful projects occurred when the client role was focused on a particular individual or department. This enabled the rather generalised aims of the end users to be converted into specific practical terms for the design team and the contractor. The author concludes that there is a major danger that, without such a focal point, the client’s objectives can be lost sight of by being fragmented between various individuals and departments. The dangers are highlighted by Wood as:

"Delays can arise for no better reason than that no single person took responsibility for the steering the project through decision making process."
The report went on to state that particular problems can arise if client (particularly public sector clients) operate through committees - there were instances of major failure through lack of co-ordination between client departments.

The report by Wood (1975) did define the key responsibilities of the individual nominated to perform the client role as follows:-

1. To act as focal point for the co-ordination of the requirements of the sponsor department committee, and for the liaison with other sections of the client body whose actions will influence the content and timing of the project.

2. In conjunction with the other relevant bodies, to define the scope and objectives of the project; to decide upon the relative weighting of priorities as between quality, space, time, cost etc.; and to agree upon the methods of proceeding.

3. Consequently to create a clear brief for the designers and to assist in the development of the brief in conjunction with the design team.

4. To react swiftly in obtaining any necessary strategic client decisions required during the design or construction process.

5. To monitor the overall progress and performance on the project.

6. To ensure that proper pre-arranged channels of communication were used.

Other, more recent, sources have suggested that the client should become more involved - effectively being the Project Manager (for example by providing in-house project management to direct the project). Baxter (1982) gives a list of attributes which a client adopting this approach should bring to a project, which includes:

(a) manage organisation;
(b) lead and motivate;
(c) hands on leadership approach;
(d) exercise authority;
(e) good communication; and,
(f) manage own time.
It has been shown that, generally, the lack of a clear focus for the client activity led to poor project performance. However, Baxter (1982) argued that the lack of a clearly identified client did not always lead to failure given a strong and competent design leader. The NEDO (1983) report, on the other hand, stated that it is important to recognize that the client does have important responsibilities to fulfil and that these cannot satisfactorily be delegated to the designer or contractor. The same report held that the client needed to ensure that sufficient time is allocated for undertaking the role. The existence of a nominated individual in the client role was not found to be a guarantee of success. Indeed, Wood (1975) further showed that much depended upon the ability, status and commitment of the person selected to fulfil the leadership role.

It was observed, from the foregoing arguments, that some weaknesses in the conventional view of the client role seem to include:

1. Confusion between the roles of the client and the Project Manager.
2. Based virtually all on the commercial building industry. Do clients in different industries need to behave differently?
3. Based almost entirely on what the participants feel is required from the client not vice versa. Does a client want something different from that which the industry believes they want?

3.4.5 The Impact of the Client on the Project

The previous section investigated how clients should discharge their role. This section considers the impact that these client activities may have on the project and its performance.

Wood (1975) suggested that a close relationship led higher performing projects: "private clients seem to be more closely involved in monitoring their projects than are public clients. They also appear to have accepted the need..."
for specific project management in the client role more widely than the public sector"

Faster Building for Industry, NEDO (1983) recommended that strategic choices made by clients as to how to organise and manage their projects could have a crucial impact upon subsequent project performance. In fact, the potential for increased productivity was clearly stated to rest not only with the industry and the individual project teams, but was also affected by various clients. Indeed, by ensuring the right approach to the project, it was claimed that clients could obtain their buildings more quickly and hence more efficiently at no extra cost. The same report provided evidence to suggest that the more experienced a client is, the better the projects for which they were responsible, were found to perform:

"In practice, most projects which went well were for experienced customers, and were ones in which the customer supplied a substantial and well directed management input".

Again, Wood (1975) reported that, very often, the client performed badly in terms of contribution to building success and providing information. It stated that, at worst:

"A client appears to come on the scene confused as to their wants, remain in the background and return to the wings at the end of the project convinced only that he has been overcharged"

This view appeared to be an extreme.

Wood (1975) also indicated that a construction project requires collaboration between the participants - client, design team and construction team. Two key areas were held to be important:-

1. The degree of client involvement in the project.
2. The nature and content of the brief.

The same report also noted that client involvement in and monitoring of the design and construction phases should not be allowed to become client interference - the
client should do what is necessary to retain strategic control over projects. The need to appoint a project manager separate from the client is implicit in the fulfilment of this ideal but the appointment of a project manager is by no means a guarantee of success. The role of the project manager in ensuring the client obtains high performance in the project is considered later in the chapter.

3.4.6 Experienced And Inexperienced Clients

A key driver in the style of role actually adopted by clients is previous experience of the construction industry. Bennett (1991) stated that there is a wide diversity of experience in client organisations ranging from first time through regular to those which can be termed as expert.

From much of the published literature it was apparent that the assumptions that, general, clients are inexperienced, as highlighted in this work by CIOB (1988):

"many clients are bound to be inexperienced, they have their normal daily business to attend to, so they will try to operate as part timers surrounded by professionals"

However, the same report came to the view that the role adopted by the participants needed to encompass activities that a more experienced client may take for granted as part of their domain:

"The industry needs to do more to fill the management gap left by the customer who does not have the experience or does not wish to provide this input. The traditional method of organisation involves the customer in different relationships with different firms, and many inexperienced customers were dismayed at the complexity of the process”.

Unlike an inexperienced client, one who is continually involved in the construction projects could almost become a “professional client”, which has its own active role to play alongside other professional project participants. Masterman (1992) noted
this feature and defined a “Frequent Constructor” as a client who has an annual spend and construction programme that is large enough to be of special interest to the potential contractors and other project participants. An “Infrequent Constructor” would alternatively not have this volume of work.

3.4.7 Client Management Vs Project Management

A weakness of the concept of project management was found to be that it suffered from a lack of definition. Whilst the term project is given to any activity with a defined beginning and end, project participants are likely to give the term project manager to their controller of their sub-project. In addition project managers can adopt a variety of styles – Lock (1996). Any of the participants (e.g. client, contractor, sub-contractor) can have their own member of staff called a “Project Manager”. The term project manager can be defined as “the person in charge of the whole project”, “our manager for the project”, “someone who works on the management of the project”. These definitions are subtly different. The former definition is taken in this research. Lock (1996) stated that the project manager can be of varying seniority. Project managers frequently looked after several projects but NEDO (1985) suggested that they should be dedicated to a single project. In addition, there are many places where the project manager can come from. In general the following are usual sources:-

1. The client organisation.
2. A specialist project management function owned by the client organisation.
3. A separate project management firm.
4. Be provided by contractor of designer.

The project manager may either be a specialist project manager; or be a professional (engineer/architect); or be a contractor.

The client exists at the head of the project organisation and NEDO (1983) argued that there is a need for a “Client Project Group” to progress such tasks as investigate
need, set up teams, preparation and development of brief, design function and feasibility, preferred solution, construction commissioning and occupation. Nahapiet and Nahapiet (1985) suggested that this may be built from in-house personnel or may be external depending upon the skills available.

With internal project management of this nature, the client project group and its project manager can be shown to have two difficult responsibilities. Firstly, there is a need to examine and define the client's requirements, set achievable objectives, monitor how these are being met and ensure that any corrective action is initiated. Secondly, the project must be managed on a day-to-day basis to ensure that the agreed objectives of the project are met. These two activities are mutually exclusive. Additionally, combination in a single project manager or group can potentially cause problems since the project manager would be both judge and jury on the project.

The separation of the responsibility for objective setting and direction from that of management and the achievement of objectives has been recommended by Darnell (1987) - and there is evidence to suggest that the performance of projects increases as a result.

The lesson to be drawn for clients was that they should ensure a clear division between "Project Management" and what could be described as "Client Management".

3.5 PERFORMANCE AND VALUE FOR MONEY

3.5.1 Definition of Performance

The previous sections reviewed various reports and choices of contracting arrangement - the work undertaken by these sources was aimed at ensuring that the

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13 Ibid p 147
construction industry could deliver maximum performance to its clients. Virtually without exception, each piece of research defined its own perspective of performance. This made it particularly difficult to compare the results and equally difficult to decide which elements of performance were important to the client.

Performance definitions generally embodied questions such as:-

- Has the client received the project that it wanted within budget?
- How well did the project compare with other similar projects?
- Was the project acquired at the minimum price for the exact requirements?

As with most of the work, performance was defined from the point-of-view of the project (or at least the project manager). However, as Cox and Dale (1987) noted:

"Only the owner can judge whether he has got value for money spent and whether his objectives have been met."

The problem of defining project performance was an important consideration. Performance was difficult to ascertain in an absolute form, as projects were only being compared with previous experience. Perhaps the simplest view of performance was Client Satisfaction but most sources agreed that time and cost considerations were important (and easily measurable). It was difficult to relate price data to previous prices or industry norms. Performance was more readily rated by increase of actual times over planned times but this provided something of a broad brush measure. Value-for-money was often cited as the goal for clients, but there was little clarity about what this meant. Wood (1975) defined value-for-money as "return on investment for private clients" but notes that this was more difficult for public clients. The definition of "maximum benefit within budget" was suggested.

Masterman (1992) cited a report by the Audit Commission which focussed on problems encountered in publicly promoted projects and concluded that they often stem from one of the following issues:-

- Poorly defined/over defined specifications.
- Unenforceable contract conditions.
Inadequate tender evaluation processes.

Inefficient contract monitoring.

Bureaucratic contract administration - leading to delays, on-costs etc.

Problems with definition or delivery of the client role.

Performance was held to be effected by the risks at large within the project and how well they are managed by McGowen (1992). Table 3.3 details the most important risks and the factors that may aggravate them.

<table>
<thead>
<tr>
<th>Key risks and factors leading to their aggravation</th>
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<tr>
<td><strong>Risks</strong></td>
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<td>Variations.</td>
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<tr>
<td>Programme sequence and method of execution of the works.</td>
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<td>Work executed by the client or by others.</td>
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<td>Postponement and/or acceleration.</td>
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<td>Timing of the issue of instructions or information.</td>
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<td>Possession of the site.</td>
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<td>Unforeseen ground conditions.</td>
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<td>Completion, commissioning and handover to client.</td>
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<td>Ambiguities, discrepancies and errors.</td>
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<td>Weather.</td>
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In addition, cost performance was stated to be affected particularly by:-

- Scope for dispute.
- Payment.
- Variations.
- Delay and disruption.
- Delays in the settlement of claims.
- Irrationality in the valuation of claims.
The evidence supported the view that the definitions of performance appear to fall into three distinct types:

- **Hard measures of project delivery;** such as completion to time and specification. These are of most use to project participants, but do show a measure of the efficiency of the project process. They can be used to compare against other (similar) projects. It is important for a client to know that the project has been delivered *efficiently*, but the client will probably not have sufficient base data to be able to compare against other clients’ projects. The project team need to be responsible for this performance measurement.

- **Hard measures of commercial success,** such as return on investment. These measures are more important for the client, but are largely irrelevant for the project team. These types of measure look at the *effectiveness* of the project. These performance measures are driven as much by the success of the client’s main business as by the success of the project.

- **Soft measures of client perception.** Many clients have only the most rudimentary measures of the performance of their projects and the perception of individuals within the client’s organisation can be more powerful in the perception of how well the project was delivered. Although it is relatively easy to measure and analyse client perceptions, they rarely give a reliable measure of how well the project performed - being more often connected with the health of the relationships between the project and the client.

### 3.5.2 Tools for measuring performance

Several of the NEDO reports already considered methods for measuring client and project participant perceptions. The “hard” measures of time, cost and functionality may be measured with relative ease during the project.
Harrison (1992) stated that performance analysis could be based on three concepts:
types of “control centres” (such as: work packages, overheads, and cost accounts);
work breakdown structure and earned value. A framework of project reporting that
may be used to monitor and compare project performance was also developed, which
used variance analysis built up from project budgets, prices and predicted cash flow.

This type of analysis appeared to possess several weaknesses:-

- It dealt with historic information only. Although it is important to know past
  performance; for practical control purposes it is also essential to know what will
  happen in future and whether the rate of work is accelerating or decelerating.

- It did not use all data available. There is a need to analyse three things together:
  planned expenditure of resources; actual expenditure of resources and value-
  earned.

- It was not a clear indication of performance. There is a need to define more
  detailed performance indices.

A pure measure of cost performance was considered by Harrison (1992) - the amount
of “cost escalation” during the life of a project. This was defined as:

“*The difference between the final cost, or latest estimate of final cost, and
the original definitive estimate*”

or

“*the change in estimated cost over time*”

Quality and functionality were found to be more difficult to measure Harrison (1992)
as they require some form of quantification of complex technical issues. Most
projects assumed that quality and functionality were fully delivered even though
participants may understand that the specification had been relaxed in certain areas.
There was a need to treat functionality and quality issues in the same way as cost and
time.
Value analysis (as used in Value Engineering or Value Management) was cited as a technique for improving project performance by many authors and is variously discussed by Male & Kelly (1991), Green (1990) and Dell'Isola (1982). It is concluded that, if applied in a systematic manner, Value Analysis can not only provide a method of measuring quality and functionality, but also of integrating these with cost issues. This would give a holistic measurement of project performance; but no source appeared to have made this connection.  

3.5.3 Impact Of Procurement Route On Performance

The link between the procurement route and the actual performance of projects has been researched by a range of work. For this research, it is necessary to consider if there is evidence to support (a) if there is a link between procurement route and performance and (b) if this is the main driver of performance.

• Cost

Wood (1975) included research in which the performance of projects procured by the conventional route was measured. In a small sample of factory projects, only 26% were completed within 5% of the estimated cost. The remainder exceeded the budget figure by a greater margin. In a similar sized sample of office projects, 33% were completed within the 5%. However, Masterman (1992) cites a report by the Department of Trade and Industry and the Department of the Environment jointly, which stated that the conventional method of procurement provides a high degree of price certainty and competition.

The client's perception of the financial consequences of using this procurement system, as identified by CCMI (1986) in a survey of management contracting, was that it tended to cost more than conventional methods and in addition the
uncertainty regarding the end cost was seen as a distinct disadvantage. The survey of 10 experienced clients carried out by Naoum (1990) found that:

1. All of the respondents believed that management contracting was more profitable to the contractor than to the client.
2. 30% of clients surveyed were of the opinion that management contracting involved fewer claims; 40% believed the method involved the same number of claims as other methods and the remainder did not believe the method involved fewer claims.
3. Only 20% believed management contracting was cheaper than other methods; 40% believed that the method produced the same level of cost and the remainder were of the opinion it was not cheaper.

Masterman (1992) cited comparative research that showed some construction management projects that were surveyed had a lower average cost than the management contracts that were examined and that the average cost overrun for the former method was 3% whilst the corresponding figure for the latter was 7.3%. However, very little further specific evidence appears to exist with regard to the comparative cost of this method and it must therefore be a matter of conjecture as to its relationship with other procurement methods in this respect.

**Time**

The NEDO (1974) guide showed that of the sampled factory projects carried out using the conventional method nearly 55% were completed within 5% of the programmed time for the design element and 51% for the construction element. Similar figures for office buildings in the same study revealed that nearly 60% of the projects were completed within the same percentage of the estimated construction period. Thus, between 40% and 49% of all the projects surveyed overran their estimated design and construction period by an excess of 5%. Wood (1975) also established that of a sample of 2000 public sector building and civil
engineering projects which were examined over 80% were implemented by the use of the conventional procurement method; whilst no specific results were obtained for this major element of the sample, over 60% of the total projects overran by an average of 17.4% with a third exceeding the estimate project period by more than 30%.

_Faster Building for Industry_, NEDO (1983), found that the time saved by the use of variants of the conventional system during the pre-construction phase of the project, it was established that further savings could be made during the construction phase itself by over 10%. Another report produced by NEDO (1988) surveyed over 500 industrial companies, the majority of whom had carried out construction projects using the conventional procurement system. It found that of the 300 or so who had recent capital investment experience, 17% were dissatisfied with the project times achieved by the construction industry.

Sidwell (1983) provided a description of research into the attitudes of the client organisations to management contracting supports this perception in that 100% of the respondents to a questionnaire comparing this method with the conventional approach were of the opinion that management contracting allows an earlier start to be made on site and resulted in speedier completion of the project; 90% of the respondents also believed that the use of this system resulted in more reliable predictions being made as to the eventual length of the construction period.

_Faster Building for Industry_, NEDO (1983), showed that management contracting type procurement systems produce the best performance in terms of construction time. Barnes (1977) found that ‘the pace of construction work on all of the projects did not differ sufficiently to conclude that management contracting has an overwhelming advantage in speeding up construction’. However, this latter study did establish that the risk of delay was reduced as a result of the system’s flexibility and its ability to be able to accommodate and overcome difficulties and changes.
When comparing conventional methods of procurement with approaches such as construction management, NEDO (1974) and NEDO (1983) both confirmed that, on average, the design and construction phases of projects were shorter. Masterman (1992) cited analysis of management contracting and construction management established that significant savings in time could be made and early start on site achieved when using either of these methods. However, construction time overruns were greater. *Thinking about Building*, NEDO (1985), advises the use of this method when early completion of the project is important or crucial.

- **Functionality and Quality**

Naoum (1990) found that 80% of the respondents did not believe that the use of management contracting provided a better design than that achieved when using the conventional approach. However, most respondents acknowledged that management contracting was not chosen for this characteristic. On the question of the quality of the completed project, Barnes (1977) found that the level that had been achieved ‘appeared to be largely better under the management contracts than the generally conventional expectation’. The conclusion was that the quality standards achieved are at least as good as those obtained on conventionally procured projects. On the question of the construction management contribution to the ‘buildability’ of a project, Bennett (1991) reports that ‘the detailed design observed were no easier to construct than those produced in conventional practice’.

- **Is there a link?**

The evidence produced here suggests that there was a link between procurement route and performance, but its effect on the main areas of performance was not clearly determined. There was, then, a need to clarify this issue (see later).
3.6 THE CLIENT ROLE AS PROCUREMENT

3.6.1 Some evidence from Literature

Some attempts had been made to define the wider concept of Procurement in a project environment. In construction it is often difficult to distinguish this from Project Management:

"Procurement is the amalgam of activities undertaken by the client to obtain the building."

or the more detailed:

"INCEPTION - Brief, financial assessment, planning requirements, environmental impact, decision on project management or other procurement method, decision on proceeding.
DESIGN - Alternative conceptual designs, strategic development of chosen design, detailed development of design, preparation of detailed drawings, design of temporary works approval of contractor design, payment for design.
CONSTRUCTION - Selection of procurement method, selection of main/managing contractor, selection of works contractors and nominated sub-contractors, determine works programme, insurances and definition of liabilities, mobilisation of resources, overall management and co-ordination, management of works, inspection/approval of works, payment for management, payment for works.
COMMISSIONING/TESTING - Testing of installation, commissioning of works, warranties and guarantees, handover, final payment to parties, responsibility for running/maintenance."

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15 The Oxford English Dictionary (1989) gave the accepted English usage of procurement and states that it engenders the following concepts: obtain by care or effect, acquire, to contrive to obtain or bring about, to bring upon one, to induce, to urge earnestly, cause, induce, provide, acquire.
Harrison (1992) stated that procurement entails: project liaison; buying; inspection; progressing and expediting. Lock (1996) used the phrase "Purchasing Cycle" to explain how procurement contributes to the project. This involved:-

- Statement of use (demand).
- Supplier selection.
- Order preparation.
- Supplier receipt and acknowledgement.
- Expediting.
- Delivery & invoicing.
- Goods inward inspection.
- Stores receipt.

The frequently quoted generic procurement objective:

"To purchase the right quality, at the right time, in the right quantity, from the right source, at the right price",

is true enough but did not throw much light on the activities actually required to be undertaken.

England (1970) gave a definition of what procurement entails as:

"...learning of the need, locating and selecting a supplier, negotiating price and other pertinent terms and following up to ensure delivery... ...additional functions of material supervision such as inventory control, traffic receiving, incoming inspection and salvage operations."

Scheuing (1989) stated much the same thing:

"Recognition of need, requisition issued, requisition received, specification developed, vendor search, vendor selection, purchase order issued, contract order issued, contract formation, expediting, receiving and inspection, contract completion."
Dobler, Burt and Lamar (1990) also defined procurement by listing the activities involved:


### 3.6.2 Client Procurement

The concepts that seemed to recur in the quotations were:

1. Acquisition of something, is involved,
2. There is some precognitive influence,
3. That influence is at an "arms length" - i.e. the procurer is not actually doing the thing themselves, or even explicitly ordering it to be done, but providing an influence that makes it occur.

The concept of procurement could be seen as one that ties together all of the concepts of client management. It was a process by which a Client can influence the Project. Almost by definition, a Client who was involved in Procurement is an active client\(^{16}\). A distinction has to be made between the Procurement activities of a Client organisation - which were primarily aimed at securing the services of the best available Project Participants - and the procurement activities of, say, a contractor - which were aimed at the supply of the most basic resources.

It was proposed as a result of the foregoing research that the questions to be answered were\(^{17}\):-

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\(^{16}\) Ibid p 111

\(^{17}\) This point was the subject of debate within the team drafting the Construction Round Table, CRT (1995), report on end project checks.
1. Can we view the client role as a procurement activity? If so, does this assist in our search to unify theory and practice in the organisation?

2. "Is procurement:
   a. a stage in the construction project;
   b. an activity that takes place throughout the construction project; or,
   c. the whole project from the client point of view?"

3.7 THE IMPACT OF THE CLIENT ON PERFORMANCE OF INFRASTRUCTURE PROJECTS

It was concluded from the evidence presented in this chapter that there are weaknesses in the existing accepted body of work. The principal weaknesses appear to be:-

1. Most existing work is based on building construction. This poses questions of; (a) how much similarity is there with infrastructure, and, (b) to what extent can conclusions for building be applied to infrastructure? There was evidence that infrastructure is basically different to building construction because:-

   a. It is more difficult to measure performance. There is an absence of units (such as floor areas, number of storeys) on which to base measurements.
   b. All projects are sufficiently different to hinder comparison between any elements that are common. It is difficult to establish norms.
   c. These add up to generally a greater complexity.

However, there was evidence that research into building is applicable to construction, if the following criteria are satisfied:

   a. The nature of the clients and their objectives are similar
   b. The constraints on the project are similar
   c. The dependencies within the project are similar.
   d. There is a similarity in the end use of the project. For instance, used to obtain a revenue for the owner.
2. The majority of research looked at the project from a project and not a client point of view. The question to be answered here was: will the conclusions stand when the client's priorities are paramount? There was evidence that those conclusions derived from work looking at how the industry can improve its delivery to the client remain pertinent, but those conclusions relating to internal processes of the construction process may not always be relevant.

3. Most work reported here assumed that a client possessed little knowledge or expertise in construction. Since the clients within this research were experienced regular constructors of infrastructure, the question posed is: how will the recommended client role change if the project is being promoted by an "expert client"? There was evidence that more regular clients are willing and able to take a greater involvement in their projects and that they use a greater number of internal processes.

4. There was no real distinction, in the published work, between project management and the role of the client's organisation. The evidence has suggested that there is a distinct "Client Management" role to be performed by a client organisation.

5. Most clients within the work studied were assumed to have a passive role. The evidence suggests that a more active role will have a greater impact on project performance. However, little evidence was available on when and where this greater involvement should occur to ensure it improves project performance rather than interfering with it.

6. The type of Contracting Arrangement and the selection of the right participants seemed to be accepted, by a large body of work, as the main drivers on performance. The chapter has revealed work that has refuted this view. The
chapter did not, however, produce evidence to determine what are the key drivers on performance.

The client, therefore, had a fundamental role to play during the creation of his asset. The initial decision to undertake the project was the client’s, he pays for it and will use it when completed. If this is all he does, then the involvement is somewhat passive as after setting the project under way, the client effectively puts all his faith in the Project Manager until completion - merely providing sums of money as requested. A client who builds rarely may be quite happy with this situation as he should be able to employ professionals who are a great deal more competent than he is. If there is any greater role for a frequent client, the question arises as to whether the client can influence project success by means other than just competently performing the basic duties already mentioned? In certain circumstances the client may well know more than any of the project staff. For example, the likely trade off between the cost and benefit to him of variations. A frequent client will also probably have views on which participants have performed well in the past.

3.8 REVIEW

A wide ranging literature study was undertaken and reported in this chapter. The review revealed much previously published work on the subject of Procurement Routes; improving construction project performance and project management skills. Less published work considered the role of the client. The following findings were made at this stage:

1. Much of the research work has been directed at commercial buildings and comparatively little published work has considered the particular needs of commercial infrastructure clients.
2. Most work has looked at the problems from an industry point of view. The client has a different perspective.

3. The client should be proactive. This may be difficult for small clients as it can be hard to "buck the market".

4. Most work has not studied what causes a client to adopt a particular style of role.

5. There has been no attempt to establish a unified picture of the possible benefits of a developed client role.

6. It is difficult for the project professionals to undertake the activities which transcend the individual project - for a variety of reasons. These "super-contractual" activities are ultimately the responsibility of the client, even though they may be undertaken by professional advisers.

7. Value Engineering techniques have been used to evaluate projects to ensure that they produce the best combination of cost and function. The impact of later income is important to the client; but is not part of the traditional definition of value.

8. Large clients can use techniques to influence their suppliers and contractors. This is positive as there are weaknesses in using purely contract based methods of procurement.

9. There is little agreement about what the procurement of a construction project precisely involves.
10. The client does have a positive impact on the success of a construction project. However, the particular objectives of a client are rarely expressly considered - even though these may be paramount.

11. The detailed roles of the client tend to depend upon the form of organisation selected for the project and there is no unifying theory that covers the entire life cycle of the project.

12. It was difficult for the project professionals to undertake the activities which transcend the individual project - for a variety of reasons. These "super-contractual" activities are ultimately the responsibility of the client, even though they may be undertaken by professional advisers.

This gave rise to a series of questions about what these reviews tell us regarding how clients can obtain construction works in the best ways for their business:-
1. How closely do the theoretical views expressed by the literature match practice?
2. How can the client bring its influence to bear on its project so that the best possible performance is achieved?
3. How can relationships throughout the supply chain be improved by action of the client?
4. Are we able to determine an all embracing concept of project performance?
5. Do clients who undertake infrastructure projects frequently, have more influence on participants than those who do not?
6. Are the commercial benefits great enough to justify the "costs" of the additional involvement?

We will need to compare the views expressed in the published literature with what apparently occurs in practice. The following chapter considers this. Particular work is required to:-
1. Fix a definition of construction project procurement from a client's point of view.
2. Investigate how infrastructure projects differ from building projects.
3. Discover if clients who build frequently possess any expertise and, if not, can they acquire any.
4. Having expertise, investigate in what way clients can play a more active role to improve the end result of their construction project.

At this point in the research, it has been demonstrated that thinking on the client role was far from fully developed. The research now had the task of investigating the client role in tandem with analysing its impact on performance. A key question was "is there only one best Client Role or do different ones work in different circumstances?"

If it was accepted that there was no one best client role, this gave a complex set of choices, and the best role may well depend on various "contingent factors" – i.e. factors on which success of the project was contingent upon. The current thinking reported above also appeared to suggest that the client role should be relatively passive – however what can the client do beyond the basic requirements to:

(a) follow the advice of professional advisors in setting up the project;
(b) supply the project professionals with what they require during the project;
and,
(c) largely let them get on with it?

If, on the other hand, the client needs to become more "pro-active"; this would raise additional questions, such as:- What types of client will benefit? Is there only one best client role or is it contingent upon circumstances (e.g. as for procurement route)? What does a client have to do to become pro-active? What are the likely problems?
Chapter 4

A PILOT STUDY WITHIN ONE ORGANISATION

4.1 OVERVIEW

In the previous chapter, the issues that provided the background to the research were investigated. The chapter concluded by both questioning what criteria were driving the performance of the project from the client’s point of view and how project performance should be measured to properly reflect the client’s needs. This chapter reports a case study into one organisation, which seeks to suggest the relevant criteria.

The organisation selected to study the client role is an organisation providing the infrastructure of the railway industry – to provide anonymity this was referred to as TransOne. It was important that the chosen organisation was representative of all organisations in the field of study. In all except for one area TransOne is wholly representative of the type of company within the field of the research – the organisation was currently a public body. Since the researcher undertaking the study was an employee of this organisation, it was possible to make use of an extremely wide and detailed level of access to both people and activities. This has allowed the use of research tools which can investigate the client procurement activities in far greater depth than those reported on in most of the available literature.
4.2 THE PROJECT PROCESS

4.2.1 Key elements of the process

The defined corporate processes built on the generally accepted project management techniques. Firstly, additional stages were created that preceded the start of the project; were intended to confirm that the project is required and that the project was adequately defined. Secondly, the actual project management system was tailored to suit the particular requirement of the industry. The key stages of the corporate process were:-

1. Initial Proposal.
2. Appraisal.
3. Option Development.
4. Investment Authority.
5. Implementation.

4.2.2 The Role of the Sponsor and of the Project Manager

Within the organisation, the term “Sponsor” was used to define the individual who performed the client role - however the individual was often remote from the project and generally used junior members of the same department (i.e. the project manager or project team members) to discharge any activities required.

The project manager’s role involved the following business tasks:-

1. Ensure that the project objectives will lead to the business needs being fulfilled
2. Review the objectives of the project if the business needs change
3. Where possible enhance the project's value to the business.

However, no guidance was given to the project manager on how to achieve these. The project manager was also expected to plan the main aspects of the project:
product; programme; cost; organisation; contractual strategy; resources; safety arrangements; assessments of risks; spend profile; and, external constraints.

4.2.3 Project Organisation

There were essentially four types of project organisation recognised by TransOne:-

1. Dedicated project team.
2. Matrix management.
3. Nominated people, but functional control.

All four types were used, but the normal organisation (on which the procedural guidance is based) was Matrix Management. For this reason, the key lines of communication within the project organisation were usually:-

1. Between the Project Manager and the Sponsor, to ensure that the business needs are understood and the benefits to the business maximised
2. Between the Project Manager and the functional departments, to ensure that their work is correctly targeted, and that the project team is fully informed as to progress, problems and possible variations.

The communication process is driven by formal techniques: meetings; memoranda; reports from the project manager to the sponsor and from functional departments; and, standard documents (such as time sheets, closure notices)\(^1\).

4.2.4 The object of the procurement activity

Procurement was seen as the means of securing resources, skills, equipment and materials not available internally. The procurement department was expected to

\(^1\) The documented approach proved to be useful for data collection.
assist the Project Manager decide a “procurement strategy” and undertake the procurement activity. It is viewed as highly important that:-

1. Contracts complement the work package breakdown and the responsibility structure of the project.

2. Contractors and suppliers are chosen who are competent and motivated to perform.

3. Provision was made to obtain key plan and progress information on a regular basis.

4. Lessons learned about contractors, forms of contract, and impact upon the project should be recorded and used for future works.

Standard conditions of contract were used wherever possible, but some clauses are modified by the use of:

(a) standard client defined modifications for all projects; and,
(b) project particular modifications.

All modifications were expected to be controlled by the procurement directorate. In particular it must be ensured that the contract documents specify adequate information flow, plan and actual, to allow the contractor's progress to be monitored and to instigate corrective action.

TransOne maintained lists of approved contractors for different types of work, from which the tender list was prepared by the contract holder. Project managers were expected to apply their experience to the suggested tender list, and to the evaluation of tenders received. The project manager approved the tender list and the final choice of contractor.
It was a recommended practice within *TransOne* to review a contractor's performance after the work has finished to primarily look for lessons for the future\(^2\).

### 4.2.5 Project control

The corporate processes in *TransOne* were built on the premise that optimum project performance will occur if the key controls are properly applied\(^3\). There were five main areas at which control is directed.

**Product control** was intended to be an integrated programme of work aimed at specifying, developing, constructing and implementing a product which satisfied (in all respects) the needs of a Sponsor. The control method was intended to identify modifications to the product which improved the commercial position of the Sponsor and deliver these modifications without disruption. A good product was considered to be one that achieved a compromise between the desires of the commercial manager, the operator, and the maintainer - in the simplest and most economic fashion. The Sponsor was responsible for clearly defining the business needs, but responsibility for the overall suitability of the product to satisfy the business needs (and thereby maximising the benefits to the Sponsor) rested with the project manager\(^4\).

**Programme** was controlled by a hierarchical programme method\(^5\). Progress reports were expected to be a key method of ensuring that the programme is adhered to.

---

\(^2\) If this is correctly followed, this will provide a useful database of project performance. We will see later that this information is rarely kept.

\(^3\) Again, the detail of the requirements and the document based approach makes this an attractive source of data for the research.

\(^4\) However, it is noted later that projects often have a low visibility in the early stages when it can be difficult to get senior managers to spend adequate time to take the necessary decisions yet these decisions will have the greatest impact on the final product, and on its cost.

Financial control on projects was directed at expenditure control and cost control\(^6\). Expenditure\(^7\) being:

\[
\text{SPEND TO DATE} = \sum (\text{ACTUAL PAYMENTS} + \text{ACCURUAL FOR WORK DONE})
\]

The accrual element of expenditure was calculated by the Project Engineer or Resident Engineer. As a result an accurate view of expenditure could not be obtained directly from any financial system within TransOne\(^8\). Cost control differed from expenditure control in that it was forward looking and aimed at influencing future costs; expenditure control is aimed at accurately recording historic information. Cost was defined as:

\[
\text{FORECAST TOTAL COST} = \sum (\text{ESTIMATE FOR WORK} + \text{FORECAST VARIANCE IN COST})
\]

All estimates for Authority were prepared in terms of current day money at the Base Date at which each estimate was prepared. Thereafter all reports, variations and applications for re-authority are prepared using costs expressed at that Base Date. This meant that actual costs which were incurred, or estimates which were prepared, at times earlier or later than the Base Date were inflated or deflated to Base Date levels.

To control safety, a project safety strategy was compiled, finalised and accepted by all involved in the implementation of the project prior to authorisation of the scheme.


\(^7\) Definition: "Expenditure is the financial cost of work done (or goods and services received)".

\(^8\) This does place reliance on the project team properly undertaking a valuation of accruals at the appropriate time.
The purpose of variation and **change control** in *TransOne* was to ensure that modifications to the project are accepted only after adequate assessment of their impact upon the project as a whole\(^9\).

### 4.3 PROJECT MANAGEMENT IN PRACTICE

#### 4.3.1 Pre-authorisation practices

In general, the responses provided evidence that the actual projects adhered well to initial appraisal and authorisation processes. The one exception - and this was a fairly major one - was an activity known as "quick-spend". This arose because capital budgets were defined annually and if money was not spent by the end of the financial year it was forfeit\(^{10}\). Many projects (or often parts of projects) that were in a reasonable state of development would often be granted funds at very short notice on the authority of one senior manager.

The project portfolio was controlled by a Divisional Investment Panel and they managed programming and timing issues. Although the panel members were from the client side of the business, one manager believed they were too far away from the detail to allow proper judgements to be made [C16]. When other managers were questioned on this issue, there was a split of opinion between Client and Project Managers as to whether this was a good or bad feature. All Client and Project Managers agreed that there was, in general, a lack of experience in the Divisional Investment Panel - both in the needs of the project team and in business skills related to project development.


\(^{10}\) Budd (1983) discusses this feature of publicly funded organisations and suggests strategies to alleviate the problems. Publicly owner organisations are not allowed to plan projects to a total value of more than 100% of the available money. Contingencies are tightly controlled and do not reflect the risks of delay to such projects. It is therefore, almost impossible to meet the capital spend targets without a more sophisticated process.
No packaging of projects or parts of projects occurred in any of the project portfolios studied; this was attributed to the fact that every project was separately authorised in a one step authorisation process that allowed work to commence as soon as the authority was given [C27]. As was noted earlier, there is no requirement to package projects in the investment regulations.

No evidence was found of commercial business input - the business managers were general managers with production or engineering backgrounds. Their business skills seemed to relate to the ongoing operation activities and not to development of those activities. Few respondents agreed with this view explicitly, but was no evidence to the contrary.

Once authorised, the project objectives were regarded as set. Objectives were not defined in any formal manner within authority papers and it was sometimes difficult to determine the exact objectives. There was also no evidence to find authorising bodies reconsidering objectives during the project even though there was evidence that the project objectives did change [C37].

It was observed that a lot of effort can often be spent in an appraisal due to the difficulty of collecting data and of tying this into the client's business objectives.

### 4.3.2 Implementation of projects

The importance of the brief identified in the previous chapter suggested that project briefs would be produced as part of the authorisation process even though the corporate processes did not require this. The relatively narrow purpose of the authorisation documents meant that the documentation produced for financial authority needed to be translated into a working brief before implementation is begun. Where this occurred, it was undertaken by the project manager [C27]. There appeared to be no other resource to undertake this work. Some project managers
undertook substantial development work to produce a brief of which they were satisfied.

Some project managers believed that there can be enough detail in the authority document to perform the function of a brief [C6]. However, when used in this way some of the key features of a brief were not present. Also, the project manager may have been able to use the authority documents as a brief; but there was evidence that other project participants (e.g. Designers) needed more guidance - which they obtained by direct questioning of the project manager, users or the client.

Even where a formal brief was produced, it was rare to find this document updated as the project progressed. Clients, however, believed that the brief needed to be a “live” document [C22].

In general, the design activity was left to designers. There was little direct input from project managers as they did not feel competent in this area. However, most project team members acknowledged that the design stage is a key point where costs are fixed. The evidence revealed that designers talked directly to users to define detailed requirements. Project participants believed that this was sufficient and no one acknowledged that there may be a better way.

This situation appeared sufficient where a good brief had been produced that defined the important elements prior to commencement of the project; thus leaving the design team to ensure that less important elements fit with the overall requirements. It appeared less satisfactory where major issues were not formally defined and the project designers were left free to decide such issues themselves or with end users - all of whom may not have been aware of the client’s aims and objectives for the project.
Interestingly, the project manager’s direct involvement in the construction phase generally consisted of: selection of contractor and monitoring progress from report provided by the construction supervision team. The actual supervision of construction was left to specialists.

Again, the project manager did not have specific input during commissioning [C11], although there did seem to be an obvious presence on site of most project managers at this stage. This was explained by several project managers as a need to ensure proper and smooth handover to the client’s staff (i.e. users). The visibility of project managers to project participants seemed to rise with increasing interest of client [C11].

Project teams regarded the commissioning of a project as an evolution of the design and construction stages rather than a separate activity in its own right. Few construction teams had formal processes or activities connected to smooth handover and no project manager provided these. Problems were experienced with training, handover and maintainability issues. Several clients pointed to their view that commissioning was problematic and that this was due to the project manager being concerned with the next project [C5, C12, C13]. They felt that project managers regarded acceptance by the client and immediate operation by users as merely a hurdle to clear. Whilst not being as forthright in their opinion, several project managers agreed with this sentiment.

4.3.3 Post-implementation

Maintenance procedures and operations manuals were handed over as part of the commissioning process - although this did not always occur. Project managers did not always become involved in this process and there were examples where the project manager had not checked if this had occurred. There was no example of a
project team having become involved in maintenance or operation as part of the project review process.

One client department did require that back checks be done on all projects over £500K. The report was made to the investment body within the department; with the Sponsor unable to change the project managers report - but able to add an overview. [C37]. Other client departments did not make such reviews mandatory but it was a common practice to summarise lessons learnt placed on the project completion certificate. Project managers were responsible for any project review that did occur, and they were also left to choose what was reviewed and how the review should take place. One project manager had a set of requirements that he believed the review should address [C27] - see table 4.1.

<table>
<thead>
<tr>
<th>Table 4.1 Requirements of Review¹¹</th>
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<tbody>
<tr>
<td><strong>Sponsor:</strong></td>
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<tr>
<td>• Overall benefits and hidden benefits</td>
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Others had similar views on the contents of the review:

"Questions to be asked are - Did the PM fulfil their side of the project for the client, how did the PM and project overall perform, how did individual elements perform" [C1].

Sponsors were not provided with guidelines on what they should expect from a review - one client asserted: "Sponsor should know what to look for". At best this resulted in lack of consistency; at worst, less experienced clients do not perform the activity properly.

---

¹¹ Source: List provided by Project Manager [M13] based on introduction to remit for Investment Panel for this department.
Not surprisingly, the fact that project managers were left to do the review and were not chased by the client often meant that reviews tended not to be done [C27].

In summary, post completion reviews did not always happen; when they did it was rarely a thorough process and the results of the review were provided as a report and hence were not disseminated widely. It was observed that the review process appeared to have little value outside of the immediate project participants - one client did not see this as unusual:

"Organisations don't learn but individuals do" [C40].

This opinion ignored the considerable amount knowledge included within corporate processes and policies.

4.3.4 Commercial Benefits

Project managers and clients were asked about what commercial benefits were expected of projects and who was responsible for their delivery. There was agreement that the project managers could not be responsible for all commercial benefits; but there was generally a very simplistic view of the benefits to be gained [C37]:

- Company operations not inconvenienced.
- Company will get money back.
- Safety - but there are difficulties in quantifying this in a meaningful manner.
- Back checks are undertaken.

Indeed, this was also reflected in low opinion of the motivation behind projects:

"The Hidden Agenda is often that money is there to be spent" [C37].

There was a lack of data on base costs within the industry and this led to an inability to evaluate or explain the impact of the project on real costs. Furthermore, this meant
that it could be difficult for project managers to see success to business objectives [C24]. This problem was shared by clients:

"Assessing the impact of the project on business ROCE\(^{12}\) is a problem and this allows massaging of the project plan" [C32].

With the fundamental weaknesses found; it was not surprising that more complex techniques; such as risk assessment; were not undertaken [C17].

4.3.5 **Procurement and Contractual Issues**

It was general practice for the project engineer to choose the form of contract that was appropriate. One project manager believed this to be a beneficial situation as the decision: (a) may confuse the Project Manager; and, (b) the Sponsor did not care [C37]. Other project managers recognised the need to consider more sophisticated issues:

"There is a need to set a procurement\(^{13}\) strategy and ensure it meets the needs of the project" [M13].

and some managers noted that procurement was a key issue to be resolved in a successful project:

"key need is someone who knows what they are doing in procurement - procure the procurers first" [C27].

4.3.6 **Project control**

Project managers and clients agreed that, within *TransOne*, the only central control on the project process was on money - its availability and progress against spend plans [C27]. Although the monitoring process sought to identify potential

\(^{12}\) Return on Capital Employed. Pizzey (1994) gives this as the measure of percentage return on capital involved in business activity.

\(^{13}\) Contracting strategy and tender process.
overspend, any underspend (potential and actual) was not managed [C32]. The measure used to monitor money was [C13]:

<table>
<thead>
<tr>
<th>SPEND TO DATE</th>
<th>PREDICTED TOTAL SPEND</th>
</tr>
</thead>
</table>

Changes to the project occurred quite often; mainly due to the following reasons [C27]:

1. Extra work being found.
2. Change of mind by the client.
3. Change of Board/national standards.
4. Results of enquiry into incident.
5. National policies to upgrade standards.

and [C40]:

"The reasons are:

more information becomes available, decision was good at the time it was made;
obsolescence; and,
risks change over time."

There was general agreement that the process did not provide a proper feedback of the results of these changes [C40].

Client staff were aware of the need for them to give decisions on time and to project timescales otherwise the programme may be affected, but they generally had a simplistic view of the way that they would impact on the programme:

"if you do things just in time then things turn out just about right - if you don't then they don't" [C40].

Project managers, in general, asserted that programmes tended to be over optimistic; both from project engineers and clients [M13]. They believed they were the individuals who should bring some realism to these programmes. The programme
was felt to be the most important element that required control; but that it was often the weak link. In practice, more emphasis was needed to produce a programme that was in sufficient detail, and was robust [C8]. Client and project managers both agreed that the timing of projects was agreed to often be driven by things outside the project [M13, C1, C10, C15, C22].

Project managers were particularly strong in their views that the change control process defined in the corporate manual should be applied - there was evidence that the process was applied in all but a few instances [M29].

Clients rarely saw change instigated by themselves as bad - only changes instigated by the project team. Project managers, on the other hand, tried to minimise change wherever possible. There was evidence that some of the more experienced project managers did see the clients need to change:

"there is nothing wrong with the sponsor changing his mind so long as everyone understands the effects of the change" [M13].

The main job of project manager in the change process was to ensure alternatives are offered [C37].

However, most project managers agreed that change tends to reduce the project performance - and that the change control process was a good way of minimising both the amount of change and the impact that the change had on the project. The paradox of the project manager wishing to minimise change but seeing the right of the client to make changes of the business required can put the project manager in a difficult position. One manager quoted how he dealt with a particularly dynamic senior manager who promoted projects:

"I would never directly tell him that the change would not be a good idea or could not be made. We would note his requirements and cost up the impact on the project as well as the benefits that the change may bring - we would often give alternative ways of achieving the required result - for instance doing the
work after the project was complete. The cost of the change would normally mean that he did not pursue it”

4.3.7 Role of the Project Manager

The rules stated that a project manager should be appointed for all projects over £25K in value from initial proposal through development as an idea. This did not always happen in practice although designers often fulfilled the role of project manager in small projects - even if they were not formally appointed [C27]

In practice, the normal role of the project manager was as co-ordinator of functional teams - it was unusual for a project manager to be able to set up his own team. This only occurred on the largest projects. Several respondents agreed with the view that the project manager needed to have more control over resources [C1].

The smallest projects posed particular problems for the project manager and the input is little more than a reporting role in these circumstances.

One project manager was placed in the role of client’s representative when there was an external project manager because the senior director responsible for the project had noticed that all projects that this person was involved in went reasonably well. The director appeared, however, to be unsure why this would be the case [C7].

It was observed that some project managers found it difficult to distinguish their role from that of the “client”. For instance, one project manager wished to report directly to the funding body direct rather than via the “Client” [C19].

Several clients wished the project manager to undertake activities that one might expect the client to do - they wished project managers to have a “feel for the business” [C40]. Some project managers felt this to be a weakness and that the
client often wished to hand over full responsibility once the idea for the project had been formed – project managers believed that clients thought that the appointment of a project manager was a “cover all” [C27].

As noted before, the client rarely inputs any additional effort in defining the project after the approval of investment - it was up to the project manager to write any more detailed brief over and above the authority. There was agreement that the documents for investment authority did not communicate the client’s needs to the project in a proper manner [C3].

One project manager summarised the role in a suitably succinct manner:

“The PM role is to get business spec, produce something to give to designer, translate objective of project into reality, importance of frozen business spec.” [C39].

Within TransOne, the project manager was often needed to progress a large number of projects very quickly [C39].

4.3.8 Improving the project processes

Clients and project managers were asked a series of questions on how they believed the project processes within TransOne could (and should) be improved. Ten distinct issues were identified as being potential improvements:-

1. “A proper remit (i.e. project brief) is essential. There are corporate rules for this (in the project management manual) and if these are followed then briefing is adequate - the problem is that, in general, the rules are not followed”. [C37].
2. "Although there is a programme, some projects are being pursued even though they are not yet in the budget so as to soak up the yearly underspend. The effect of this is not quantified". [M13]

3. "Not enough time spent on planning" [C32].

4. "Clients need to accept the importance and time required to plan and develop projects" [M13].

5. "We do not maximise benefits" [C32].

6. There were:
   "... problems often with Client not attending Project Meetings, there is no involvement even though I welcome involvement". [C22].

7. There was:
   "... no pro-active process during the development of the scheme ..." [C32].

8. "The only feedback of lessons learnt is the completion certificate. However there are problems with this as no-one is anxious to but down lessons actually learnt, there is not emphasis on good lessons, completion certificate is filed away and not readily accessible." [C35].

9. "Most plans are the aspirations - the client only has a "wish list". Some form of strategy is required for all projects as has been done for this project." [C32].

10. "There is a need to allow change where this is appropriate because change is not always bad - the client is in the driving seat." [C35]
The list was not exhaustive; but it did provide the research with observations as to where improvements lie. Further work was required to look for further improvements and to investigate if these potential improvements apply to projects in general.

4.3.9 **Perceptions on the client role**

Project Managers, Clients and others in the project team were asked about their perceptions of what the client role is in the projects undertaken by *TransOne*.

1. Is the client important to the successful delivery of the project?
   - "*Client can make or break project*" [C27].
   - Bad client decisions can affect project [C27].
   - Client role: be clear about what he wants [C39].

2. What resources does the client need to discharge its role?
   - Need "Sponsors Contract Officer" - nearly always P&MM [C37].
   - Do need nominated person from client [C35].
   - Lack of focus on client representative [C40].
   - "*Clients can best represent themselves*" [C40].
   - Client role: Sponsor is Client, Professional sponsor in Planning and Marketing Manager as Client Agent, PM manages projects, Investment Panel are independent funding body receive reports from PM [C37].

3. What direction should the client give?
   - Vision and strategy needed from client [M13].
   - A remit is essential. Client should provide it but often PM has to write this. [C37].
   - Responsibility is on Client that PM is doing what client wants [C40].
4. Is client input always good?

- Input of client might be perceived as interference [by the project team] but not by the client themselves [C40].
- Client should stick to basic roles. PM should write down what client wants, ask, sign off [C35].
- Clients do not fully understand impact of change [C40].

5. What objectives do clients have?

- Objectives often change [C37]
- Client often doesn’t know benefits he expects himself [C32].
- Clients see collapsing of project timescales as good [C40].
- Problem of “short term-ism” with business client (Freight) [C32].

4.3.10 **Defining project success**

The performance targets for projects in *TransOne* were initially clarified by one manager [C27]: time; specification; authorised sums; disruption to traffic; safety record, and; satisfaction of users with project. The client level “Critical Success Factors” for one project are reported as only [C27]: (a) clarity of client idea, and (b) certainty of funding.

The overall performance of the project portfolio was felt to be good by both client staff and project managers. However, no hard data was collected by anyone in *TransOne* to support this view. The only data collected was the individual reviews provided to the investment panels.

Some Project Managers did understand that the project level monitoring that they undertook did not provide a sufficiently good view of project performance.
For instance, one project manager stated:

*We need to measure performance at the “Business Level”* [M13].

and another felt that:

*“Projects never judged against right criteria”* [M22].

### 4.4 DIFFERENCES BETWEEN DECLARED PROCESSES AND ACTUAL PRACTICE

#### 4.4.1 Processes

A comparison of the activities that were revealed as occurring at each stage of the project process against the defined processes was undertaken. The results of this are reproduced in table 4.2. The table also indicates the resources that were typically used and the benefits that were considered to accrue.

The documented activities were known with some certainty, having been available solely from authentic corporate documents. The actual activities and resources expended were the result of the case study analysis contained earlier in this chapter. They were, therefore, based on the evidence revealed by this research. The benefits accruing at each stage were not explicitly available from published documents and were not readily quoted by individuals within the case study. The benefits, therefore, have been produced following analysis of both documents and responses by individuals.
<table>
<thead>
<tr>
<th>Stage</th>
<th>Documented Activities</th>
<th>Actual Activities</th>
<th>Actual resources expended</th>
<th>Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial Proposal</td>
<td>1. Preparation of Initial Proposal Form with key details.</td>
<td>1. As documented</td>
<td>Generally minimal; but includes:- Users Sponsor Business Manager</td>
<td>Creation of potential project ideas.</td>
</tr>
<tr>
<td></td>
<td>2. Prior to item 1; meetings to scope proposal</td>
<td>2. Financial return calculations</td>
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<tr>
<td></td>
<td>3. Appraisal report on Initial Proposal; including:- (a) the business needs as seen by the Sponsor; (b) the benefits anticipated to result; (c) alternate options to the suggested course of action (including the &quot;do nothing&quot; option); (d) an appraisal of the proposed investment to ensure that it is cost-effective; (e) the technical achievableof the project and technical difficulties quantified; (f) tested for the effect of the most sensitive factors; (g) the effect on the ranking of options; (h) external constraints and the maintenance of operating standards.</td>
<td>1. As documented but to varying level of detail.ondenomations documented, but with following detailed differences:- (a) simple sentence of aim only; (b) difficult to quantify; (c) sometimes generated, sometimes not; (d) figures only sufficient to prove return; (e) Rarely considered for infrastructure projects. (f) Rarely occurs – two examples noted; (g) No effects noted; (h) Only done if there was obvious known effect.</td>
<td>Independent professional Appraiser Sponsor User Rarely - Project Manager</td>
<td>Evaluation of business case that lies behind idea.</td>
</tr>
</tbody>
</table>

NOTE: Sometimes only undertaken in the barest detail to short cut time required in effort to commence work on project quickly.
<table>
<thead>
<tr>
<th>Stage</th>
<th>Documented Activities</th>
<th>Actual Activities</th>
<th>Actual resources expended</th>
<th>Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Option Development</td>
<td>1. Identify people who will contribute to this work.</td>
<td>1. Mainly occurs if work is to be contracted out or if there are known delivery problems with particular departments; 2. Not usually undertaken – only by more experienced project managers where there were known problems; 3. Programme produced in most cases but procedures rarely written; 4. Additional plans and systems sometime produced; 5. Always produced – sometimes with great thoroughness.</td>
<td>Project Manager Sponsor User</td>
<td>Ensure that solution to business issue is optimum option.</td>
</tr>
<tr>
<td></td>
<td>2. Agree lines of communication and responsibilities for this stage of the work,</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3. Produce programme and procedures for this development phase.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>4. Produce more detailed plans and systems for control of project, programme and cost.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>5. Establish the Project Safety Strategy.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Investment Authority</td>
<td>1. Authorise Investment in line with defined criteria.</td>
<td>1. Authorise investment - some discretion allowed (not necessarily strictly in line with criteria). For instance, see note in Appraisal.</td>
<td>Investment Panel Sponsor Project Manager</td>
<td>Ensure that no project commences until business case is evaluated, optimum option is selected and funding is available.</td>
</tr>
<tr>
<td>Stage</td>
<td>Documented Activities</td>
<td>Actual Activities</td>
<td>Actual resources expended</td>
<td>Benefits</td>
</tr>
<tr>
<td>---------------------</td>
<td>---------------------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------------</td>
<td>--------------------------</td>
<td>------------------------------------------------------------</td>
</tr>
</tbody>
</table>
| Detailed design     | 1. Carry out a detailed review (in conjunction with the design departments) of the preparatory design work.  
                     2. Establish the ground rules for contracts and lines of communication with the functional departments.  
                     3. Ensure that every department is clear regarding the deliverables it must produce.  
                     4. Prepare detailed control plans (covering cost, time and necessary resources) so that all parties are clear regarding their targets and responsibilities.  
                     5. Agree on every department producing adequate plans and obtain regular (four weekly) reports on their progress against the plans,  
                     6. Encourage functional departments to utilise services to assist in problem solving; promote the supportive nature of the Project Manager's role.  
                     7. Ensure that any design queries requiring decisions or answer from the Sponsor are dealt with quickly,  
                     8. Undertake regular co-ordination meetings to ensure that all areas are fully specified and designed. | 1. Undertaken by design departments on their own unless particular problems have arisen;  
  2. Normally produced by design departments who have their own contracts staff;  
  3. Occurs with more competent project managers;  
  4. Sometimes produced in outline;  
  5. Undertaken in progress meetings;  
  6. Rarely occurs (only one example of this occurring but several project managers stated that they would use if necessary);  
  7. Undertaken as quickly as possible – project managers tend to apply their own priorities;  
  8. Occurs in all projects – usually on a monthly basis. | Project Manager Designer | Detailed definition of work required giving reduction of risks and easier evaluation of construction bids. |
### Table 4.2
Comparison of Defined and Actual Processes

<table>
<thead>
<tr>
<th>Stage</th>
<th>Documented Activities</th>
<th>Actual Activities</th>
<th>Actual resources expended</th>
<th>Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Procurement and Contract</td>
<td>1. Draft tender documentation.</td>
<td>1. Often undertaken by technical departments – they usually have the expertise;</td>
<td>Project Manager</td>
<td>Selection of lowest price of contract for defined</td>
</tr>
<tr>
<td>Action</td>
<td>2. Competitively tender contract.</td>
<td>2. Normally occurs as documented; unless &quot;quick spend&quot; is involved;</td>
<td>Designer</td>
<td>acceptable quality.</td>
</tr>
<tr>
<td></td>
<td>3. Award contract in line with defined authority level.</td>
<td>3. Normally occurs as documented.</td>
<td>Procurement</td>
<td></td>
</tr>
<tr>
<td>Construction</td>
<td>1. Appoint Contract Manager</td>
<td>1. Broadly as documented and main decisions taken by technical department;</td>
<td>Project Manager</td>
<td>Creation of infrastructure to give benefit.</td>
</tr>
<tr>
<td></td>
<td>2. Supervise works; including progress reporting.</td>
<td>2. Broadly as documented and main decisions taken by technical department.</td>
<td>Designer</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Site Supervision and Contract</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Managers</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Procurement (occasionally)</td>
<td></td>
</tr>
<tr>
<td>Commission</td>
<td>1. Plan the commissioning tasks, including: costs, staff consultation and staff</td>
<td>1. Broadly as documented and main decisions taken by technical department;</td>
<td>Site Supervision and Contact</td>
<td>Bring infrastructure into service.</td>
</tr>
<tr>
<td></td>
<td>resources, provision of commissioning spares or consumable.</td>
<td>2. Usually as documented;</td>
<td>Manager</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2. Plan the training programme and reserve resources,</td>
<td>3. Broadly as documented and main decisions taken by lead technical department;</td>
<td>Project Manager</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3. Co-ordinate the commissioning with the demands of day-to-day operating,</td>
<td>4. Broadly as documented and main decisions taken by technical department;</td>
<td>Designer</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4. Inform operating staff about their role in the new works; including training,</td>
<td>5. As documented – i.e. Project Manager takes lead.</td>
<td>Users</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5. Prepare progress reports for external customers, particularly if there are any</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>delays to published programmes.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stage</td>
<td>Documented Activities</td>
<td>Actual Activities</td>
<td>Actual resources expended</td>
<td>Benefits</td>
</tr>
<tr>
<td>---------------</td>
<td>---------------------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>---------------------------</td>
<td>-----------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Post completion</td>
<td>1. Obtain an acceptance note from the user.</td>
<td>1. Broadly as documented and main decisions taken by lead technical department;</td>
<td>Designer</td>
<td>1. Ensure client has all documentation</td>
</tr>
<tr>
<td></td>
<td>2. Settle contractual claims and other disputed issues.</td>
<td>2. Undertaken by technical department or project manager as appropriate;</td>
<td>Contract Manager</td>
<td>2. Ensure lessons learnt are fed back to project promoters.</td>
</tr>
<tr>
<td></td>
<td>3. Collect technical certificates from technical functions.</td>
<td>3. As documented – except project manager may be involved in significant issues;</td>
<td>Project Manager</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4. Ensure all outstanding orders are complete.</td>
<td>4. No formal process;</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>5. Hand the works over to the operators/maintainers.</td>
<td>5. Broadly as documented and main decisions taken by lead technical department;</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>6. Ensure that spending departments have completed asset record data.</td>
<td>6. Few project managers chase the production of these and they are only produced in any form for signalling assets;</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>7. Hand over the as-built drawings.</td>
<td>7. Rarely occurs in any formal way;</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>8. Issue a Completion Certification.</td>
<td>8. As documented</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
4.4.2 Contracting and Procurement

The actual procurement activity was compared with the documented requirements and the results are contained in table 4.3.

<table>
<thead>
<tr>
<th>Issue</th>
<th>Documented Process</th>
<th>Actual Process</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction of Select List</td>
<td>Select lists to be held by Procurement Director, but no prohibition of lists held by others</td>
<td>Select lists held by each contracting department and/or function. Proliferation of select lists.</td>
</tr>
<tr>
<td>Choice of Procurement Route</td>
<td>To be chosen based on nature of project.</td>
<td>Based on that historically used for that function.</td>
</tr>
<tr>
<td>Tendering Process</td>
<td>Competitive process to be used unless authorised by the main board.</td>
<td>Competitive almost always used.</td>
</tr>
<tr>
<td>Award process</td>
<td>Procurement Director or delegated Contracting Officer to award contract.</td>
<td>Actual process follows very closely that documented.</td>
</tr>
<tr>
<td>Management</td>
<td>Reporting back to Project Manager at defined intervals. Project Manager attend and/or chair progress meetings. All variations approved by Project Manager and Procurement.</td>
<td>Reporting generally occurs but to varying degrees of detail, accuracy and frequency. Project Manager often has progress meetings separate from contract meetings. Variations normally approved by Contract Manager.</td>
</tr>
<tr>
<td>Review</td>
<td>Reviews on performance to be made for each contract and endorsed by Project Manager and Contracting Officer. Details to be kept with select list information and disseminated to this involved. Procurement Director to hold review information.</td>
<td>Reviews made for about half of projects. Terse details only held with select list, rest placed on file and poorly disseminated. Procurement Director normally only notified if there is a significant problem (bankruptcy of contractor) or if contract is let by Procurement Director.</td>
</tr>
</tbody>
</table>

It can be seen that the actual processes differed from the defined processes in a number of key issues. This appeared to occur because changes to the availability of money and to client requirements (at short notice) meant that the formal processes could not respond quickly enough with the limited resources available. This was
obviously a benefit to the business in many cases but led to an erosion of the benefits of the carefully formulated formal processes.

### 4.4.3 Individual participant roles

As noted earlier in the chapter, various individuals impacted on the project process. The actual influence of these people was compared with the documented role that they are expected to undertake. The results of this are summarised in table 4.4

<table>
<thead>
<tr>
<th>Individuals</th>
<th>Documented Role</th>
<th>Actual Role (where different from documented)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Board Members</td>
<td>Establish corporate policy&lt;sup&gt;12&lt;/sup&gt; Agree funding levels with central government.</td>
<td></td>
</tr>
<tr>
<td>Business Sector Directors</td>
<td>Define detailed business objectives. Agree funding levels with Board and with other external funders such as PTEs.</td>
<td>Prioritise actual schemes.</td>
</tr>
<tr>
<td>Business Planning Managers</td>
<td>Produce Business Plan; monitor achievement. Analyse and evaluate programme of projects.</td>
<td>As documented.</td>
</tr>
<tr>
<td>Investment Analysts</td>
<td>Analyse and evaluate particular</td>
<td>As documented.</td>
</tr>
<tr>
<td>Project Manager</td>
<td>Agree funding contribution for particular schemes with external and internal funding bodies. Select designers and contractors.</td>
<td>Prioritise actual schemes. Support investment analysis (sometimes undertake for urgent schemes)</td>
</tr>
<tr>
<td>Design Professionals (e.g. Project Engineer)</td>
<td>Design works. Consult Project Manager and users.</td>
<td>Project Engineer responsible for selection of Contractor and decision to sub-let design but Project Manager will intervene if he does not like it&lt;sup&gt;16&lt;/sup&gt;</td>
</tr>
<tr>
<td>Construction Professionals (e.g. Contractor)</td>
<td>Construct works as designed by designers</td>
<td>As documented except modified where professionals believe there is a benefit.</td>
</tr>
<tr>
<td>End Users</td>
<td>Take over works and use. Input to specification of works.</td>
<td>Input to construction.</td>
</tr>
<tr>
<td>Maintainers</td>
<td>Maintain works following completion</td>
<td>Locate and rectify latent defects.</td>
</tr>
</tbody>
</table>

---

<sup>14</sup> These different individuals were noted by Putley (1990) in an MSc thesis on the TransOne project management process.

<sup>12</sup> Source: Defined by investment regulations and statutory remit for board.

<sup>16</sup> Source: Respondent [C37].
Some differences were noted to the roles actually undertaken by each of these participants. Generally, however, the individuals undertook the roles assigned to them.

One project manager [M13] defined a good participant in the project as one who:

"Sticks to the remit and has little licence to investigate unnecessary avenues".

4.4.4 Client Role

The documented and actual input provided by the client in projects within TransOne was compared. The results of this are summarised in table 4.5.

<table>
<thead>
<tr>
<th>Issue</th>
<th>Documented Process</th>
<th>Actual Process</th>
</tr>
</thead>
<tbody>
<tr>
<td>Client input to project team</td>
<td>Provide individual to discharge client duties - Sponsor.</td>
<td>Client has to be represented on project Team [C37].</td>
</tr>
<tr>
<td>Finance</td>
<td>Provide financial targets and management information.</td>
<td>Clients interested in financial information mainly [C27].</td>
</tr>
<tr>
<td>Business Objectives</td>
<td>Agreed with central government, as 10 year plan, modified annually. 10 year business plan derived from this. Particular departmental objectives (including budgets) derived from this.</td>
<td>Changed on annual basis.</td>
</tr>
<tr>
<td>Project viability and business benefits</td>
<td>Detailed, structures and formal appraisal undertaken by independent appraiser.</td>
<td>Direction from senior managers and relies on data provided by users and other interested parties.</td>
</tr>
<tr>
<td>Completion</td>
<td>Formal handover; detailed in Project Management Handbook.</td>
<td>Full detail of project Management handbook rarely followed.</td>
</tr>
<tr>
<td>Delivery of benefits</td>
<td>Requirement of investment panel to back check benefits, but no process defined.</td>
<td>Benefits rarely monitored or checked over sufficiently long period.</td>
</tr>
</tbody>
</table>

The actual input by the client was very close to the defined processes, in the fact that a formal process is undertaken. However, the detailed activities within the process were often "short circuited" - particularly in the later stages of the project. The client’s interest seemed primarily in the decision to undertake the project and less so in the performance of the project process.
There was a tendency for Sponsors to want a comprehensive product of high quality, and to want it quickly at low cost. This was usually impossible and so the project objective was the compromise between these attributes that most effectively fulfilled the business needs. Unless the business needs were clearly established at the outset then the manager could not determine how to identify the ideal compromise between product, cost and times. He then had no basis for taking decisions.

4.4.5 Value for money and performance

Theory and practice appeared relatively consistent in the fundamental process that occurs in the search for value for money. These were:
1. Economic appraisal was undertaken to select the best option for the form of the project.
2. Budgets were established to coincide with the work breakdown and/or stages of the project.
3. Managers were expected to deliver each budget within the levels set and, where possible, deliver at less than the levels budgeted.

Value for money and performance are measured against this background. They are often expressed in terms of variance against budgets, programme and, exceptionally, profitability.

The measures were concluded to be relatively weak and were either not meaningful in the business sense or included components over which the project has no control. The ideal measures would satisfy the following: (a) they address all issues, and; (b) they only possess components over which the project has control. They would additionally be able to be broken down into sub-measures that fit with the project stages and work breakdown structure.
4.5 **ISSUES ARISING FROM THE PILOT STUDY**

4.5.1 **The Client Role in the Project**

It was clear from both the theory and the practical examples in *TransOne* that the client occupied a (if not the) key position in the project. Without the client deciding that the works were required and arranging the wherewithal to undertake the works; then there was no project. It was more surprising that few authors (or project practitioners in *TransOne*) saw the project initially from the client's perspective; most viewed the project as something definite to be delivered. Whilst this may have indicated a great deal about the skills required to successfully manage and deliver a project - it does highlight the opinion that the client's perspective is often given second priority.

From the client's perception, the project was merely a means to an end - an enhancement to the current business. The actual process of design and construction was a complication that most clients wished to see undertaken as quickly as possible. The real goal of most clients was to receive a fully working piece of infrastructure as soon after the decision to proceed as possible. If it were possible to get from the start of the construction project to the end with little or no involvement, they would generally have done this. For the project team, each construction project was their reason to be in business. Few project team members were truly concerned with the clients business. The client, for them, was the person who has engaged them and who they expected to give direction on what is required in general terms. If this guidance was not perfect (or even lacking) a good project team would normally be able to provide a completed project that was a good example of its type - based on their experience of providing similar construction projects for other (or even the same client). This may not be exactly what the client wanted (or needed) in that particular instance.
The issues noted above, led us to what was termed 'The paradox of client position'. A diligent client appeared to feel that they needed to influence the project (and probably have to) but this was often seen as interfering by the project team. The skills of the Project Manager in managing the client have been noted in Chapter 3\textsuperscript{17} but the evidence of any investigation of this relationship was scarce. If the client was not fulfilling the role required, this gave the project manager a series of problems:

- The client may not be doing the things that they should be doing for the project and may be interfering where not really necessary.
- The lack of full project objectives and requirements makes the normal management work of the project manager more difficult because plans, budgets and specifications are harder to form.

### 4.5.2 Active And Passive Clients

Questions around the client role put to people within TransOne indicated that the level of involvement of clients varied greatly. Some individuals who undertook the client role became intimately involved in the detail of the project, others varied the scope of the works to meet changing business demands (or better understood requirements) but remained outside a detailed involvement. The clients that became most involved had often come from a project management or engineering background themselves. Other clients who became actively involved had no obvious detailed knowledge of projects - they were clearly business managers. Often these clients seemed to promote the successful projects.

Some clients who seemed to get involved in the project rarely managed to have the most successful projects; although there were several examples of projects that were adequately successful. Project managers often liked a more passive client because it

\textsuperscript{17} Ibid p 57
allowed them to deliver the project with very little interference. Often, though, a client's lack of involvement (for instance little in the way of briefing, not making required decisions during the project) led to problems for the project.

<table>
<thead>
<tr>
<th>Strengths</th>
<th>Passive Client</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Interest in the construction process.</td>
<td>• Does not interfere with project and cause delays.</td>
</tr>
<tr>
<td>• Willing to become involved where required during project.</td>
<td>• Project Manager able to establish clear reporting lines.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Weaknesses</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>• Changes required by client often increase costs, reduce quality or delay programme.</td>
<td>• Brief often lacking.</td>
</tr>
<tr>
<td>• Strong views can lead to unbuildable aspirations.</td>
<td>• Difficult to get decision in timely manner.</td>
</tr>
<tr>
<td></td>
<td>• Often poor variation control.</td>
</tr>
</tbody>
</table>

It could be asserted that it is possible to label clients as Active Clients or Passive Clients and analysis of this resulted in table 4.6 Baxter (1982) also used the term Active Client and concluded that these clients have the following characteristics:-

- Provide good briefing to project team members.
- Show interest in the construction process.
- Willing to become involved where required during project.
- Give speedy decisions.
- Some clients often even had a full time presence on site.

Although the Active Client role seemed to be the best option; both Active and Passive clients seemed to have strengths & weaknesses. Because of the varied strengths and weaknesses; it seemed useful to test which involvement with the project is beneficial and which is detrimental to project performance. From the evidence referred to here, it would be expected that this "ideal" role would be closer to the active rather than the passive role.
4.5.3 Project Successes and Problems

A difficult issue surrounded how clients and project teams defined success and failure. Published texts and practitioners alike were able to quote delivery "on time, to cost and quality" as a fundamental definition of a successful project. Literature sources seemed to mainly develop this idea and used it to promulgate measurement tools to determine whether and by how much a project had met its objectives. Most projects in TransOne judged success by completion on time and to budget with a project that was "fit for purpose" - generally in that order of importance.

One way of defining project success could be the absence of problems\(^{18}\). Some projects appeared to experience a range of problems. Typical ones were bankruptcy of contractors, escalation of costs due to poor budgeting or increase in scope, contractual disputes with contractors, re-design being required. Some problems appeared to be caused directly by the client and some were internal to the project. Some problems were caused by the nature of the project itself or the environment in which the project was being executed.

When the question was framed in a different way - i.e. getting the client to select projects that they considered successful and asking them to analyse the reason why they believed a good result was obtained - then other issues became apparent. These were: quality of the brief; detail of the initial estimates on which the project budget was based; reporting to the client in a consistent, accurate and timely manner; good publicity for the individual performing the client role both within and outside the organisation; praise received from peers. Some of the more experienced clients also agreed with some of the literature sources which highlight the importance of experience of the client and the project team together with the use of more sophisticated tools (such as aggregation of many projects into less large projects). A

\(^{18}\) Another would be to look for the presence of other issues - the Critical Success Factors. Chapter 5 is devoted to the formulation and analysis of the performance drivers.
simple view of whether the project was a “success” (or indeed a failure) appears too simplistic a view and more sophisticated concepts were explored.

4.5.4 Performance and value for money

The concept of performance occurred regularly throughout all the work reviewed but was rarely mentioned by practitioners except in the context of (a) success and failure; and, (b) cost. Many published works on the subject sought to find a more sophisticated definition, and in most cases, measure it. There appeared to be no consistent method of measuring performance and very little agreement on its definition. The review considered performance from the perspective of client satisfaction as well as delivery of the “hard” project deliverables - time, cost and quality. The involvement of risk was particularly investigated as well as recognising a range of techniques for ensuring value for money. Most of the published research (and all the projects considered in the case studies) did have some measurement of performance but there was little apparent agreement on a single definition of project performance.

The term value-for-money was widely used in TransOne but none of the respondents were able to define what this term actually means. Indeed, one individual in TransOne asserted “there is no such thing as value-for-money” [C32]. As noted above, performance was normally defined and measures against programme, budgets and specification. These were, however, internal project features. It was observed that in many cases, the best performing projects against these measures were actually those projects that had the least demanding initial budgets and time limits. This was harder to spot for infrastructure projects than for say, building projects, as the “quantity” element of the work is harder to define.

Few projects actually had a measure of project performance that included client level objectives and, surprisingly TransOne rarely conducted back checks to ensure that
projects delivered what they were originally intended to do. Not one instance was found that indicated that detailed project performance was reviewed during the project or used to guide project decisions.

4.5.5 Procurement Route

The logic behind the choice of procurement route was by far the largest body of work on the subject of client role. However, very little evidence existed that the procurement route has an impact on the performance of the project. Evidence did exist that poorly defined projects that enter the construction phase too quickly are prime candidates for poor performance - and that these were often also the projects that were built using cost plus arrangements. It is also true that the most speedily and cheaply constructed projects were those that lent themselves to a design and build route - but these projects by their nature were more easily tackled in a design and build method. It appeared that the actual nature of the project may be more of a driving force on performance than Procurement Route.

4.6 FINDINGS

The analysis undertaken within this chapter has resulted in a series of findings relating to the client role and associated processes with this single organisation:-

1. The corporate processes and procedures defined in the formal manuals and handbooks within TransOne only provide part of the picture of how the client obtains a project in practice. Although written by practitioners as a guide to good practice and to collect the knowledge of best practice for all to use; there remained the question as to whether these rules are actually implemented. Actual activities are driven more by pragmatic considerations and before judging the success of the project processes, it was necessary to examine the practices used in real projects.
2. As was expected, the actual project management deployed in practice varied greatly from the theoretical procedures defined within the company. The responses made an interesting comparison with the defined processes. The main stages were generally adhered to, perhaps because they are enshrined in the key control processes of the company and finance will not be released unless the defined documents and decisions are taken. Other facets exhibited a greater diversity.

3. It was particularly evident that the concepts available from published literature were not sophisticated enough to explain the many issues that we have encountered. Particularly lacking from the published literature were satisfactory explanations of:-
   a. The key position of the client, its role and the paradox of the client position.
   b. Defining project success, dealing with project problems.
   c. Defining performance and value for money.
   d. Formulation of client objectives rather than project objectives.
   e. The impact of experienced and inexperienced clients.
   f. Client management as opposed to project management.
   g. Whether clients should be more active; and if so what they should do.

4. It was noted in the previous chapter that all theories were not consistent with each other, that the body of work did not add up to a whole unified theory and that where work was intended to suggest ways of improving problems observed in the industry, the problems appear to recur over a significant period of time. It was also noted that the practice in one organisation was intended to represent "best practice" as seen by those attempting to define a consistent process. It was shown that the, often successful, progression of a project relied on, at best, an interpretation of the rules and, at worst, a bending of the rules.
5. It became necessary to derive a definition of the client role from first principles and this required the derivation of some new concepts within construction project management. Firstly, the needs of the client are compared with those of any commercial organisation wishing to obtain (i.e. procure) a service or goods. The concept of the client role as one of procurement is thus created. This enables us to define the client role with some precision. The chapter further proposes a model of the client role, based on these principles. Since the model sets out the framework of activities necessary and suggests the contribution they make to the value added by the project, it was possible to use this to explain the competence of the client organisation in achieving what it requires. Future chapters will build on this model (principally by making it more quantitative), test it and demonstrate how it can be used in practice.

6. Defined procedures gave a good guide to the activities that the organisation undertakes and provides details of the processes that the organisation has decided to adopt. However, it was important that the measurement of actual practice is properly compared with these procedures.

7. Clients who undertook infrastructure projects frequently had more influence on participants than those who do not. There was evidence to suggest that an experienced client should build up an active role, whereas an inexperienced client should adopt a more passive role and concentrate on reducing the interface element.

8. In this context, procurement signified a level of knowledge and activities that go beyond the consideration of each project as being entirely a 'one-off' activity. A new definition of procurement proposed as a result of this analysis is that it embodies the following activities:
   - Content and form of supplier agreements.
4.7 REVIEW

This chapter considered how projects are managed in one organisation - *TransOne*. The research looked not only at the defined corporate processes, but also at the practice and views of those actually involved in the project process.

During the course of this chapter significant new developments have been made in the understanding of the client role. By comparison of the key items of published work and the actual practice in one organisation the differences between what one might expect and what actually happens have been demonstrated. These differences affected the way in which the client role is viewed - as well as: the project itself; the performance of the project and the available measures of that performance. It has been necessary to develop some new concepts to interpret the client role and the value for money obtained by the project. These are consistent with current theory, but also allow the explanation of the practice in *TransOne*. It has been noted how the theoretical client role in a construction project has many similarities with its theoretical role in “procurement” generally. This has allowed a new insight into how the construction project fits into the whole business activity.
5.1 OVERVIEW

In previous chapters, the client role was examined in a variety of ways. It was concluded that there was no single best client role. Indeed, difficulty was experienced in a single definition of client role. However, various potential performance drivers were identified. The work reported in this chapter sought to determine the answer to the question:-

"Is good project performance contingent upon the defined factors being present, or absent, to a significant degree"

These performance drivers may therefore be called "contingent factors". The factors to be tested in this chapter are listed in table 5.1. The list was derived from the conclusions of Chapter 3 and Chapter 4.

5.2 POTENTIAL PERFORMANCE DRIVERS

A series of 22 factors were noted during the pilot study. As was noted above, some of these factors may be controllable by the client, some by project participants, some may not be controllable and some of those suggested may have no impact at all. Indeed some that are influenceable by the client may be complex and may affect the participants or other factors.
<table>
<thead>
<tr>
<th>Item</th>
<th>Title</th>
<th>Attributes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Procurement route</td>
<td>Design &amp; Build, Traditional, Construction Management and other methods already noted.</td>
</tr>
<tr>
<td>2</td>
<td>Client’s relationship with selected participants</td>
<td>Good, bad.</td>
</tr>
<tr>
<td>3</td>
<td>Experience of the client in construction projects</td>
<td>Experienced, Inexperienced, Successful, Unsuccessful, moderate.</td>
</tr>
<tr>
<td>4</td>
<td>Nature of Clients Business</td>
<td>Commercial development, public service etc.</td>
</tr>
<tr>
<td>5</td>
<td>Nature and experience of the project team</td>
<td>Internal or external sources participants, level of experience.</td>
</tr>
<tr>
<td>6</td>
<td>Nature of project.</td>
<td>Technology, duration, cost</td>
</tr>
<tr>
<td>7</td>
<td>Generating need for project</td>
<td>Process, detail, missed project ideas.</td>
</tr>
<tr>
<td>8</td>
<td>Communicate need and connected requirements</td>
<td>Project Brief: existence, detail, clarity.</td>
</tr>
<tr>
<td>9</td>
<td>Finance for project</td>
<td>Provided, not provided.</td>
</tr>
<tr>
<td>10</td>
<td>Provide essential pre-requisites</td>
<td>Access to site, etc.</td>
</tr>
<tr>
<td>11</td>
<td>Take ownership of results</td>
<td>Commissioning, user acceptance, ownership.</td>
</tr>
<tr>
<td>12</td>
<td>Change</td>
<td>Client, project driven</td>
</tr>
<tr>
<td>13</td>
<td>Restrictions to programme</td>
<td>Possessions, environmental.</td>
</tr>
<tr>
<td>14</td>
<td>Provision of internal resources</td>
<td>Plant, materials, labour.</td>
</tr>
<tr>
<td>15</td>
<td>Usurping role of the participants</td>
<td>Instructions etc.</td>
</tr>
<tr>
<td>16</td>
<td>Lack of response to other participants</td>
<td>Major, minor issues</td>
</tr>
<tr>
<td>17</td>
<td>Provision of aims and objectives</td>
<td>Explicit framing, communication</td>
</tr>
<tr>
<td>18</td>
<td>Direction of project specific activities</td>
<td>Guidance etc.</td>
</tr>
<tr>
<td>19</td>
<td>Management of supplier base</td>
<td>Select Lists, Performance monitoring, Supply Chain Management.</td>
</tr>
<tr>
<td>20</td>
<td>Management of project base</td>
<td>Portfolio management</td>
</tr>
<tr>
<td>21</td>
<td>Benefit maximisation</td>
<td>Change control, search for added value, track changing objectives.</td>
</tr>
<tr>
<td>22</td>
<td>Induction of experience</td>
<td>Collection of lesson learnt, provision to others.</td>
</tr>
</tbody>
</table>

The following questions were tested for each of the factors:

a. Does it have any impact at all?
b. Is the impact positive or negative?
c. How strong is the impact?
d. What is the nature of the impact - progressive or go/no go?
e. Is the client a controller - directly-indirectly, solely-jointly, primary-subsidiary?
f. Who else is influential?
g. Is this a client level performance driver? (Yes/No)
5.3 EVALUATION OF DATA

5.3.1 Overview of Case Studies

Appendix B contains the descriptions that summarised the 24 Case Studies of projects undertaken within TransOne. The projects ranged in value from just below £1M to £140M and represented the spread of significant projects that the company undertakes. To ensure a consistency of presentation, a focus on the key factors and ease of reference; each description consisted of the following aspects of the project:

- Duration
- Start Date
- Client
- Outline of Project
- Client Details
- Project Organisation
- Planning, Monitoring and Management Tools
- Procurement Strategy
- Performance
- Client Role
- Lessons Learnt
- Discussion
- Conclusions

The Case Studies fell into three groups. The first were minor improvement projects, generally of less than £1M in value and they were are included because their complexity demonstrates particular features. (P2, P3, P6, P15). The second, and the largest group, were mainstream projects (P4, P5, P7, P8, P9, P12, P13, P14, P18, P19, P20). They were in the value range £1M to £10M although examples were available with values up to £20M or so. The projects were generally “self-contained” and did not impact on other projects. The final group - many of which are termed “mega-projects” - were very complex projects (P1, P10, P11, P17).
TABLE 5.2
SUMMARY OF CASE STUDIES REPORTED

<table>
<thead>
<tr>
<th>No.</th>
<th>Title</th>
<th>Value (£K)</th>
<th>Duration</th>
<th>Perform</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1</td>
<td>Avonmouth</td>
<td>16,537</td>
<td>2y 4m</td>
<td>VG</td>
</tr>
<tr>
<td>P2</td>
<td>Bristol</td>
<td>759</td>
<td>2y 2m</td>
<td>G</td>
</tr>
<tr>
<td>P3</td>
<td>Bristol TM</td>
<td>880</td>
<td>6m</td>
<td>G</td>
</tr>
<tr>
<td>P4</td>
<td>Reading</td>
<td>2,084</td>
<td>1y 1m</td>
<td>M</td>
</tr>
<tr>
<td>P5</td>
<td>Woolwich Arsenal</td>
<td>1,724</td>
<td>1y</td>
<td>G</td>
</tr>
<tr>
<td>P6</td>
<td>Isle of Grain</td>
<td>886</td>
<td>1y 5m</td>
<td>G</td>
</tr>
<tr>
<td>P7</td>
<td>East Croydon</td>
<td>8,994</td>
<td>2y</td>
<td>P</td>
</tr>
<tr>
<td>P8</td>
<td>Chichester/Havant</td>
<td>4,543</td>
<td>1y 6m</td>
<td>G</td>
</tr>
<tr>
<td>P9</td>
<td>London Victoria</td>
<td>5,248</td>
<td>2y 3m</td>
<td>M</td>
</tr>
<tr>
<td>P10</td>
<td>East Coast Main Line</td>
<td>70,000</td>
<td>3y 10m</td>
<td>G</td>
</tr>
<tr>
<td>P11</td>
<td>London North Pole</td>
<td>59,247</td>
<td>2y 2m</td>
<td>G</td>
</tr>
<tr>
<td>P12</td>
<td>East London</td>
<td>6,300</td>
<td>2y 3m</td>
<td>M</td>
</tr>
<tr>
<td>P13</td>
<td>Great Eastern</td>
<td>82,850</td>
<td>5y 2m</td>
<td>G</td>
</tr>
<tr>
<td>P14</td>
<td>Salisbury</td>
<td>8,555</td>
<td>10m</td>
<td>VG</td>
</tr>
<tr>
<td>P15</td>
<td>Watford</td>
<td>356</td>
<td>6m</td>
<td>G</td>
</tr>
<tr>
<td>P16</td>
<td>Stratford</td>
<td>6,466</td>
<td>3y 6m</td>
<td>M</td>
</tr>
<tr>
<td>P17</td>
<td>London Waterloo</td>
<td>140,000</td>
<td>2y 1m</td>
<td>VG</td>
</tr>
<tr>
<td>P18</td>
<td>South Wales</td>
<td>585</td>
<td>11m</td>
<td>G</td>
</tr>
<tr>
<td>P19</td>
<td>Exeter</td>
<td>1,050</td>
<td>1y 2m</td>
<td>G</td>
</tr>
<tr>
<td>P20</td>
<td>Reading - New Bridge</td>
<td>2,400</td>
<td>1y 7m</td>
<td>VG</td>
</tr>
</tbody>
</table>

SPECIAL PROJECT CASE STUDIES2

<table>
<thead>
<tr>
<th>No.</th>
<th>Title</th>
<th>Value (£K)</th>
<th>Duration</th>
<th>Perform</th>
</tr>
</thead>
<tbody>
<tr>
<td>P21</td>
<td>Inductive Loop Warning System</td>
<td>2,757</td>
<td>5y +</td>
<td>G</td>
</tr>
<tr>
<td>P22</td>
<td>Automatic Train Protection</td>
<td>10,540</td>
<td>2y 10m</td>
<td>G</td>
</tr>
<tr>
<td>P23</td>
<td>SKAKO Ballast Train</td>
<td>1,400</td>
<td>1y 1m</td>
<td>VG</td>
</tr>
<tr>
<td>P24</td>
<td>Networker Trains</td>
<td>74,000</td>
<td>3y</td>
<td>M</td>
</tr>
</tbody>
</table>

1 Performance
2 Not strictly within bounds of research, but provide useful insight into client role and processes as they were managed in the same way - and are necessary to account for bias in population.
Typically they involved the reconstruction of all or part of a route. Generally they were £20M+ but here one example (P1) was around £16M.

The final four projects considered in the case study analysis were not construction projects and hence strictly fell outside the defined boundaries of the research. They have been included because they enabled the investigation of effects noted in the main Case Studies to be studied in projects with a slightly different purpose.

Two (P21 & P22) were development projects based almost entirely on electronic technology and thus had very little construction involvement. They were managed in the same way as construction projects and have been included here as they provide an interesting contrast to the procurement systems normally adopted. The third project (P23) is a traction and rolling stock project but was managed in a similar way to the construction projects analysed. It was interesting in that the selection of Project Management and Procurement Strategy was driven to a large amount by the perceived weaknesses in normal Traction & Rolling Stock procurement. It proved very successful for a complex set of reasons and has proved of great use to the research as a whole. The fourth project (P24) contrasts with the previous one, in that different procurement styles - those normally used for Traction and Rolling Stock - were apparent and it was significantly less successful.

5.3.2 Structure of the Case Study Investigation

Figure 5.1, on the following page, shows the structure of the case study investigation. The analysis contained in this chapter is based on the 24 case studies as summarised by the “Case Study Descriptions” contained in Appendix B. The structure of these descriptions was after the style used by Nahapiet & Nahapiet (1985). These case study descriptions were based on the data collected by the structured interviews and questionnaires. The structured interview format and questionnaire are reproduced in Appendix A.
5.3.3 **Comparison of population and case study samples**

The population and case study samples were compared to ensure that they were sufficiently similar for the conclusions drawn from the sample to be applicable to the whole population. Any potential bias to the results, arising from the differences in the sample, were investigated. The following details were used for the comparison:

- Financial Value
- Duration
- Performance
- Technical Complexity
- Start of Construction

These details were collected from the corporate project database and data for projects in the sample was checked with the responses on the initial questionnaire – reproduced in Appendix A.
Table 5.3 shows the results of the statistical analysis of the population and sample. By inspection, it can be noted that:

1. The **Financial Value** of both the population and sample were similar and within the ranges required for the research.

2. Likewise, the **Duration** of the projects in population and sample were sufficiently similar.

3. The **Technical Complexity** of the sample was also the same as the population as a whole. It was noted that both include projects (such as T&RS) that are outside the study, but it was difficult to remove these from the population data. The potential bias that this may have introduced had been allowed for by the inclusion of the 4 special project case studies - if these do not introduce significant bias into the results gained from analysis of the sample, then it can be concluded that the bias on the population as a whole were similarly insignificant.

4. The population **Start of Construction** was markedly more recent as population holds details on some very old projects (see range of population). However, past experience had shown that the planned start dates of future projects were often
optimistic and that actual start dates were several years later. The effect was less where the start date is imminent. The research looked at projects that were being undertaken by the process and resources noted at the time of the research and the sample was explicitly chosen on that basis. Therefore, there was a significant difference between population and sample, but the sample was shown to be more robust an indicator of current practice than the population.

The results of this comparison were that (a) the sample was significantly the same as the population and (b) no undue bias had been introduced. Therefore, two conclusions were produced. First, the difference in Technical Complexity had been adequately accounted for. Second, the difference in start date did not add bias but did add accuracy to the data.

A back check on this evaluation was undertaken after the results were obtained to check whether there is any noticeable bias at completion. There was no evidence that any bias had caused significant errors in the results.

5.4 ANALYSIS OF PROJECT CASE STUDIES

5.4.1 Purpose

Table 5.1 detailed the potential performance drivers and the way in which they may affect performance3. The case studies provided evidence to investigate these with particular focus on the following key issues:-

a. Is it a driver?

b. What are the effects?

c. Is it at client level and what effects are there at other levels?

d. How powerful is the effect?

3 Ibid p120
5.4.2 Results of the analysis

Respondents in each of the projects in the case study were asked to rate the strength of the link between the Contingent Factor and project performance on a scale of 1 to 10. Appendix A contains a copy of the questionnaire\(^4\). If there was no relationship then a zero rating was given. If the presence of the factor led to increased performance then the relationship was positive and, conversely, presence of the factor leading to decreased performance would give a negative relationship. Respondents were also asked to indicate if the relationship occurred at the “project” or “client” level. The responses have been averaged to give a characteristic relationship strength. The results of this process are shown in Figures 5.2 to 5.25.

5.4.3 Procurement route

A range of procurement routes were noted, including Design and Construct and Construction Management methods. The predominant route used was a traditional approach although internal resources were widely used in all projects. The reason for using internal resources seemed to range from “because they are there” to based on a structured investigation of those areas where the clients internal resources were in fact better than those available in the external market.

There was little evidence to support the view that any procurement route was better than another. Several projects provided evidence that the procurement route chosen was a case of “best fit” and where routes other than the traditional route was chosen, some form of logical decision process was used to select the procurement route. The selection method relied, with one exception, on the past experience of the project manager and procurement specialist (where one was involved). The project that was the exception used the results of the report,

\(^4\) Ibid p313
Figure 5.2  Procurement Route (1)

Figure 5.3  Client Relationship (2)

Figure 5.4  Client Experience (3)

Figure 5.5  Client Business (4)

KEY (to Figures 5.2 to 5.6)

- CLIENT LEVEL
- PROJECT LEVEL
- AVERAGE
Figure 5.6 Past Experience (5)

-10 -5 0 5 10

Average = C0

Figure 5.7 Nature of Project (6)

-10 -5 0 5 10

Average = C0

Figure 5.8 Generate Need (7)

-10 -5 0 5 10

Average = +C9

Figure 5.9 Communicate Need (8)

-10 -5 0 5 10

Average = +C7

KEY (to Figures 5.6 to 5.9)

CLIENT LEVEL  PROJECT LEVEL  AVERAGE

The Client Level Performance Drivers
Figure 5.10Finance Project (9)

Figure 5.11Essential requisites (10)

Figure 5.12Take Ownership (11)

Figure 5.13Change (12)

KEY (to Figures 5.10 to 5.13)

CLIENT LEVEL

PROJECT LEVEL

AVERAGE

Pettit, J. H., PhD, 2000 The Client Level Performance Drivers

The Client Level Performance Drivers
Figure 5.14  Programme Restrictions (13)

Figure 5.15  Provision of Resources (14)

Figure 5.16  Usurping Roles (15)

Figure 5.17  Lack of Response (16)

Average = -C6

Average = -C5

Average = -C6

Average = -C9

KEY (to Figures 5.14 to 5.17)

CLIENT LEVEL

PROJECT LEVEL

AVERAGE

131
**Figure 5.18** Provision of Aims (17)

Average = +C7

**Figure 5.19** Direction of Activities (18)

Average = +C6

**Figure 5.20** Management of Supplier (19)

Average = +C6

**Figure 5.21** Management of Project (20)

Average = +C8

**KEY** (to Figures 5.18 to 5.21)

- **CLIENT LEVEL**
- **PROJECT LEVEL**
- **AVERAGE**
Thinking about Building, NEDO (1985), which was based on research on building projects rather than infrastructure.

Although there was evidence that the objectively chosen procurement routes enhanced the project performance, this was mainly anecdotal and given by those responsible for the original choice of route. Some project problems noted could have been due to the procurement route and attempts were made to establish a link - however, no successful link was established. No direct evidence was revealed to suggest that an inappropriate procurement route led to a reduction in project performance.

5.4.4 Nature of client

This issue considered how the client was structured, rather than the client’s business. Generally, projects within TransOne all have one clear organisation as “client” (in the meaning used in the CDM regulations) and so, in this respect, all projects had the same client organisation. However, the actual client was found to be best described as the relevant operating division of the organisation (either functional or business) which was paying for the work; since they act as virtually independent entities in the promotion of construction work. If each individual division was taken as a client, it was possible in all cases to identify an individual to personify the client or promoter. Often this was the head of the division, or alternatively a defined member of the division’s top management⁵. The importance of drawing this distinction was critical to both the view of what was meant by the client and by how the qualitative model will need to allow the build of the data from individual project to a view of the entire organisation⁶.

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⁵ This aspect was in accordance with the defined processes.
⁶ Ibid p181.
It was noted that there appeared to be the relatively bureaucratic manner in which the authorisation process occurred - there was evidence that the bureaucracy involved gave dysbenefits - see later sections.

There was considerable evidence that the clarity of role served to improve the performance of projects - there was always an individual who could be identified to give decisions, direction and define project objectives. The significant project problems seemed to occur when these decisions, direction or objectives were not given, or were delayed.

Several projects were wholly or partly funded by organisations outside of *TransOne*; usually these were Local Authorities or other governmental bodies. One instance was funded by a commercial developer. No evidence was found that this impacted on project progress once the project was underway - problems had occurred due to funding (see following section). Several client representatives acknowledged the potential for this situation to cause problems but noted that "common sense" prevailed. In practice, this meant that the funding agreement contained a definition of how works would be managed - in each case the *TransOne* client representative provided direction to the project and the project manager was a *TransOne* employee. This appeared to mean that projects generally proceeded to the satisfaction of *TransOne* over and above the external client. External organisations were normally content with this arrangement - primarily because the project was not of great importance to them (when compared with other projects they were promoting) or, if the project was of major importance, the element involving *TransOne* was set up as a sub-project.

The projects were all undertaken for one organisation - even though the different operating divisions were very much self-contained. This suggested that there was a need to investigate different and un-connected client organisations to determine
whether the findings of this section hold true in a wider range of client organisations.

5.4.5 **Nature of project**

The case studies were selected to give a full range of technology, duration and budget. 20 projects were construction projects containing a mix of building, civil, M&E, track, signals, telecommunications and Information Technology - 4 projects were other than construction works. The duration of projects ranged from 3 months to 5 years. Budget had a similar large range £250,000 to £70 Million.

The range of technology did not have a noticeable effect on project performance, although there was some evidence that complexity could cause project problems. There did not appear to be any correlation between project complexity and performance; merely that complexity was cited as reasons for project delay and cost increase. Additionally, the four special projects did not, on average, exhibit any greater problems due to technological complexity than did the true construction projects. It is suggested, then, that technology does not have a direct bearing on project performance.

There was no evidence to suggest that different project durations affected the performance of the project. Longer projects often did exhibit more or greater problems; but there is no evidence to suggest that there was any fixed relationship between project duration and performance.

There was no evidence to suggest that the cost of the projects affected performance. Higher value projects often did exhibit more or greater problems; but there was no evidence to suggest that there was any fixed relationship between cost and performance.
5.4.6 Nature of project participants

Most projects had an internal project manager, engineers, procurement/commercial staff. External contractors undertook the work of the main contractor and supply of manufactured components. Design was undertaken by internal or external participants depending upon the project. Specialist construction services were also undertaken by internal and/or external participants.

There was no evidence to suggest that internal resources were more or less competent than external resources. There was also no evidence to suggest that any role should always be undertaken internally or externally sourced participants. There was, however, evidence to suggest that certain projects should have certain roles either externally or internally sourced - where good reasons existed. Several projects could demonstrate an objective decision process to supply resources internally/externally and these tended to be the better performing projects. What was not clear was whether this was a symptom of all round good decision making or purely a result of the best fit of internal and external resources. This only became apparent when the affects of other decisions and aspects of these projects were investigated - see below.

5.4.7 Experience of project participants

All projects involved participants who could be defined as "experienced". There was - perhaps obviously - unanimous agreement that good performance resulted from experienced - and suitably qualified - participants.

The only direct evidence of the merits of experience related to the project manager. Although all project managers were "experienced" and trained; the most experienced at managing projects in the railway environment produced the best projects. The evidence was that, therefore, the experience needed to be in the
projects undertaken by the actual client. Whether this was purely due to the specialist nature of the railway industry (i.e. experience needs to be in the industry and/or technology) or for the client remains to be investigated. Evaluation of other client/industries was required to answer this latter point.

5.4.8 Client's relationship with selected participants

Several project managers remarked on the “good relationship” they had with the client - and partly attributed the success of the project to this relationship. Clients in these projects mostly concurred with the project manager’s view; although in one instance the client felt that the relationship was significantly worse than did the project manager. This latter example appeared to be more a clash of personality as the project was moderately successful (when compared with the client’s objectives).

It was difficult to find clients or project manager who would admit to a poor relationship with each other; although all of the projects which were accepted to have had the greatest difficulty in achieving the set objectives did seem to possess some problems with the client/project relationship. These problems were varied, including; unclear objectives or client unable/unwilling to clearly communicate objectives; change of client during project (especially at critical stages); problems with decision taking and clients who wished to be involved in the projects in ways in which they were not best suited. These issues were investigated in more detail in later sections; but the results suggested that it was the details of what the client did that affected the project and not how “good” the relationship was. The quality of the relationship seemed to be a result of both client and project manager doing the right things rather than the other way around. In one project - poorly performing by general agreement – the client and project manager appeared to have a good and productive relationship. This was an important point as a minority of client and project managers believed “team building” for the project team to be
useful and the inclusion of the client necessary to engender a good relationship. The one example where such a workshop was applied, was also a project where client and project manager provided the roles necessary for each other.

5.4.9 Experience of the client in construction projects

Experience, in simple terms, was measured by length of experience as a client - or at least when the individual first became involved in the promotion of construction projects. The quality of the experience was difficult to determine.

Unlike experience of project participants; absolutely no evidence was found that experience of the client, per se, led to a higher performing project. It was true that clients involved in the more successful projects did things that helped the project. Specific questions to these clients traced the fact that they knew what was required due to their experience.

Other clients had similar levels of experience but still caused problems for the project. An interesting difference was noted here: as a generalisation, inexperienced clients tended to detract from the project by not doing things that were required and experienced clients often harmed the project by doing things that they need not do. However, there were exceptions to this generalisation.

The result supported the assertion that it was not experience which led to good projects; but the activities that experience has taught the client to (a) undertake or (b) refrain from undertaking.
5.4.10 Nature of Clients Business

Since all projects were undertaken for the one organisation, no evidence was available on the effect of the client’s business on performance. The differences in the detailed nature of the operating divisions were noted (all involved in rail transportation; only the market segment was different) then no difference in project performance was noted that was attributable to the nature of their business. Some businesses may make the definition of objectives more straightforward (the freight client noted this as this client’s business objectives were almost entirely finance related) as opposed to client businesses with more complex objectives (passenger businesses had more soft objectives). A definite answer to this issue needed to involve a wider range of unrelated client organisations.7

5.4.11 Generating need for project

As was noted in previous chapters, there was a fixed process for the authorisation of projects. There was no laid down formal process for the generation of the need for the project. The proposal for each of the projects arose in different ways: some were proposed by external organisations (particularly the jointly funded ones); some arose due to the life expiry of existing infrastructure; but most were intended to provide an improvement in some way. It was suspected that several were “pet projects” of the client. The latter type arose because an individual had proposed a project to improve the business and this had been accepted by the authorising panel. Not one project had resulted from a structured examination of the business.

It was shown to be true that all the projects had resulted from a successful and sufficient activity to generate the need for the project and that potential projects had not arisen because there was either no need for a project or the need did not result in a project being promoted. There was evidence that instances of the latter

7 This was the purpose of the testing process reported in Chapter 8 – Ibid p225.
Pettit, J.H., PhD, 2000 The Client Level Performance Drivers

case had arisen and that there were potential projects which could have been more beneficial or even removed the need for the other projects.

When questioned on the need for a robust way of seeking projects most clients agreed that there were deficiencies; although many clients believed that project ideas came from a creative process (even inspiration) that was difficult to systematise. Given the bureaucracy of many of the other processes; it was interesting to note the reluctance to apply formal processes to this area - especially when deficiencies were almost universally acknowledged.

The evidence supported the conclusion that this criteria was a critical go/no go factor which must be in place and was purely under the control of the client

5.4.12 Communicate need and connected requirements

Project managers were requested to commence work on a project (i.e. the need was communicated to them) in a variety of ways. The most frequent method of instruction was by minutes of the authorisation meeting. In almost all cases, the only supplementary information available to them was the appraisal report containing option evaluation, financial objectives and outline feasibility details. In only a few cases was a formal instruction provided to the project manager from the client. Indeed, two projects appeared to have commenced with (at best) a verbal request. These latter two projects were shown to have experienced problems throughout. When questioned, all project managers (even the two with no written instructions) were adamant that they would not start work on a project until written instructions were received including confirmation of the financial authority. This was, however, the only information that they demanded.

All but three project managers stated they required more information from the client than was normally provided. Clients never drafted a brief themselves and, in
the case studies examined in this research, did not possess resources to undertake the preparation of such a document.

There were several instances where the project manager spent considerable effort in writing the brief in a structured and thorough manner; and in agreeing this with the client. In these examples, the brief produced amounted to around 500 pages and had taken several months to prepare, revise and agree. Not all projects were as fastidious at producing the project brief - there were several projects where there was no actual brief produced at any stage. There was clear evidence that the quality and detail of the brief had a positive impact on project performance. All good projects had an adequate brief and all poorly performing projects suffered from an inadequate (or missing) brief.

Client and project managers agreed on the importance of both client and project team having what they termed as “ownership” of the Project Brief and this was principally demonstrated by collecting signatures of the client, project manager and heads of technical departments. This was seen as a way of stopping clients and functional heads:

"not supporting what we are trying to achieve; ensure they provide the resources required and not changing their minds later on in the project"

Project managers often felt that they were best placed to create the brief themselves; and there was evidence that this allowed the project manager and his team to gain a greater understanding of the project and the clients requirements. However, an examination of the project briefing documents produced revealed that these were very much project delivery oriented and contained a great deal of detailed technical information. Many clients did admit to not reading the whole document; but relying upon the project participants to advise on the detailed methods of achieving what they required.
The benefit of client input has been noted above. However, even the best project brief did not use the most powerful methods to optimise the business benefits. This was found to be due to the lack of resource for the client to develop the project from a business point of view and the fact that the project manager - by definition - was not a specialist in the client business appears to mean that.

The evidence supported the conclusion that this criteria was a critical go/no go factor which must be in place and was purely under the control of the client.

5.4.13 Finance for the project

Projects which were unable to find funding did not proceed. The prime method of allocating funding was the authorisation committee although senior managers did have authority to allow a project to commence on their personal discretion. This latter case occurred at the end of the year “Quick Spend” where money became available for the use of projects due to slower capital spending elsewhere in the organisation. The problems of this in public bodies has been noted before.

The authority process was also followed where external funding supported all, or part, of the project. This generally ensured that proper agreements were in place to off-charge expenditure from the project to the external organisation. The obvious importance of financing the project was provided in one project, not part of this case study research (but considered) that did not proceed to construction due to the insolvency of the developer who provided all funding.

There was no evidence that project teams arranged funding; although the project manager did become involved in support of funding related work prior to the project being authorised.

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8 Ibid p86 (including footnote).
The evidence supported the conclusion that this criteria was a critical go/no go factor which must be in place and was purely under the control of the client

5.4.14 **Provide essential pre-requisites**

Few problems were noted with the formation of the relevant legal agreements - principally because *TransOne* is effectively a "blue chip" client who is unlikely to be unable to pay or refuse to honour payments without good reason. Contractors and suppliers were thus keen to do business. The agreements were also tried and tested, not unduly onerous on other parties and (a benefit of a large bureaucratic organisation) difficult to change from the standard. Most contractors (and external funding providers) had worked with *TransOne* before and were accustomed to the forms of agreement required. For these reasons, few problems were noted with this activity. There was some evidence that this situation may not have given the optimum solution for every project; but the assertion that the forms of agreement are the best when viewed across the whole project portfolio is hard to dismiss even though no evidence that this was the case was available. Commercial developers often wished to vary terms, but this did not occur in any of the projects under study - in fact few project managers or clients would consider this even if there was an apparent advantage of doing so.

Site access was noted as problematic in several cases - and this caused delay but not increase in cost to the project. Some examples of delayed site access occurred even when *TransOne* was the owner of the site due to the divisional nature of the organisation.

The evidence supported the conclusion that this criteria was a critical go/no go factor which must be in place and was purely under the control of the client.

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9 It will be useful to evaluate clients who are not similarly blessed.
5.4.15 **Take ownership of results**

Few problems were encountered with this activity. No evidence of practical problems was encountered. Not only was a formal handover to the users (rather than the actual client) a regular occurrence but commissioning occurred in most projects. The only technology that did not receive commissioning was civil engineering works and in fact the two pure civil engineering projects were the only ones to possess no commissioning stage.

Only a few projects undertook close-out reviews with the client on wider business issues, but this aspect is dealt with later.

To properly test this issue, it will be necessary to find an instance where the client has not wished to take the project on completion; or at least to investigate instances where this was a perceived problem\(^{10}\).

Although full evidence was not produced, the evidence revealed that this criteria was a critical go/no go factor which must be in place and was purely under the control of the client.

5.4.16 **Change**

Significant evidence was found in all projects that change causes a reduction in project performance: resulting in delay, increased costs and reduction in quality. Change appeared to come from two sources:-

1. The client - requiring amendments to better suit its requirements. There was evidence that these changes resulted from an unclear brief or the client not fully understanding the project scope/specification prior to its commencement.

\(^{10}\) This does occur in Chapter 8 and the issues surrounding the criteria are confirmed to be as stated here.
There was also evidence that some client change was due to changes in the client’s business - which were also unforeseen.

2. The project - in response to (generally unavoidable) unforeseen problems. Unforeseen ground conditions were a prime example but so was obsolescence of specified components.

The evidence supported the conclusion that this criteria was a factor which, if it occurs to any significant degree, will result in project problems and/or a reduction in the overall project performance and its ability to satisfy the objectives of the client.

5.4.17 Restrictions to programme

Projects in this study were fairly notable for the amount of restrictions that the client (or at least its business) placed on the construction programme. The site was never freely available, since most activities take place on an operational railway. There was evidence from each project that the need to plan work within (and around) possessions had a major impact on the performance of the project. Much of this impact was not apparent to the client or many of the project participants as the effects as opposed to other construction were an accepted part of construction for this client. Main contractors were fully aware of the effects.

Other restrictions, such as those for local noise reduction reasons, occurred in four projects and these also had a negative (if significantly smaller) impact on performance. It was revealed that in practice restrictions imposed by external organisations (or the project participants themselves) have a relatively small impact on project performance when compared with those imposed by the client alone.
The evidence supports the conclusion that this criteria was a factor which, if it occurs to any significant degree, will result in project problems and/or a reduction in the overall project performance and its ability to satisfy the objectives of the client.

5.4.18 **Provision of internal resources**

Internal resources were provided for a variety of purposes: specialist on-track machines; materials such as rail, sleepers or ballast; design resources; and labour (particularly track and signalling personnel). There was evidence that the provision of these - particularly an unreliability - led to a worsening of project performance. The problems of material supply were generally minor; but those of on-track machines were particularly noticeable in several projects.

The evidence supports the conclusion that this criteria was a factor which, if it occurs to any significant degree, would result in project problems and/or a reduction in the overall project performance and its ability to satisfy the objectives of the client.

5.4.19 **Usurping roles of the participants**

It was noted above how the level of client involvement with a project did not appear to be a reliable predictor of project performance. One of the reasons why client involvement could be a weakness was suggested to be when the client attempted to undertake work which should be the role of one of the participants. Examples were; giving direction to designers (in one case) or contractors (in several cases) without involving the project manager; or involvement in the ordering/delivery of materials. The later example occurred in one project where the client had other works requiring the materials and in three projects where materials were ordered at the same time as the appointment of project manager in a
bid to accelerate the project by ordering long lead time materials (in two out of the three projects, no real benefit was revealed).

This usurping feature was not prevalent in the projects studies, but did occur in certain instances. None were particularly problematical and most project managers were able to prevent (a) offending the client; and (b) overly confusing the project participants involved.

The evidence supports the conclusion that this criteria was a factor which, if it occurs to any significant degree, will result in project problems and/or a reduction in the overall project performance and its ability to satisfy the objectives of the client.

5.4.20 Lack of response to other participants

More noticeable, was the delay injected when clients did not give response (particularly decisions) when the project required this. Most projects noted instances where the client could not, or did not respond, in the time scales necessary. This did not always cause any significant problems as the project manager either made assumptions or delayed the implementation of that aspect of the project until a decision was forthcoming (project managers were generally proactive in chasing these decisions). The examples noted were relatively easy for the contractor to plan around - a typical minor decision would be, for instance, choice of tile colour in toilets. Whilst this was obviously not best practice, the main problem appeared to be one of nuisance.

There were three examples of significant delay in taking - or informing the project team - of decisions. These were notable in that they caused major and identifiable problems for the project - resulting in delay and cost increase. There was also one example of a project participant causing similar problems - the project, which had
other problems, incurred significant extra costs whilst waiting for the architect to select a glazing system for a footbridge and booking area of a new station.

There was evidence that an on-site client presence solved problems in this respect, be they minor or more important.

The evidence supported the conclusion that this criteria was a factor which, if it occurs to any significant degree, would result in project problems and/or a reduction in the overall project performance and its ability to satisfy the objectives of the client.

5.4.21 Provision of aims and objectives

Not all project participants were fully aware of the Client’s aims and objectives for the project - indeed not all project managers appeared to be able to succinctly quote these. In some instances this derived from the client not being clear themselves and in others the problem appeared to be one of communication.

There was evidence to suggest that when the project manager and client are fully aware of the explicit aims and objectives, then the project performs well. There was also direct evidence that lack of awareness reduced project performance. There was also evidence in two projects that there are benefits of the client aims and objectives being made clear to a wide range of participants - commercial designers and contractor. In one of the examples; the aims and objectives were simplified and published as part of a definite communication process; in the other the clarity came from the client representative and his involvement in the project.

The evidence supported the conclusion that this criteria was a factor which, if it occurs, would increase the project performance, reduce any project problems and ensure that the project is better able to satisfy the objectives of the client.
5.4.22 **Direction of project specific activities**

There was evidence that some clients provided direction of project specific activities and that this resulted in benefits to the project process. Where such direction did not occur, there was no evidence that this had any effect on a project.

The evidence supported the conclusion that this criteria was a factor which, if it occurred, would increase the project performance, reduce any project problems and ensure that the project is better able to satisfy the objectives of the client.

5.4.23 **Management of supplier base**

It has been shown that the procurement department and engineers/quantity surveyors within the civil engineering functional departments have their select lists. These lists had an indication of satisfactory performance and contractors and other suppliers met the managers of the lists periodically. Only the procurement department attempted more sophisticated supplier management techniques - including the most detailed qualification documentation and more sophisticated supply chain management processes. There was evidence that the more sophisticated processes did result in better suppliers/contractors which were the contractors who worked on the better performing projects.

There was particular evidence that the more sophisticated supply chain management techniques led to enhanced performance; with identifiable reductions in project construction times, quality improvements and cost reductions. Examples from the case studies included:-

1. Providing framework agreements for common components - station platform venture being a prime example.
2. Knowledge of long lead-time components and liaison with manufacturer - steel piles and special steel rail being examples noted from five projects.
Other activities involved discussing forward spend plans; although no evidence was found that this actually improved project performance. It was supposed to benefit suppliers by allowing them to plan market activities, but such was the uncertainty in when planned projects would actually occur it was difficult to see how suppliers benefited.

The evidence supported the conclusion that this criterion was a factor which, if it occurs, will increase the project performance, reduce any project problems and ensure that the project was better able to satisfy the objectives of the client.

5.4.24 Management of project base

Some New Works Managers undertook a process to manage the portfolio of projects to ensure that sufficient resources were available to undertake the project - not least the project management resource. Other New Works Manager groups did not apply any techniques. There was evidence that individual projects benefited from portfolio management. There was less evidence (but indications of a stronger benefit) that the overall client portfolio could better deliver the overall client's aims and objectives if the right techniques were used.

Although some sophisticated techniques appear to be available, there was little enthusiasm for their use - this was true for project managers and clients alike. The benefits of the most sophisticated techniques will need to be investigated further.

The evidence supported the conclusion that this criteria was a factor which, if it occurs, will increase the project performance, reduce any project problems and ensure that the project was better able to satisfy the objectives of the client.
5.4.24 Benefit maximisation

The only benefit maximisation technique noted on the case studies related to change control processes. As noted above, some client driven changes could be readily evaluated and a decision made as to whether they actually add to the value added by the project. This occurred in seven of the case study projects - proformas were in use for most of these and, although not identical, they were all adaptations to improve upon a basic form provided in the Project management handbook.

No project had a structured method for tracking and responding to changing client requirements and objectives although several projects experienced difficulties when these did change - there was evidence that such a formal process would have pre-empted client driven detailed changes by several months in some cases. The evidence suggested that such a process would reduce the negative impact of such detailed changes - potentially to nil impact.

No project was found to have used techniques to pro-actively search for improved value - such as Value Management - indeed clients and project managers alike were sceptical about the benefits that this might bring. However, there was evidence to confirm that value available from the project was being missed - especially on longer duration projects.

The evidence supported the conclusion that this criteria was a factor which, if it occurs, will increase the project performance, reduce any project problems and ensure that the project is better able to satisfy the objectives of the client.

5.4.26 Induction of experience

The client does not have a process for ensuring that lessons learnt are captured, fed back to others and cast in better ways of undertaking projects. The existence of the
Project Management manual was the only vehicle by which this occurs. One New Works Manager team did attempt to review their work and disseminate the benefits of experience in internal team meetings and there was evidence that this served to improve future projects. Other project managers agreed that some form of experience capture would be beneficial and that the method used by the one team would be useful.

The other example of where experience was captured was with contractors - most divisions had their record of contractors which they wished to use and this was based to some degree on the past experience of that contractor working for that division. The opinions of different divisions could differ widely on the same contractor.

There was more evidence that not having learnt from projects previously undertaken elsewhere served to allow project problems to happen where they need not have done. One project exhibited the same problems as another also studied (but completed a year earlier) and it was possible to identify potential ways in which the problem could be solved (and avoided in future).

The evidence supported the conclusion that this criteria was a factor which, if it occurs, will increase the project performance, reduce any project problems and ensure that the project was better able to satisfy the objectives of the client.

5.5 **CONCLUSIONS FROM THE CASE STUDIES**

5.5.1 **Summary of findings**

The findings of the case study investigation were summarised as presented below. There were five key findings and they allowed the determination as to whether the model described in the previous Chapter 3 was accurate.
1. It was demonstrated that the following criteria were significant client level performance drivers:
   - Generating need for project.
   - Communicate need and connected requirements.
   - Finance for project.
   - Provide essential pre-requisites.
   - Take ownership of results.
   - Change.
   - Restrictions to programme.
   - Provision of internal resources.
   - Usurping roles of three participants.
   - Lack of response to other participants.
   - Provision of aims and objectives.
   - Direction of project specific activities.
   - Management of supplier base.
   - Management of project base.
   - Benefit maximisation.
   - Induction of experience.

2. It was demonstrated that the following client level drivers are go/no go criteria which must be in place if the project is to occur:
   - Generating need for project.
   - Communicate need and connected requirements.
   - Finance for project.
   - Provide essential pre-requisites.
   - Take ownership of results.

3. It was demonstrated that the following client level drivers serve to reduce the performance of the project:
• Change.
• Restrictions to programme.
• Provision of internal resources.
• Usurping roles of three participants.
• Lack of response to other participants.

4. The evidence described in this chapter supported the assertion that the following client level drivers serve to improve the performance of the project:-
• Provision of aims and objectives.
• Direction of project specific activities.
• Management of supplier base.
• Management of project base.
• Benefit maximisation.
• Induction of experience.

5. The evidence described in this chapter supported the assertion that the following criteria are performance drivers, but act at the project level:-
• Procurement route.
• Client’s relationship with selected participants.
• Experience of the client in construction projects.
• Nature of project.
• Change.

These were not included as part of the client role model.

6. The evidence described in this chapter supported the assertion that the following are not performance drivers:-
• Nature of Clients Business.
• Past experience of the client.
• Nature of project.
These, therefore, were not included as part of the client role model. Although the experience of the client has been cited as a performance driver, the evidence did not support the assertion that the more detailed issues revealed by this research show that they are the true drivers.

1.5.2 Using the findings to develop the quantitative model

The contingent factors demonstrated by the research described above provided the key platform on which to build the quantitative model. However, the data was further interpreted to demonstrate that it was possible to produce an interlinked description of the client role in an infrastructure project. This description is, effectively, a “qualitative model”. The model is described in the following section.

5.6 A MODEL OF THE CLIENT ROLE AND ITS PERFORMANCE DRIVERS

5.6.1 Differing facets of the Client Role

The previous section demonstrated the key performance drivers on the performance of a project from the client point of view. A descriptive model was then created to present a unified view of the potential role that clients can adopt. The advantage of undertaking this interim step (before producing the quantitative model) was that it provided a descriptive distillation of the evidence and analysis so far undertaken.

The model also enabled different clients to be compared and related to the contingent factors. It addressed many of the issues noted in the previous discussions – particularly the lack of definition considered earlier in this chapter. The model was based on the premise that a client has a definable impact on a project, the client input can be divided into three main areas:-
1. The elements that are necessary for the project to occur at all. This is termed the "Base Role" by the model.

2. Activities which a client is able to undertake that will improve the performance of the project. The model terms these the "Added Value Role".

3. Input to the project by the client that will adversely affect the performance of the project. This is the "Interfering Role" in the model.

These three facets of the client role may be used to classify the various client activities.

5.6.2 Base Role

The study of those projects which experienced fundamental difficulties in their progress revealed that there were a selection of fundamental roles that the client needed to undertake to ensure that the project actually occurs. Since these appeared to be a basic requirement of any project, they have been termed the "Base Role". The activities which fell under the base roles bore the greatest resemblance to that defined at the start of the chapter. The particular activities involved were found to be¹¹:-

1. **Generate the need for the project.** The client organisation must generate the need for the project in the first place and accept the implications of it (i.e. authorise it). This process of creation and sanction includes a sufficient level of formal appraisal.

2. **Communicate that need and connected requirements.** The requirements must be communicated to those who will enact the work - most commonly by the appointment of a person to manage the project and the development of a brief. This element includes all the activities surrounding the production of the brief.

3. **Finance the project.** The project must then be paid for. There are two aspects to this element; the finance must be raised for the project and the requisite mechanisms for payment to the participant must be put in place.

¹¹ Ibid pp 140 to 145.
4. **Provide the essential pre-requisites.** There are a range of other essential prerequisites (beyond finance and the brief) that must be provided. These include providing the site along with any necessary approvals and permits and the creation of the relevant legal agreements with the participants.

5. **Take ownership of the results.** Finally, the client must take ownership of the results of the project by accepting that the project has been completed and beginning to use it for the purposes intended.

A study of projects that have been accepted as failures, found that the reason for failure was that one of these base criteria were missing. In addition, there appear to be problems if each of the five main elements of the role are fragmented - for example undertaken by different organisations. An example of this is the Channel Tunnel project, as reported by Stannard (1990) where the funding and future ownership of the results of the project were the responsibility of different organisations to those who promoted the original idea. It was not until the project team reorganised itself to form a unified client role that problems in this area were solved.

Large organisations, which need to regularly undertake construction projects, can suffer from fragmentation of the base role and there is a need for them to crystallize this role so as not to give confused messages to the project. The Project Manager is often expected to do this. In this instance the Project Manager becomes extremely important as he must act in the role of Client Agent and have the dual abilities of understanding the clients business and have sufficient authority to ensure that the right answers emerge.

Recommendations on how to become a better client have, in the past, been directed at this type of role. Indeed, client organisations were shown earlier in this thesis to usually regard their role as confined to the basic role. However, the scope for
improving the success of the project through these activities is limited. Clients need to look at other areas where they can assist project success.

5.6.3 **Interfering Role**

It was found that the client could adversely affect the progress of a project in a number of ways. This has been termed the "Interfering Role" because the underlying characteristic was of a client who interferes in the normal progress of the project. The activities that fell under the category of the "Interfering Role" were found to be\(^1\):

1. **Change.** Change occurred during the life of all projects. Conventional wisdom was to decide upon the full requirements prior to commencing the project or at least work on site. There was, however, a difference between a client who ordered a change because of past failure to become clear about its needs and a client whose needs had actually changed and the project would be a failure if it did not respond to those altered needs.

2. **Restrictions to the Programme.** Any restriction on the programme and progress (for instance on the provision of the site) were limitations that would adversely affect the project. The client may restrict working hours or, in the most extreme cases, delay commencement of the works due to problems in acquiring the site or gaining planning permission.

3. **Provision of internal resources.** Being the provider of some of the resources also produced problems. Generally, clients should avoid the temptation to provide their own resources. Often specialist plant may be involved in works and a client may wish to own this themselves — for instance, if there was sufficient work to make the plant viable but insufficient work for every potential contractor to own their own specialist plant.

4. **Controls on technical details.** If the client decided to control certain technical details (and this included safety precautions particular to that client) then

\(^{12}\) Ibid p 145 to 149.
performance will tend to be lower than average for the market. There may be very good reasons for the client to pursue any of these roles (for instance the safety precautions) but it should be accepted that these were factors that reduce performance.

5. Usurping the roles of other participants. Other problem-causing roles occurred when the client usurped the roles of participants, such as by making direct instruction to sub-contractors or making design decisions that were best left to the experts.

6. Lack of response to other participants. The client could be the cause of delays brought about by the absence of its people or even the prevarication of these people in responding to needs of the project for information. It was demonstrated to often be tempting for a client not to make a decision unless the individual was sure that it was the right decision. The model suggested that any decision is likely to be better than no decision.

In order to improve the performance of the project, the client should seek to reduce the activities that go to make up this interference. In the real world (as evidenced by experience within TransOne) it was not always possible to avoid these issues totally. However, it was found that the intention must be to reduce the incidence of these issues or to reduce the impact that they will have on the project.

These issues have been termed “interfering” factors. Evidence was described earlier which demonstrated that there was scope for improvements by reducing the effects of these factors on project performance.
5.6.4 **Added Value Role**

The most successful clients were found to be those who engage in a selection of roles which could be described as adding value and are generally outside of what was generally taken to be project management - they are more akin to the idea of programme management. The particular activities included were found to be\(^{13}\):-

1. **Provision of aims and objectives.** Any prudent client would consider it essential to undertake an appraisal of options and seek to find and optimise the best one. Financial techniques for this are fairly well developed.

2. **Direction of project specific activities.** A clear vision and appropriate achievable objectives also mark out the successful client from less successful ones.

3. **Management of supplier base.** Processes for the management of potential participants over and above project specific techniques (such as the preparation of tender lists) is a common feature. In its simplest form this is the creation of select lists but can be far more sophisticated.

4. **Management of project base.** An active management of project portfolio to match aspirations with reality is another feature. Most clients who invest significant sums of money have a portfolio of projects that may be undertaken at some point. Decisions need to be taken as to the priority of the project, how it may be packaged with other projects to improve value for money and the appropriate timing to realise the maximum benefit.

5. **Benefit maximisation.** A key way in which a client can help improve an ongoing programme of work is in facilitating the feedback of lessons learnt in one project to future projects. Appropriate techniques are needed to do this as the information needs to be collected and made available in a way that is readily assimilated. Post completion reports are notoriously poor methods of doing this.

\(^{13}\) Ibid p149 to 153.
6. **Induction of experience.** A more complex concept is that of "feedforward" of information - basically the prediction of how changes will affect the future progress of the project. This involves change control (i.e. the evaluation of proposed variations) and the proactive management of the project.

**5.6.5 Uses of the qualitative model**

Use of this qualitative model provided the basis of the unified view that was noted as necessary, earlier in this chapter. The model was developed from one organisation in one industry. It can be used to explain many issues apparent during the initial analysis of previous work covering many clients in a range of industries. It has not been proven that the model will fit all types of client organisation, any project, any industry. However, the purpose of the qualitative model was to provide a framework for the development of the quantitative model – which will be tested against a variety of clients in various industries.

Viewing the client role in this manner described by the quantitative model enabled the following to be undertaken:

- Classify client activities and use this for comparing different client organisations. Compare and contrast map onto model, examine what different client organisations actually do, how successful they are.
- Select the best overall role.
- Determine which elements should be used.
- As the basis of a Performance Measurement System.

The identified roles could be used to guide a client organisation towards an improvement in its performance in a construction project. It was apparent that clients who involve themselves in only the base roles tend to be mainly infrequent constructors who have little to gain by maintaining complex links to the industry. Their approach can best be described as that of the Passive Client. Large clients who
have significant amounts of money to spend within the construction industry involve
themselves, at least in part, in the added value roles. Whether any client is involved
in the added value roles should depend only upon the benefits accruing\(^{14}\).

5.7 REVIEW

This chapter described the investigation into the potential client level factors that
affect the performance of a project – these may also be termed the “contingent
factors”. The following has been achieved:

1. The potential performance drivers have been filtered to remove those that are
   important or not client level. This has proved the tentative qualitative model.
2. The proven performance drivers have been “sized” in that their impact has been
   estimated.
3. The mechanism by which they act has been investigated.

The fundamental conclusion of the work described in this chapter is that one can
describe a model of the clients role that satisfies the following factors:

(a) Fits with wider business activity of the clients and its needs.
(b) Is consistent with the construction activity and its needs.
(c) Defines the key activities that must be performed by the client to properly fulfil
   items (a) and (b).

This makes the model a very powerful tool to explain the apparent features of any
project and the client input to it.

The method provided a good explanatory tool and goes some way to helping us
predict when a client is liable to be successful. However, this stage of the research
did not allow the accurate measurement of the impact of the particular ways of
satisfying the factors. The shortcomings in the model can be summarised as
follows:\(^{14}\)

\(^{14}\) This contrasting culture was that of the Active Client. Ibid p111.
1. Being able to explain features is not sufficient. It is important to be able to predict how organisations would behave. Ideally, our model should enable us to design a client organisation that will be free from weaknesses and exhibit all the strengths that have been noted. It may not be possible to achieve the “ideal” client but the model should be able to find the optimum solution. Additionally, there was some evidence that there may not be one “best solution” but that each client may have a different answer dependant upon the environment it finds itself in. This environment may also change over time, so the best client organisation may not be a static answer, but an ever-changing situation. This posed some major challenges to the research and suggests that we have only just begun to address the true nature of the problem.

2. The model was qualitative not quantitative. There was a need to measure the role in a way that was meaningful to both the client and the project team. This could give a common and measurable understanding of performance to give the opportunity to optimise performance in a predictable way.

3. The model has been developed from structured interviews and examination of published processes and practices. There was a need to look at particular projects and to look at other organisations.

The next steps in the research were therefore to:

(a) Establish what factors affect the performance of the activity.

(b) Develop the model so that it can become quantitative in terms of measuring input (costs) and output (benefits).

(c) Test the model as an explanatory tool and as a predictive tool in other organisations.

(d) Develop the model to encompass more detailed issues - probably by looking at the individual projects.
Chapter 6

DEVELOPING A UNIFIED MODEL FOR CLIENT PROCUREMENT

6.1 OVERVIEW

In the previous chapter, a qualitative model was devised to explain the client role. However, this did not enable the measurement of the performance of the process to be undertaken and judgements made about whether the activity was giving value for money. This chapter reports how the qualitative model was developed into a quantitative model.

The quantitative model was framed as a system model. Not only did the earlier findings suggest that this would be an accurate way of representing the true situation, but there were a series of formal proofs that can be applied if the model is cast into a systems form. The chapter provides a detailed description of the sub-systems and the key elements of them.

Once the model was created, it was necessary for this to be tested to ensure it holds true for the original organisation and other similar organisations. The requirements of a testing plan and the tests undertaken are reproduced in Chapter 7 and Chapter 8.
KEY CONCEPTS THAT CAN MEASURE VALUE FOR MONEY

6.2.1 Value

Value Engineering is often used to improve value-for-money and relies on a definition - quoted for instance by Male & Kelly (1987) that:

\[
\text{VALUE} = \frac{\text{FUNCTION}}{\text{COST}}
\]

Hence, good value for money is obtained when the value is at a high level compared to other projects. Value is also maximised by the reduction of cost.

Green (1992) shows how function can be analysed and quantified using FAST diagrams. These provide formal techniques for the determination of the key elements of function decomposition into detailed elements. Dell'Isola (1997) investigates this further and provides more detailed and powerful techniques to reveal and quantify function.

6.2.2 Cashflow and the time value of money

The value concept discussed above was based on cost as the only financial measure. However, from the client’s point of view, the actual cost of a project is never actually the entire definition of success. In conclusions drawn from practice in TransOne and those provided by most of the literature, the original budget for a project was determined from an analysis of the business case for the work. This business case relied heavily on the projected income (or impact on income) that the project was expected to bring. The establishment of a construction budget and managing the project against this was a robust management tool to ensure that this part of the venture delivered what was required, but it did not provide a whole picture. It was possible for a project that delivered against budget to be a commercial failure and a
project that was delivered over budget to be a success. This may have been for reasons outside the control influence of the project – for instance, that the market did not exist. However, the impact on income might be within the control or influence of the project – e.g. in a power station project greater capacity might be provided.

Allan (1981) states that the economic analysis of projects usually recognised the time value of money – i.e. that the holding and provision of funds for a project has a cost in itself. If the money required for the initial investment was to be borrowed from a bank, interest would be charged until the loan is repaid out of income for the project. If a company invests its own funds in the project there would be no interest to pay to an external body but the company would lose the opportunity to earn a return on the money in other ways – from an alternative investment (for example another project or investing the money with a bank). This loss of alternative earning power is the “opportunity cost” of using the money for other purposes. This was an important component in the evaluation of project performance and value added since it requires the comparison of the overall situation with the project against the situation without it. It also follows that when a project reaches a positive cumulative cash flow position, it generates available funds that could be notionally invested somewhere else to earn interest. It is helpful to regard a project as receiving capital from a pool of funds for which a “cost of capital” was incurred and as paying project profits into the pool of funds for which a further return at the same rate is earned - as given in Allan (1981). A project cashflow curve is shown in figure 6.1.

The actual value of the cost of capital to use depends upon how the client organisation finances its portfolio of projects. There are usually several ways in which capital is raised for long term purposes such as infrastructure projects; including, as given by Harris and McCaffer (1989): retained profits, issue of share capital, clearing bank loans, merchant bank finance, debentures and grants. The true cost of capital for any project is, therefore, the weighted average of the interest rates of the sources actually used for the portfolio. This can be difficult to calculate as
there may be a raft of financing all at different rates – and some of these may be variable. In addition, short term finance for the running of the business can also be obtained from, for example, clearing bank overdrafts, tax incurred but not due, creditors and internal transfer - Harris and McCaffer (1989). Whilst these sources are not used directly for project funding, they do complicate the view of how to calculate a straightforward “cost of capital” as they are part of the usual corporate treasury function involved in the settlement of all types of invoices and other liabilities. For these reasons, practical project evaluation uses a single rate of cost of capital for all projects within any client organisation, which rarely changes. The research will do likewise because (a) it conforms with actual practice, and (b) it avoids unnecessary complication. It is, of course, possible to calculate a particular cost of capital for any project or portfolio (and use this in the calculation of whole value), if this is required.

There are several ways of expressing this situation in the economic evaluation of projects. Nett Present Value (NPV) is appropriate to the calculation of value because it enables any cash flow or transaction to be expressed in terms of the same base date. It is necessary to set a common base date for the alternatives being compared so that a like-with-like comparison occurs. Hence, if various options for a single project are being analysed, the base date may be the commencement date of the project - if alternative projects are being considered for a portfolio, a date common to
all projects will need to be chosen. If the cash flows are taken in yearly increments, the present value $p$ at year 0 of a cash flow $C_t$ in year $t$ at an annual discount rate of $i$, expressed as a decimal fraction is:

$$ p = \frac{C_t}{(1 + i)^t} $$

For a complete project the earlier cash flows are usual negative and the later ones positive and the project nett present value $P$ is the sum of the individual present values of the yearly cash flows:

$$ P = \sum_{t=0}^{t=n} p = \sum_{t=0}^{t=n} \frac{C_t}{(1 + i)^t} $$

In this case the life of the project $n$ years has to be specified, together with the estimated cash flows in each year up to year $n$.

If the rate of cash flows in a project can be represented as a continuous function of time, $c(t)$, and is discounted continuously instead of at discrete time intervals, the project nett present value can be defined also as a continuous function:

$$ P = \int_0^n C(t) \cdot e^{-it} \, dt. $$

Discounting using continuous and discrete time intervals gives slightly different results. Allan (1987) stated that continuous discounting can often be more convenient when the function was to be included in a wider mathematical model; but that discrete yearly intervals was usual practice even though the resulting cash flow curves are frequently shown as being continuous rather than stepped.

Inflation results in the devaluation of money over time in a way that is separate from the discounting described above that takes account of the time-value of money. To allow for this in a manner which allows the comparison of the results for different projects of portfolios, it is necessary to convert cash flows into their worth at a base date – normally the same as that used for the time-value discounting. Hence, a cash
flow in year $t$ measured in terms of the actual value of money units in year $t$ is $C_{at}$. The same cash flow in year $t$ measured in terms of the money units with equivalent value at the present time is $C_{ot}$. The relationship between them, if there is a constant annual inflation rate $f$, will be:

$$C_{at} = C_{ot} (1 + f)^t$$

Or, rearranging:

$$C_{ot} = \frac{C_{at}}{(1 + f)^t}$$

If the inflation rate varies with time from year 0 to year $t$, such that the inflation rate is $f_j$ in year $j$, then:

$$C_{ot} = \frac{C_{at}}{(1 + f_1) \cdot (1 + f_2) \cdots (1 + f_t)}$$

Therefore, on discounting yearly cash flows to find Net Present Value (NPV), the yearly cash flows are first expressed in money units of constant value, thus:

$$NPV = \sum_{t=0}^{t=n} \frac{C_{ot}}{(1 + i)^t}$$

An effect of the consideration of timing of cash flows is that the duration of the project becomes a factor in the measurement of the project performance using whole value. Generally, projects which deliver earlier will give higher values. Therefore delays to the programme which push back the timing of income will decrease the measure of the performance of the project.

### 6.2.3 Risk

So far, the consideration of costs, returns and other outcomes has been considered in a deterministic sense, in that the values of the decision variables are known with absolute certainty. In a project environment where we are looking at events that
are yet to occur, this is not the case. The purpose of this section is to consider how the uncertainty that is obviously present may be represented and analysed.

A simplistic approach to quantifying uncertainty is cited by Flanagan and Norman (1993) whereby the discount rate used to calculate nett present worth is increased to reflect the level of risk associated with the project. The equation given is:

\[ RA = (RF + I + RP)^t \]

Where over \( t \) years, the risk adjusted discount rate, \( RA \), is the sum of the discount factors resulting from the risk free rate, \( RF \), an allowance for inflation, \( I \), and the risk premium \( RP \).

A low risk investment such as a cost saving improvement to an existing plant may have a small increase to the basic rate. A higher risk project involving a new process technology or a new product would require a relatively high increase on the basic rate. To take a more specific account of uncertainty and the consequent risk in a project it is necessary to identify the sources of uncertainty in particular forecasts and estimates and then to trace their effect on the project as a whole.

The Probabilistic approach provides a more sophisticated approach to quantifying risk. If the probability that income \( A \) will occur, \( P(A) \), is said to be 0.6 then there is a 60% chance that this income will be received. If the level of the income is known then the expectation or Expected Monetary Value, \( EMV \), will be given by:

\[ EMV = P(A) \cdot A \]

The probabilities can either be determined from the objective analysis of historic data or from subjective experience based estimates (Delphi techniques).

Probabilities can be readily combined. If two events are mutually exclusive then the probability that either one or the other will occur is the sum of their separate probabilities:
\[ P(\text{either } A \text{ or } B) = P(A) + P(B) \]

If the two events are independent, that is the occurrence of one does not affect the probability of occurrence of the other, then the probability that they both will occur is given by the product of their separate probabilities:

\[ P(\text{both } A \text{ and } B) = P(A) \cdot P(B) \]

If the two events are not mutually exclusive the formula for the probability that either one or the other will occur is as follows:

\[ P(\text{either } A \text{ or } B) = P(A) + P(B) - \{ P(A) \cdot P(B) \} \]

This relatively straightforward method of including probabilities lends itself well to the use of corporate data and know-how.

To apply Stochastic methods, it would be necessary to undertake a statistical analysis of a sufficiently sized sample of the data to produce the appropriate probability distribution curves. Such techniques may provide possible benefits\(^1\).

6.3 **COMBINING VALUE, RISK AND CASHFLOW**

6.3.1 **The process for combination**

The previous section identified the key components of whole value. This section examines how these components were combined to form a definition of whole value. The steps by which this occurred were:-

1. Take the value formula revealed above.
2. Add the dimension of income as well as costs.
3. Include time-value effects by the use of discounted cash flow values.
4. Include risk within appropriate elements of formula.

---

\(^1\) It was shown that the simpler probabilistic expression of risk is sufficient. However, stochastic approaches will also fit with the model.
The effectiveness of the formula so produced will be illustrated by the addition of real data derived from TransOne. At the end of this section there are comments on the (a) availability of data, (b) features observed and their relationship to the real world, and (c) the efficacy of the formula.

6.3.2 Step 1 – Value Formula

By inspection of the formula for Value, above, it could be seen that, if function remains constant, value in a project at any point will be similar to the cash flow line for a project. If function changes during a project, then the value will vary from the line in figure 6.2 depending upon the magnitude of the change in function. This gives us a diagrammatic representation of the function for the change in value during the course of a project. If it was assumed that the concept of Whole Value is comparable to that of value used in a cost sense (except that the value added by the income potential is also included) then it can be concluded that Whole Value will follow a similar function to that in figure 6.2. This required, however, the determination of the exact formula that described how cost and income are combined to define this new concept of Whole Value.

6.3.3 Step 2 – Including cashflow

From the known graph represented in figure 6.2, the formula for Whole Value was shown to be represented by the diagram in figure 6.3. The diagram was held to be true because (a) it explained how the Whole Value will be zero at commencement of the project and at the Break Even Point; (b) it explains how Whole Value decreases as the costs of the project are expended; and, (c) it explained how Whole Value becomes positive after the Break Even Point. If this diagram does describe the concept of whole value, then by inspection, it can be used to recognise what the value of the Whole Value will be for various fixed value of Income, Cost and Function.
These can then be used to test the potential formulae. It was calculated that the values of Whole Value at these defined points were as follows:

If \( F = 0 \) then \( WV = 0 \)
If \( I = 0 \) then \( WV = -CV \)
If \( I = C \) then \( WV = 0 \)
If \( I = 2C \) then \( WV = CV \)
If \( I = \frac{1}{2}C \) then \( WV = -2CV \)
If \( C = 0 \) then \( WV = \infty \)

Also, the diagram demonstrated that for changes in any element, the Whole Value (and others) changed.
These were also used in the proof:

\[
\begin{align*}
\text{As } & I \uparrow \quad \text{then} \quad IV \uparrow \quad \text{And so} \quad WV \uparrow \\
\text{As } & C \uparrow \quad \text{then} \quad CV \uparrow \quad \text{And so} \quad WV \downarrow \\
\text{As } & F \uparrow \quad \text{then} \quad CV \uparrow \quad \text{And so} \quad WV \uparrow \\
\text{As } & F \uparrow \quad \text{then} \quad IV \uparrow \quad \text{And so} \quad WV \uparrow
\end{align*}
\]

As discussed in Chapter 2, the methodology used to determine the correct formula involved the testing of potential formula derived from a theoretical consideration by solving these formula for the known points. This methodology is applied in the following pages.

The simplest potential definition of Whole Value was the algebraic difference between Income Value and Cost Value. This generates the formula:

\[
WV = IV - CV \quad \text{(Equation 4.1)}
\]

Where:

- \(WV\) = Whole value
- \(IV\) = Income value
- \(CV\) = Cost Value

If the function was to be framed in numerate ways - such as car park spaces, platforms, sq. metres, then the units of value would be spaces/£; platforms/£ and m\(^2\)/£. Whilst this made sense in defining value to be maximised, it was noted to be common to express rates which are the inverse of value - i.e. £/spaces; £/platforms and £/m\(^2\). Therefore, it could be said that rates are the inverse of value:

\[
\text{UNIT RATE} = \frac{\text{COST}}{\text{FUNCTION}} = \frac{1}{\text{VALUE}}
\]

If the client was more interested in the income that the project could bring and how much this was greater than the costs (i.e. the profit), then an alternative view could be taken. The value defined by the function/cost equation was only half of the client's
perception of value - this may be termed Cost Value. "Income Value" (the other half of the client’s perception of value) would be defined in a similar way to the Cost Value equation above:

\[
\text{VALUE} = \frac{\text{FUNCTION}}{\text{INCOME}}
\]

The client’s perception of value may be termed "Whole Value" as follows:

\[
\text{WHOLE VALUE} = \text{INCOME VALUE} - \frac{1}{\text{COST VALUE}}
\]

(Equation 4.2)

Looking again at the definition of rates, it may alternatively be argued that the definition of Whole Value may be obtained from the algebraic difference in the Income Rate and the Cost rate:

\[
R_w = R_i - R_c
\]

Where:

- \( R_w \) = Whole Rate
- \( R_i \) = Income Rate
- \( R_c \) = Cost Rate

Which gave, in terms of value:

\[
\frac{1}{WV} = \frac{1}{IV} - \frac{1}{CV}
\]

(Equation 4.3)

Another line of argument resulted in a third potential definition for Whole Value. This preserved the original value equation but substituted the nett cash flow of the project for the cost:

\[
WV = \frac{F}{(1 - C)}
\]

(Equation 4.4)
Where:

\[
\begin{align*}
C & = \text{Cost} \\
I & = \text{Income} \\
F & = \text{Function}
\end{align*}
\]

Since this would result in a decrease in Whole Value for increasing income (which would be counter to the concept of value), it was unlikely that this would provide the true definition of Whole Value. However, if the equation was inverted, this will be a change to the units used in the conventional definition of value, but preserves the relationship that numeric quantity of value should increase to show an improvement in value:

\[
WV = \frac{(I - C)}{F}
\]

(Equation 4.5)

Where:

\[
\begin{align*}
C & = \text{Cost} \\
I & = \text{Income} \\
F & = \text{Function}
\end{align*}
\]

A more complex definition that satisfied the issue revealed above, would be to add to the definition of cost value a factor to account for the income to be generated. One method of doing this was found to be to multiply the Cost Value by the frequently used economic criteria for projects Nett Present Value $\div$ Outlay:

\[
WV = \text{COST VALUE} \times \frac{NPV}{OUTLAY}
\]

Where:

\[
\begin{align*}
NPV & = \text{Direct Function} \\
OUTLAY & = \text{Capital Cost} = C
\end{align*}
\]

Expressing this in terms of Function, Cost and Income gives the following formula:

\[
WV = \frac{F}{C} \times \frac{(I - C)}{C}
\]

(Equation 4.6)
By applying the same logic, another similar equation arose. This involved the multiplication of the Cost Value by the Nett Present Value only:

\[ WV = \text{COST VALUE} \times \text{NPV} \]

Which gave the following formula expressed in terms of Function, Cost and Income:

\[ WV = \frac{F}{C} \times (1 - C) \]

(Equation 4.7)

Each of the equations were inspected to reveal how the values would match the known values derived from diagram 6.1. Table 6.1 shows the results of undertaking the proofs and calculation for each formula. As indicated by this table, Equation 4.6 is the only expression that fully describes the value function for income and cost.

Table 4.2 shows that it was proven that the equation for Whole Value is:

\[ WV = \frac{\text{COST VALUE}}{\text{OUTLAY}} \times \frac{\text{NPV}}{\text{OUTLAY}} \]

This provided a powerful numeric tool to determine the value added by any project to the client's business as it involved a combination of Income, Cost and Function. It was possible, for the first time, to involve function in economic analysis.

6.3.4 Step 3 – Including Time Value

Time value was able to be included in a relatively straightforward manner - the present worth of any cost or income streams should be used in the equation proved in the previous section. The formulae to calculate the present worth for any timing of cash flow, including in conditions of inflation, were given in section 6.2.2.
### Table 6.1
RESULTS OF PROOF FOR WHOLE VALUE EQUATIONS

<table>
<thead>
<tr>
<th>Whole Value</th>
<th>Results for Each Formulae</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input</td>
<td>4.1</td>
</tr>
<tr>
<td>F = 0</td>
<td>WV = 0</td>
</tr>
<tr>
<td>I = 0</td>
<td>WV = -CV</td>
</tr>
<tr>
<td>C = 0</td>
<td>WV = ∞</td>
</tr>
<tr>
<td>I = C</td>
<td>WV = 0</td>
</tr>
<tr>
<td>I = 2C</td>
<td>WV = +CV</td>
</tr>
<tr>
<td>I = 1/2C</td>
<td>WV = -2CV</td>
</tr>
<tr>
<td>I ↑</td>
<td>WV ↑</td>
</tr>
<tr>
<td>C ↑</td>
<td>WV ↓</td>
</tr>
<tr>
<td>F ↑</td>
<td>WV ↑</td>
</tr>
<tr>
<td>Units</td>
<td>Nr/$</td>
</tr>
<tr>
<td>Result of Proof</td>
<td>False</td>
</tr>
</tbody>
</table>

**NOTE:**
Blank cells within the above table denote that the calculation was not undertaken as the formula was already proved to be false with the data already available and f(F,C) denotes a complex function which is not detailed here.
6.3.5 Step 4 – Including Risk

It was shown in the previous chapter that many project costs were not directed at maximising function, but at reducing risks. Safety issues, for example, are typical. Other risk issues involve the reduction of the risk of cost or programme escalation. Whilst it was possible to translate most of these activities to a reduction in cost; it may not be possible to do this with accuracy. In some cases it was difficult to undertake this in any way. The research, therefore, suggested that project performance benefit involves the three elements: (a) a reduction in cost; (b) a reduction in the risk of an occurrence, or, (c) the increase in function. Therefore, it was necessary to add an expression to both function and cost to allow for the risk and uncertainty involved. When this was done, the full equation became:-

\[
WV = \frac{DF + (DF \times DFR)}{DC + (DC \times DCR)} \times \left[\frac{DI + (DI \times DIR)}{DC + (DC \times DCR)} - \frac{DC + (DC \times DCR)}{DC + (DC \times DCR)}\right]
\]

or, rearranging to become:-

\[
WV = DF \times (1 + DFR) \times \left[\frac{DI \times (1 + DIR)}{DC \times (1 + DCR)} - 1\right]
\]

Where:

- \(WV\) = Whole Value
- \(DF\) = Direct Function
- \(DFR\) = Risk to the Direct Function (+ve or -ve)
- \(DI\) = Direct Income
- \(DIR\) = Risk to the Direct Income (+ve or -ve)
- \(DC\) = Direct Cost
- \(DCR\) = Risk to the Direct Cost (+ve or -ve)

In order to ensure that costs are only being experienced (or maximised) on the right aspects of function, cost or risk management, it would be necessary to carefully define those aspects that are of value to the project and the client. These aspects were expected to vary between client and, probably, between project.
The details of how value-for-money may be measured and maximised were developed here. However, it was necessary to develop the tentative client role\textsuperscript{2} definition into a quantitative systems model before attempting to apply the numerate concepts developed at this point.

6.4 DEVELOPING THE QUALITATIVE MODEL INTO A QUANTITATIVE MODEL

6.4.1 Modelling as a system

The qualitative model described in the previous chapter gave a method of explaining issues arising from how clients enact their role in infrastructure projects. Casting this qualitative model into a formal systems model gave the following benefits:

1. The flow charts developed enabled the sequence and linking of actual activities to be mapped.
2. The model can be made numeric by applying the formula developed above.
3. Understanding of the model can be enhanced because it was possible to access the formal proofs and other work undertaken into systems theory and industrial dynamics.
4. Actual processes used in organisations could be compared with the model to see if they contain the same features as the model.

Systems models can be built in a variety of ways. One of the common tools to flow chart the processes, controls and resources involved is the Structured Analysis and Design Technique (SADT, but also known as IDEF) which is described by both Marca and McGowen (1988) and Fellows (1998). This was investigated for use in constructing the model as it was encountered in several organisations involved in this research (see Chapter 8). The method is a relatively straightforward way of

\textsuperscript{2} Ibid. p 156
producing a map of the actual activities in an organisation and of designing (or representing) a simplified, improved process.

The method has been used throughout the research as a design tool, but will not be used to report the actual model produced as its complexity is not required to portray the key elements of the model. Instead, a simplified series of flow charts have been produced, and these are used in this chapter. The remainder of section 6.4 provides a discussion of the simplified modelling method used to construct the model of the client role.

6.4.2 Components of the model

The model was based on the basic building blocks derived from several sources. These were:

1. The model was primarily composed of sub-systems to allow the whole process to be sub-divided into ever smaller and more defined pieces. This process, termed decomposition, allowed a simple model to be produced relatively quickly and refined as more information becomes available.

2. The model had a flow of identifiable (and countable) items through the model. In Industrial Dynamics, as developed by Forrester (1962), this was normally the item or items being manufactured. Here, the definition of Whole Value was used as the item to be monitored. This was a more abstract concept than tangible items; but Forrester (1962) supported this application.

3. The controls that affect the flow – either to decrease it, stop it, delay it or have other effects – were formally identified.

4. There was an explicit feedback loop. Feedback is the flow which ensured that any difference in the actual output and the desired output were able to be fed back to the start of the process so as to allow amendment to the input.

5. In addition there was an explicit feedforward loop. Feedforward allowed a change in the control to be used to affect the output so that the difference in the
actual output and the desired output is minimised before that difference becomes apparent.

Figure 6.4 shows how these features were portrayed in a flow diagram.

![Simple Feedback Control Model](image)

**Figure 6.4 - Simple Feedback Control Model**

The research work developed this fundamental system model to ensure it contained features appropriate to both Industrial Dynamics and the use of this technique. These were:

1. The concept of an inventory was introduced. The inventory, as defined by this work, was a list of items (e.g. projects) that are in that current defined state.
2. Decision Points occurred between inventories. These gave the opportunity to treat different items within the flow in different ways depending upon the item and the input to the decision.
3. Activities were defined as any action required to implement the decision - at the decision point or within the inventory. The level of activity, complexity and cost can be varied dependant on the value that they give to the process. Hence, it
would be determined which activity would be appropriate in any circumstance - i.e. for different clients with differing project portfolios.

4. A source was defined as the start of the process and a sink was the defined end. They mark the boundaries of the system.

Figure 6.5 shows how these are represented in the model.

All of these features can be supported by the SADT/IDEF technique noted before.

6.4.3 System Synthesis

The system was synthesised in the following manner:

1. By applying these concepts to the understanding of the client role developed at this point in the research, the principal sub-systems and how they interrelated were crystallised. Sources and sinks of projects, together with other key pieces of resource, were identified.
2. By reviewing the case studies in the previous chapter, the connection of the sub-
systems was identified. The boundaries of the environment, the client and project
elements of the model were also identified.

3. By studying the processes used within Transone, it was possible to identify the
inventories that were used and those that logic suggests should be used together
with the principal decision points.

6.4.4 Quantitative Measurement

The model undertook a quantitative measurement of the performance of projects at
any point by applying the definition of Whole Value developed above. This formula
could be used to calculate the whole value of any project in the inventory and the
whole value represented by the inventory in total.

Therefore (a) the average performance of the client portfolio can be calculated and
compared with other clients, and (b) the performance of a particular project could be
calculated and compared with the average. The financial element of value was
calculated from recorded information. The Value Criteria element needed to be
determined by (a) fixing the Value Criteria that were important and (b) combining
them in a weighted manner. The changes to the financial and Value Criteria and
their absolute value could be calculated for any point in the system. The definition of
Whole Value was also used to drive the decisions at the relevant decision points.

A sample set of Value Criteria for TransOne are contained in the calculations of
sample data⁴.

⁴ Ibid p 213
6.3 DISCUSSION OF MODEL AND ITS PRINCIPLE SUB-SYSTEMS

6.3.1 Overview of system

Table 6.2 lists the key subsystems contained within the model. There were three layers to the model:-

1. The mandatory client layer which showed how the essential client activities bore on the project activity. These were the Base client roles defined in the previous chapter.

2. The optional client layer showed how the client may add value to the process. This layer was based on the Added Value role identified previously. The subsystems were derived from the detailed areas within this.

3. The third layer, the Project Management layer, was represented as a single subsystem with all the activities normally associated with the management of an infrastructure project

The optional layer was more complex and consisted of five interconnected subsystems. Broadly, there was a simple connection between each sub-system in that one sub-system will feed projects into the next one when it was complete. Figure 6.6 depicts the key sub-systems within the optional client layer. The impact of the mandatory client layer and the project management layer are also shown. The key subsystems are outlined here and described in detail in later sections:-

1. The Projects subsystem dealt with the management of the potential projects from inception to the commencement of work. It dealt with the processes necessary to determine which projects should be enacted and how the timing of a project may be best adjusted to ensure the maximum benefit available commensurate with the availability of resources.

---

4 This not described in detail here as it is outside the bounds of the research, not being a client activity.
2. The Resources or Suppliers sub-system dealt with the selection and management of suppliers, contractors and other project participants. It dealt with the processes necessary to determine which resources are necessary for the enacting of the project portfolio, how they can be managed outside of a particular project and the performance they exhibit across all projects. The subsystem was able to be replicated for each of the classes of project participant (or resource) which the project will use.

<table>
<thead>
<tr>
<th>Label</th>
<th>Subsystem</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>α</td>
<td>Projects</td>
<td>Manage the portfolio of projects prior to commencement of works.</td>
</tr>
<tr>
<td>β</td>
<td>Suppliers</td>
<td>Manage the key resources outside of the normal project activity.</td>
</tr>
<tr>
<td>χ</td>
<td>Organisation</td>
<td>Decide which form of organisation (normally contracting arrangement) should be used.</td>
</tr>
<tr>
<td>δ</td>
<td>Management</td>
<td>Project management of the project.</td>
</tr>
<tr>
<td>ε</td>
<td>Review</td>
<td>Review and agree performance with client and effect handover.</td>
</tr>
<tr>
<td>ϕ</td>
<td>Benefit</td>
<td>Implement “Aims”, “Objectives” and change control</td>
</tr>
<tr>
<td></td>
<td>Maximisation</td>
<td></td>
</tr>
<tr>
<td>γ</td>
<td>Induction of experience</td>
<td>Ensure lessons learnt are fed back to future projects in an effective manner.</td>
</tr>
</tbody>
</table>
Figure 6.6 - Main System Flow Chart
3. Organisation sub-system deals with the available arrangements for the organisation of a project. This was replicated to take account of the various features which were important: - Contracting Arrangement, Form of Contract (if different), Project Organisation (if different ones are identified within the client's projects). The sub-system is developed here purely to consider the contracting arrangement as it was assumed that the selected project organisation and form of contract will support this.

4. The Benefit Maximisation sub-system described the activities necessary to take the overall aims and objectives of the project portfolio and ensure that these impacted on the detailed decisions taken during other client activities.

5. The Induction of Experience sub-system described the role to be played by the review of project performance and methods to ensure that this new information was used effectively to improve the performance of future projects.

6.5.2 Supplier Selection

The participant selection sub-system related to the selection and management of project participants: contractors, designers, nominated sub-contractors and potentially, the Project Manager. A better term would be the resources sub-system. Figure 6.7 shows the flow chart for the sub-system, table 6.3 lists the decisions and table 6.4 lists the inventories.

Although the sub-system applied to all these resources, its application to the main contractor is used as an example. There are many contractors in the market, some of whom may not be aware of the client or be aware that the client is interested in employing contractors of their type. These are represented by the source in the sub-system. Contractors can first learn of a client's need (a) from an un-solicited approach to a member of the client's staff or (b) by noticing an advert in a trade
magazine or other form of communication. Not all participants may wish to work for the client, not all may have acted on whatever process is in place to identify participants (for example not all may have responded to advertisements in the technical press). There is significant self-selection in this process as this is the contractor's decision (Decision A - Invitation). Clearly then, the whole market of participants who could work on projects for the client (the source) is not the same as the actual group of participants who are available to the client and the project (Inventory 1 - Available Participants). In theory, the sub-set of contractors within the Available Participants inventory should be better than the market as a whole - i.e. it should be possible to measure the Partial Value of the inventory and compare this against the market as a means of measuring the value added by the collection of potential contractors. The Partial Value definition here may not include all the Value Criteria that the client should study, because it may not be possible to collect reliable information on each criteria for every contractor within the market population. A value judgement has to be reached on which criteria are to be used. Efforts to improve the process at this point can include efforts to:

1. Increase the Partial Value added; or

2. Reduce the cost of achieving an appropriate inventory of Available Participants.

The client will need to have some objective criteria to sieve the Available Participants (Decision B - Pre-Qualify) and achieve a list of contractors who the client actually wished to use (Inventory 2 - Participants under Management). We have called this inventory Participants under Management because the evidence from the case studies suggested that skilful management of this element would add the most value to the sub-system. It is necessary for the client to define selection criteria to apply to the decisions that are derived from: the known weaknesses of

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5 It is suspected that the value judgement may result in a different set of necessary Value Criteria depending upon the nature of the client - this is considered in more detail in Chapter 7. However, the readily available information is similar in the case of each client and this helps to ensure that the appropriate criteria are similar.

6 Ibid, p 150.
contractors; the needs of the project to be undertaken and the client’s own business. This decision may be seen as a hurdle which contractors must get over to be considered for work. It may be in the interests of the client to help contractors address weaknesses, if the contractor appears to be suitable in other ways. This requires work with contractors for what is sometimes termed “strategic reasons” which include ensuring that sufficient contractors are available to maintain a competitive market. There are, in effect, two sections to this inventory - those that are viewed as potential suppliers and those that are ready for selection on tender lists.

The previous decisions and inventories have been fundamentally under the control of the client. The following activities were closely linked with the project and the role that the client has to play is different. Contractors who will be asked to tender for the project works are drawn from the select list according to pre-defined criteria (Decision C - Qualify). This gave rise to the formal Tender List (Inventory 3 - Tender list). Various methods of competitive and negotiated bidding are available to select the bid from the contractor who will give the perceived best value for money (Decision D - Select).

The status of the chosen contractor is recorded by the final inventory (Inventory 4 - Project Participants). This inventory will be a collector of all the types of project participant and, if maintained by the client at the portfolio level, will be a list of the contracts underway with all current potential participants. Such a register is useful for audit reason (to ensure that only “approved” participants are in use) and to satisfy, for instance, the Construction Design and Management (CDM) regulation requirements for the client responsibility. An optimisation process to find the maximum value that can be added for minimum cost provides the optimum level of input into these processes.

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7 These criteria also have to satisfy EU Procurement legislation (see Chapter 3) and be demonstrably fair in the event of challenge from contractors.
8 Again, this needs to follow EU procurement legislation.
9 “Most economically advantageous” tender is a phrase used in EU procurement directives.
10 CDM probably provides the minimum level of input that a client needs to provide.
Figure 6.7 - Supplier Selection Sub-system
Two other decisions are important to this area of client/project management. At the completion of the project there needs to be a review of the contractor’s performance. The overall business effect of the contractors actions are dealt with in the review and lessons learnt sub-systems (see later). However, the client will decide to use the contractor again, or not if the performance has been particularly poor (Decision E - Completion). An explicit decision to not use the contractor seems rare and an explicit decision to keep the contractor has (in the case studies) been by default. More likely decisions on the long-term future of the contractor occurred in activities connected to what is termed list maintenance (Decision F - List maintenance).

<table>
<thead>
<tr>
<th>Label</th>
<th>Decision</th>
<th>Purpose</th>
<th>Techniques</th>
</tr>
</thead>
</table>
| A     | Invitation     | Suppliers decision to wish to supply to the client | 1. Advertise in OJEC  
2. Advertise in journal  
3. Word of mouth |
| B     | Pre-Qualify    | Appraisal of new suppliers                   | 1. Criteria based selection  
2. Past performance  
3. Sales Pitch |
| C     | Qualify        | Shortlist of contractors to use              | 1. Criteria based selection  
2. Past performance  
3. Sales Pitch |
| D     | Select         | Selection of contractor to use               | 1. Criteria based selection  
2. Past performance  
3. Sales Pitch |
| E     | Completion     | Appraisal of used suppliers                  | 1. Removal of contractor from project  
2. Performance review of successful contractors |
| F     | List maintenance | Appraisal of existing suppliers            | 1. Client removes supplier from select list(s). |

The recent performance of contractors in actual projects, their success at bidding for work and their ability to satisfy selection criteria - together with new contractors entering inventory 2 and possible reductions in the total number of contractors required to fulfil future workload - meant that there is a need to remove contractors
from the list. This seems a more difficult decision as to whether to include a contractor at this stage yet is less structured\textsuperscript{11}.

The difference between the list (if one exists) of suppliers who wish to work for the client and those of the market as a whole were compared to give a picture of the quality of the process for motivating the right contractors to work for the client and the size of any barriers to entry.

\begin{table}[h]
\centering
\begin{tabular}{|l|l|l|l|}
\hline
Label & Inventory & Purpose & Measurements \\
\hline
1 & Available participants & Participants who would like to be used. & Number in inventory \\
 & & & Value Criteria \\
2 & Participants under management & Lists participants who may be used. & Number in inventory \\
 & & & Value Criteria \\
3 & Tender list & Asked to tender & Number in inventory \\
 & & & Value Criteria \\
4 & Project participant & In use on project. & Number in inventory \\
 & & & Value Criteria \\
\hline
\end{tabular}
\caption{Inventories within Supplier sub-system}
\end{table}

6.5.3 \textbf{Project Selection}

The other main input sub-system is that for potential projects. Figure 6.8 shows the flow chart for the sub-system, table 6.5 lists the decisions and table 6.6 lists the inventories. The theoretical pool of ideas is represented by the source in the sub-system. Various activities can be used for the generation and capture of potential project ideas (Decision A - Idea Capture) including those proposals thought up by any member of the client’s organisation (a bottom up approach) and using more structured methods such as value management workshops to move from the general client business objectives to identify particular projects which can contribute to this (a top down approach). The outcome of these processes is to arrive at a list of potential projects that could be pursued (Inventory 1 - Potential Project Ideas). Not

\textsuperscript{11} TransOne did not have a formal process for this to occur and lists generally got larger over time. Priority indications were given to contractors on this inventory which meant that lower priority firms were on the inventory in name only.
all of these can be pursued because finances would not be available and many projects may overlap. In addition, the creative processes used to identify potential ventures may not be sufficiently thorough to have investigated all risks and costs that may occur. It was noted in earlier chapters that formal methods are used to ensure that the business case for any project has been thoroughly investigated and to endorse those that show benefits greater than a defined threshold (Decision B - Endorse Business Case). This gave rise to a list of projects which the client has decided to allow to occur (Inventory 2 - Project Portfolio).

All these inventories and decisions are clearly totally under the control of the client and should not be decided by project teams.

<table>
<thead>
<tr>
<th>Label</th>
<th>Decision</th>
<th>Purpose</th>
<th>Techniques</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Idea Capture</td>
<td>Collect ideas in formalised way.</td>
<td>1. VM and VE</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2. “ideas in the bath”</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>3. Pet projects</td>
</tr>
<tr>
<td>B</td>
<td>Endorse Business Case</td>
<td>Ensure business case has been evaluated to sufficient degree.</td>
<td>Review panel</td>
</tr>
<tr>
<td>C</td>
<td>Accept Implementation form</td>
<td>Ensure right implementation form is used.</td>
<td>Review panel</td>
</tr>
<tr>
<td>D</td>
<td>Authorise start</td>
<td>Ensure that the project commences at right time.</td>
<td>Review panel</td>
</tr>
<tr>
<td>E</td>
<td>Review implementation form</td>
<td>Identify improvements</td>
<td>Analysis of fit, benefits of packaging</td>
</tr>
<tr>
<td>F</td>
<td>Review business case</td>
<td>Identify improvements</td>
<td>Analysis of Age, Market conditions (supply and customer)</td>
</tr>
</tbody>
</table>

The work undertaken in Chapter 4 showed where the activities mentioned above were undertaken. However, projects usually moved from the Project Portfolio inventory to commencement with little more being done to improve the value-for-money being attained. It was demonstrated earlier that the method of
implementation\textsuperscript{12} was accepted along with the business case. This issue seems one that could be developed after the business case has been investigated and can be undertaken only for those projects with an assured benefit. (Decision C - Accept Implementation form). This gives rise to a reduced list of packaged projects (Inventory 3 - Packaged Projects) that are a defined improvement over and above the individual projects from which they were comprised. Improvements can be made as this process will remove any project overlaps, group together projects which are of a similar nature - so as to allow a larger project to be formed, that will be of more interest to the market and benefit from standardisation of design and serial contracting.

<table>
<thead>
<tr>
<th>Label</th>
<th>Inventory</th>
<th>Purpose</th>
<th>Measurements</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Potential Project Ideas</td>
<td>List of potential projects.</td>
<td>1. Number in inventory</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2. Value Criteria</td>
</tr>
<tr>
<td>2</td>
<td>Project Portfolio</td>
<td>List of projects that can actually be undertaken.</td>
<td>1. Number in inventory</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2. Value Criteria</td>
</tr>
<tr>
<td>3</td>
<td>Packaged Projects</td>
<td>List of projects as they will be implemented.</td>
<td>1. Number in inventory</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2. Value Criteria</td>
</tr>
<tr>
<td>4</td>
<td>Projects Under way</td>
<td>List of projects being implemented.</td>
<td>1. Number in inventory</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2. Value Criteria</td>
</tr>
</tbody>
</table>

Only at this point should the client need to authorise the project to start. This decision (Decision D - Authorise start) would need to ensure that the packaging and business analysis activities had been undertaken properly. It would also ensure that the assumptions made (for instance that a market will still exist for any products etc. to be produced) still hold true. Projects authorised in this way form the final list (Inventory 4 - Projects Under way).

\textsuperscript{12} These are elements of Project Organisation as described in the following section. Ibid p198.
Figure 6.8 - Project Selection Sub-system
It was necessary, also, to review whether the implementation form was appropriate to the project(s) and whether any other benefits could have been gained (Decision E - Review implementation form). In a similar way, the business case needed to be verified - especially a review of whether the expected benefits have in fact been attained (Decision F - Review business case). If benefits have not been realised then further activities are necessary to determine why this has been the case and if there are any further actions that can be taken to enhance the outcome.

6.5.4 Project Organisation Design

The other main input to projects is the design of the project organisation. As stated earlier, this was taken to be driven by the Contracting Arrangement or Procurement Route. A flow diagram for this sub-system is shown in figure 6.9. Table 6.7 lists the decisions and table 6.8 lists the inventories.

<table>
<thead>
<tr>
<th>Label</th>
<th>Decision</th>
<th>Purpose</th>
<th>Techniques</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Clarification</td>
<td>Review of potential methods</td>
<td>Documentation of defined features</td>
</tr>
<tr>
<td>B</td>
<td>Appropriateness</td>
<td>Filter out methods that should not be used for this organisation</td>
<td>GO/NO GO decision based on client prejudice or rational reason why some forms do not work or should not be used.</td>
</tr>
<tr>
<td>C</td>
<td>Use</td>
<td>Select best method for this particular project</td>
<td>Decision matrix based on best fit (see Thinking about building)</td>
</tr>
<tr>
<td>D</td>
<td>Review of performance</td>
<td>Understand more about method</td>
<td>Workshops</td>
</tr>
<tr>
<td>E</td>
<td>Withdrawal</td>
<td>Decide not to use methods in future</td>
<td>Structured decisions</td>
</tr>
</tbody>
</table>

The source in the sub-system represents the total range of Procurement Routes, contract arrangement and other issues that are theoretically possible.
The client organisation must make some step to collect those that it wishes to consider (Decision A: Clarification). In its simplest form this is the sum total of the arrangements known to the client's "project professional". More strictly, it should result in a formal list of the available arrangements (Inventory 1: Available arrangements). Not all of these will be appropriate to the client's particular situation and a decision process should exist which considers this (Decision B: Appropriateness) and which leads to a formal list of those arrangements which should be used (Inventory 2: Useable arrangements).
Table 6.8
Inventories in the Organisation sub-system

<table>
<thead>
<tr>
<th>Label</th>
<th>Inventory</th>
<th>Purpose</th>
<th>Measurements</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Available arrangement</td>
<td>List arrangements that are known to exist.</td>
<td>1. Number in inventory</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2. Value Criteria</td>
</tr>
<tr>
<td>2</td>
<td>Useable arrangement</td>
<td>List arrangements that client wishes to use.</td>
<td>1. Number in inventory</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2. Value Criteria</td>
</tr>
<tr>
<td>3</td>
<td>Arrangement in use</td>
<td>Arrangements that are currently in practical use.</td>
<td>1. Number in inventory</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2. Value Criteria</td>
</tr>
</tbody>
</table>

The decision as to which procurement arrangement to use is primarily a project decision (Decision C - Use) and gives rise to a list of the procurement routes currently in use (Inventory 3 - Arrangement in use).

As with previous sub-systems, a review of performance should be undertaken following the use of the arrangement (Decision D - Review of performance) and this could lead to withdrawal of the procurement route if evidence exists that the route does not give the client value-for-money (Decision E - Withdrawal).

6.5.5 Induction of experience

The simplest flow diagram is that which represents the Induction of experience sub-system as shown in figure 6.10. Table 6.9 lists the decisions and table 6.10 lists the inventories. The input to the sub-system is taken as being from the decision to accept a project as complete at the same time as it is handed to the client. (Project completion). These elements are described in the section on the Project Management Sub-system and are, by definition under the influence of the project.

This gives rise to a list of projects which are currently being reviewed and lessons learnt being extracted. The activities involved in this include simple “lessons learnt”
reviews by the project manager or more complex workshops (such as Value Management Workshops) which can extract a wide range of improvement ideas.

<table>
<thead>
<tr>
<th>Table 6.9</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Decision Points in the Induction of Experience sub-system</strong></td>
</tr>
<tr>
<td><strong>Label</strong></td>
</tr>
<tr>
<td>A</td>
</tr>
<tr>
<td>B</td>
</tr>
</tbody>
</table>

When defined processes have been undertaken (i.e. when the project has been "sucked dry" of ideas for improvement, then the project may be deleted from the project under review inventory (Decision). Ideas need to be collected on an inventory of lessons learnt. Activities to manage this include the correlation of findings from all projects and the investigation of possible trends. A decision here needs to be reached as to which conclusions and recommendations should be acted upon and which should be held in abeyance (Decision).

<table>
<thead>
<tr>
<th>Table 6.10</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Inventories in the Induction of Experience sub-system</strong></td>
</tr>
<tr>
<td><strong>Label</strong></td>
</tr>
</tbody>
</table>
| 1 | Project under review | List projects being reviewed. | 1. Value Criteria.  
2. Financial Performance  
3. Whole Value |

Those improvements which need to be made are listed (Inventory) and management needs to be undertaken to implement the lessons learnt. These are small "soft" projects in themselves. When implemented, it seems good practice to maintain a register of improvements (and the reasons why these were made) to ensure that the accrued knowledge is not lost.
6.5.6 Benefit Maximisation

The Benefit Maximisation\(^\text{13}\) sub-system impacts on the main flow in two ways: (a) the control of change during the project; and (b) the alteration of project objectives and decision criteria to coincide with changes in client requirements. The first of these is shown in the flow diagram in figure 6.11. Table 6.11 lists the decisions and table 6.12 lists the inventories.

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\(^{13}\) Benefit Maximisation may be more strictly termed benefit optimisation. However, the practitioners to whom the model was presented were more comfortable with the term maximisation.
When a potential change arises, it is necessary to determine whether it is optional or must occur (Decision A - Classification). Optional changes are generally those where the contractor wishes to use different materials with a modified specification of changes suggested by the client to “improve” the project. Changes which are obligatory include those necessary to comply with new legislation and those arising from project risks and other circumstances such as unforeseen ground conditions.
Table 6.11  
Decision points in the Benefit Maximisation sub-system

<table>
<thead>
<tr>
<th>Label</th>
<th>Decision</th>
<th>Purpose</th>
<th>Techniques</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Classification</td>
<td>Type of change</td>
<td>Option to hold or not</td>
</tr>
<tr>
<td>B</td>
<td>Benefit</td>
<td>Determine benefit of change</td>
<td>Whole Value Analysis</td>
</tr>
</tbody>
</table>
| C     | Implementation    | Determine best way to implement benefit | 1. New contract  
 | method |                  |                               | 2. Variation to existing contract |

This gives rise to two inventories (Inventory 1 - Optional changes; Inventory 2 - Obligatory Changes). For the optional changes it is necessary to determine what benefit these have (Decision B - Benefit) and to decide if the change will give sufficient benefit to the project to justify the costs and disruption. If the benefit is not great enough then the change will not occur. If the benefit is great enough then this will become an alteration to the project.

Table 6.12  
Inventories in the Benefit Maximisation sub-system

<table>
<thead>
<tr>
<th>Label</th>
<th>Inventory</th>
<th>Purpose</th>
<th>Measurements</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Optional changes</td>
<td>List this type of change</td>
<td>Whole Value Analysis</td>
</tr>
<tr>
<td>2</td>
<td>Obligatory Changes</td>
<td>List this type of change</td>
<td>Whole Value Analysis</td>
</tr>
<tr>
<td>3</td>
<td>Project Variations</td>
<td>List all variations.</td>
<td>Whole Value Analysis</td>
</tr>
<tr>
<td>4</td>
<td>Project Portfolio</td>
<td>See Project sub-system and Table 6.5</td>
<td>Whole Value Analysis</td>
</tr>
</tbody>
</table>

It is also necessary to find the best implementation method (Decision C - Implementation method). This may be either as a variation to the project (Inventory 3 - Project Variations) or may be the subject of a future project (Inventory 4 - Project Portfolio). The later implementation method removes the cost and disruption element.
6.6 COMBINING THE WHOLE VALUE FORMULA WITH THE SYSTEMS MODEL

6.6.1 The measurement of Value for Money

The criteria which were valuable for any client (or project) were termed “Value Criteria”. As in Value Engineering, the value criteria would be those features of the project function that the client wishes to ensure were maximised – in the manner described by Male and Kelly (1991). These Value Criteria were used to form a Utility Rating - exactly as in Value Engineering. This entailed some structured thinking by the client team during the evaluation of potential project options.

Cost information needed to be collected during the project to coincide with updates of the Whole Value function that were undertaken. A view was taken, at the same time as to the impact on function and income.

6.6.2 The optimisation of value for money

Having derived an equation to express value for money in measurable numerate means, this was used to optimise the value for money obtainable during the project. This concept can be used to:-

1. Select the highest value for money option that is consistent with the project parameters on maximum cost and minimum function.

2. Use the measure as a motivation tool to clearly indicate the value that individual project teams are to add.

3. Act as a go/no go decision tool for single option proposals - such as proposed variations to scope.
It was shown in an earlier section that value can be optimised in the following ways:

1. Revenue is increased.
2. Costs are reduced.
3. Function is increased.
4. Risks are reduced.

The model enables a series of what-if questions to be asked, which would determine those changes to features that add the highest degree of value. An optimisation process could be applied at the following points:

1. At the evaluation and approval stages of the project. The prime use is the option selection approach; but both go/no go and optimisation will be used to evaluate and choose enhancements respectively.
2. At the end of the project to check final performance. Option selection and "go/no go" evaluation can be used to review decisions taken during critical stages of the project.
3. During the project as decision tool to assist in the evaluation of changes etc. - generally the go/no go approach will be used here.

However, to prove the formula and to understand how useful this will be in practice, it was necessary to apply the formula, where possible, to actual projects.

6.6.3 General systems effects

Since the model has been cast as a standard systems model, several observations were made as to the likely effects of some of the key features. These were:

Tracking Added Value: Value could be calculated for any inventory and the difference between any inventory and the previous one is the effect of any decision point. This gave the impact of the activities required to support both decisions and inventory management. The value added divided by the costs of the activities was the value added from one point to another along the process. This could be plotted
on a suitable graph (see next section) and compared for various individual projects; portfolios of projects for a single client and separate clients. In this way, the size of any project or portfolio was normalised and could be directly compared.

Changing Added Value: The added value could be increased by either reducing the amount or costs of the activities involved or improving the effect of the various activities to reach decisions and manage inventories. Value would be reduced if the reverse of these occurs.

Flow without feedback: Without the effect of the feedback loops (both within the sub-systems and between sub-systems) then the process would not learn from experience and the weaknesses of the process, as initially set up, would continue - Forrester (1962). This lack of response to shortcomings had been encountered in practice and it could be investigated to search for practical improvements.

Flow without Feedforward: Without the effect of feedforward, the process would not react quickly to changes in the client’s business requirements for the project portfolio. In addition, changes arising from individual projects would be poorly controlled. These are also features which could be investigated in practical organisations.
6.7 REVIEW

The chapter described how the research tool (developed from the analysis of one organisation) and used this to construct a formal quantitative model which could be used to assess the performance of the client role. The model was in the form of a system model which allowed formal proofs (devised by others) to suggest how the client project activity may act.

The quantification of costs and benefits throughout the system was based on the theory of Value Analysis. Value Engineering techniques were used in construction projects and the model shows where and how these have impact. It provided, in effect, the formal proof of why and how Value Engineering can have value and demonstrates where such techniques fail. The model comprised a series of seven subsystems consisting of decision points, inventories and activities. These have been described in detail. The predicted behaviour of the model was also suggested. This was based on the original findings of the qualitative model, the formal proofs for this type of system and logical examination of the activity. The elements that need to be tested have been identified and the next chapter describes how these are developed.

As it stood, the model could be used to measure any client organisation and compare it against the original client organisation on which the model was based. The model had the following strengths:-

1. It was quantitative and could, therefore, produce numerate answers.
2. It allowed for costs, benefits and risks within the project activity.
3. It was meaningful to both the project team and to the client.
4. It was cast in the form of a systems diagram, which allows the model to be manipulated and interpreted according to proven standard methods.
However, the following weaknesses still existed:—

1. Although the many published sources were used in the development of the model, it was only used in the explanation of one organisation. It would be necessary to prove the model by application to a wide range of other client organisations.

2. To be of use, the model should be able to predict likely problems of any client organisation.
Chapter 7

THE PRACTICAL CALCULATION
OF WHOLE VALUE PLOTS

7.1 OVERVIEW

The previous chapter described the development of a detailed quantitative representation of the manner in which Whole Value can be measured throughout the project. Hence, this can show how the client would influence the projects. The next stage was to apply the model to real data. This enabled the research to consider if:

1. The model was an accurate representation of the true situation.
2. The model was able to both describe what has happened and predict what will happen in a project.
3. The data required to drive the model was available in practice.
4. The model could be used for practical measurements.

The chapter presents some characteristic Whole Value charts and uses them to demonstrate how they reveal particular features. The data used in this chapter was collected from the original organisation, TransOne.

7.2 ANALYSIS

7.2.1 Data Issues

The case studies investigated in Chapter 6 provided the prime source of the data used in this initial stage of the testing process. This test provided the opportunity to confirm (or otherwise) whether the model could be properly applied to the single
organisation. Further work was undertaken to determine whether the model had a wider applicability - Chapter 8 reports this.

Data was collected in the method described in Chapter 2 and was principally derived from contract files and financial or progress reports. Data was collected from various sources within the projects studied in the case study exercise; several project portfolios selected at the outset and data available from the corporate "Investment Management Planning System" (IMPS). After locating and collecting the data, some projects did not have sufficient data available to allow the Whole Value to be calculated at relevant places within the process. The Whole Value plots for these projects have not been reproduced in this thesis. They have, however, contributed to the characteristics noted elsewhere. Sufficient data was available from 13 projects (54% of those investigated).

Since the various business groups ran their project portfolios independently, it was also possible to collect portfolio data. Sufficient data was available from three of the portfolios (38% of those investigated).

The projects and portfolios have been plotted together with the average value added for the whole portfolio\(^1\).

### 7.2.2 Results For Projects And Portfolios Analysed

The data calculated in the method explained within Chapter 2 allowed the determination of the following information for each step along main flow for each portfolio and project:

1. **Absolute Whole value.** This was defined as the Whole Value calculated at any point (inventory or decision point) within the system using the formula derived in the previous chapter.

\(^{1}\) This is contained in figures 7.3 and 7.4
2. Whole Value change. This was defined as the change in Whole Value between any point (inventory or decision point).

3. Activity Cost. This was defined as the cost of undertaking the activity. In the case of decision points, this was the cost of taking the decision. In the case of inventories, this was the cost incurred in the management of the inventory.

4. Absolute Whole Value / Activity Cost. This was defined as the absolute Whole Value measured as in item 1, divided by the activity cost as defined in item 3.

5. Activity Whole Value / Activity Cost. This was defined as the Whole Value change as defined in item 2 divided by the activity cost as defined in item 3.

This data has been used to produce the following graphs:

1. Bar chart of whole value change for the relevant projects and portfolios against average for organisation. This plot allowed the impact of each activity – whether required to take a decision or manage an inventory – to be shown. High impact activities can thus be identified and these would be the activities at which it could be argued that improvement would have the greatest impact. Activities with little impact were also revealed. These activities were investigated with a view to identifying why no impact is declared. Activities with a negative impact were clearly shown as they lay below the origin of the horizontal axis. These activities should be investigated to understand why there was an apparent reduction in value.

2. Line chart of whole value for all projects and portfolios. This chart was constructed from the application of whole value change at each point throughout the project. It provided a summary of the track of value throughout the project. The key features in the whole value change were also apparent in this chart.
3. **Line chart of whole value/activity cost** for all projects and portfolios. This was a normalised version of the line chart of whole value. It allowed the features noted in the project to be compared with other projects. Where the definition of function was identical – i.e. for similar projects or portfolios, the comparison was direct. Where the definition of function is not similar, care would be required in the comparison.

4. **Bar chart of whole value change/activity cost** for example project and portfolio against average for organisation. This was the normalised version of the chart for whole value change and provides similar purpose to the line chart of whole value/activity cost, but allowed the analysis at the level of particular activities in a similar manner to the non normalised version of the chart. It also allowed activities where there was a high cost of undertaking the activity with relatively little benefit to be identified.

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Measured by</th>
</tr>
</thead>
<tbody>
<tr>
<td>Track Quality</td>
<td>Geometry over 70 metre and 35 metre chords for level &amp; alignment.</td>
</tr>
<tr>
<td>Customer Perception</td>
<td>Complaints, passenger groups, senior management perception</td>
</tr>
<tr>
<td>Local Public Perception</td>
<td>Complaints, passenger groups, senior management perception</td>
</tr>
<tr>
<td>Stock Availability &amp; Reliability</td>
<td>Percentage time in service.</td>
</tr>
<tr>
<td>Infrastructure Availability &amp; Reliability</td>
<td>Mean time between failure.</td>
</tr>
<tr>
<td>Safety (Accidents, “near misses”, SPADs)</td>
<td>Number, number per passenger mile, number per train mile.</td>
</tr>
<tr>
<td>Resource level</td>
<td>“Headcount” - people and resources.</td>
</tr>
<tr>
<td>Capital spend level</td>
<td>Achievement of spend at authorised level.</td>
</tr>
<tr>
<td>Stability of suppliers</td>
<td>Lack of bankruptcy, delivery on time.</td>
</tr>
</tbody>
</table>
7.2.3 Value Criteria

The value criteria were identified by an analysis of example projects evaluation reports; Value Management study output and declared corporate objectives - Table 7.1 lists those observed.

7.2.4 Impact of data issues on the results

Few major problems were experienced in the collection of the data since good access was available. TransOne undertakes its own internal validation processes and these were relied upon to ensure the accuracy of the data. Whilst this may have resulted in unpredictable inaccuracy, this was not critical as one of the reasons for this test process being undertaken was to determine if real data could provide sufficient quality to allow the successful application of the measurement tool. Some difficulty was experienced in establishing the costs of each activity within the organisation since budgeting and cost recording processes did not record information in a way that was readily traceable to projects and at the corporate level. However, data was collected by TransOne at the portfolio level and this enabled a view to be taken of costs at the other levels.

7.3 INTERPRETATION OF THE CHARTS

7.3.1 Features Of Single Whole Value Charts

Figure 7.1a shows the graph of Whole Value and figure 7.1b shows the graph of change in Whole Value over the key inventories and decisions of the sub-systems for a sample project – P7. The following key features were apparent:-
1. In figure 7.1a, there were significant effects on value which occurred primarily in the management sub-system. Significant effects were also noted in the project sub-system and, to a lesser extent, in the suppliers sub-system.

2. In figure 7.1a, most effects on value are positive – i.e. the activity results in an increase in Whole Value. However, in one location, the Whole Value actually reduced. This was due to a re-assessment of the costs of undertaking the project. It should be noted that there was a “back-ground noise” of negative changes which were not significant when compared to the magnitude of the project costs and income.

3. In figure 7.1b, most effects on value are positive – i.e. the activity resulted in an increase in Whole Value. However, in three locations, the Whole Value actually reduced. One was a result of the change noted above, but the additional two were due to the cost of the activity being so great as to affect the Whole Value of the project.

Figure 7.2a shows the graph of Whole Value and figure 7.2b shows the graph of change in Whole Value over the key inventories and decisions of the sub-systems for a sample project – P14. Similar features were noted in this project to the previous project, with the following additional features being apparent:

1. More value was added during the suppliers sub-system. These changes primarily come from a reduction in project risks.

2. Greater effects occurred during the Benefit Maximisation (both positive and negative) resulting from the greater variations that were issued.
7.3.2 Discussion Of Whole Value For Projects And Portfolios

Figure 7.3 reproduced data for 12 of the projects considered in the case study analysis. Figure 7.4 reproduced data for 6 of the portfolios of projects within the same client organisation (TransOne) which were studies as a precursor to the case study investigation.

<table>
<thead>
<tr>
<th>Observed Features</th>
<th>Features in Whole Value Chart</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic management of supplier base</td>
<td>Low Value Added by suppliers sub-system</td>
</tr>
<tr>
<td>Fragmented management of portfolio</td>
<td>Generally low value added by this subsystem. Individual portfolios and projects show large variability in value added. Some projects show negative value added.</td>
</tr>
<tr>
<td>Capital funds availability drives project priority</td>
<td>Similar features to above. Especially variable nature of value added by individual portfolios.</td>
</tr>
<tr>
<td>Little formal review</td>
<td>Little evidence of value added by review sub-system.</td>
</tr>
<tr>
<td>Specialist resources critical to some projects</td>
<td>Increase in cost and hence reduction in value added at identifiable points within management sub-system. Little evidence of projects sub-system adding value by reprogramming of works to avoid resource problems.</td>
</tr>
<tr>
<td>Experienced in-house design and construction management</td>
<td>Majority of whole value added comes within management and benefit maximisation sub-system due to good control of design and construction costs with relatively low on-cost of the process.</td>
</tr>
</tbody>
</table>

The graphs provided a comparison of the Whole Value of the project, where that Whole Value was added and the locations of significant changes.

Better results could have been achieved if the right data was collected and the analysis would be easier if the data was collected and recorded in a standard format. In general, projects that appeared to be good did add the most value and those that appeared poor added the least value. There were no exceptions to this.
Figure 7.4 - Summary Whole Value for 6 Portfolios within one Client Organisation
7.3.3 Evaluation of the organisation

Table 7.2 compares the features observed within the organisation with the features present in the Whole Value charts. These features were discussed with some of the interviewees who provided information as part of the structured interview process. Figure 7.5a shows Whole Value graphically and Figure 7.5b shows Whole Value divided by the cost of undertaking the management activity.

7.3.4 Accuracy of the model and measurement tool

The analysis described above gives the following findings:

1. Within this organisation, important features noted by the author showed up in the calculations for Whole Value and were noticeable in the Whole Value Charts developed.

2. The Whole Value analysis provided evidence to support the results of the case study analysis on the following contingent factors: experience of client, client's business, need for project, finance project, change, restrictions to programme, internal resources, lack of response to other participants, aims and objectives, management of supplier base, management of project base, benefit maximisation, and induction of experience. Conclusive evidence was not provided on other contingent factors.

3. The normalisation using the cost of the project activity allows a measurement of the relative worth of the effort expended within various parts of the project. This was particularly noted with this client's decision to use an in-house construction management team to reduce the amount of project management.
7.4 REVIEW

The chapter described how the formal quantitative model which can be used to assess the performance of the client role. The quantification of costs and benefits throughout the system was based on the theory of Value Analysis. Value Engineering techniques were used in construction projects and the model showed where and how these have impact. It provided, in effect, the formal proof of why and how Value Engineering can have value and also demonstrated where such techniques fail. The predicted behaviour of the model was investigated. This was based on the original findings of the qualitative model, the formal proofs for this type of system and logical examination of the activity. The elements that needed to be tested have been identified.

This test of the quantitative model has found that it was possible to track the Whole Value for projects and portfolios using data collected from real projects. It was also shown that the model allowed different projects and project portfolios to be compared with each other. In addition, it was shown to be possible to recognise project problems and project strengths from the Whole Value graphs. The conclusion of this test was that the model held true for the one organisation from which it was developed.

It was noted that the model had the following strengths:

1. It was quantitative and could, therefore, produce numerate answers.
2. It allowed for costs, benefits and risks within the project activity.
3. It was meaningful to both the project team and to the client.
4. It was cast in the form of a systems diagram, which allowed the model to be manipulated and interpreted according to proven standard methods.

---

2 These were developed as described in the next chapter.
At this point, two weaknesses were found to exist. First, although the many published sources were used in the development of the model, it was used in the explanation of one organisation. Second, to be of use, the model should be able to predict likely problems of any client organisation. To address these it was necessary to prove the model by application to a wide range of other client organisations.
Chapter 8

USING THE MODEL TO MEASURE OTHER ORGANISATIONS

8.1 OVERVIEW

Previous chapters have described the development of the model of the client procurement role in detail using data collected from a single organisation. One of the objects of the research was to develop a model that applied to all organisations in this sector of the industry. This chapter describes the work undertaken to widen the applicability of the tool so that it was proven to apply to all sections of the industry.

The research described in this chapter examined the way in which Whole Value was plotted for projects and portfolios within eight further organisations. This was particularly important as it validated that the model did measure Whole Value. Furthermore, the work verified that the model could be successfully applied to organisations other than the one from which it was developed. The application of the model to the original organisation (TransOne) is described in detail in Chapter 7.\(^1\)

The result of this testing was that the model was shown to be able to: predict strengths and weaknesses of existing processes; record actual strengths and weaknesses of existing processes; compare actual/predicted strengths and weaknesses; and demonstrate areas of concordance and examine differences to enable the modification of the model as supported by this stage of the research.

---

\(^1\) Ibid p 210
Additionally, the work reported in this chapter produced benchmark values for the Whole Value based on the analysis undertaken in this research.

8.2 RESULTS

8.2.1 Organisations selected

The selection process defined by the methodology resulted in the selection of eight organisations. These can generally be grouped into three types, as described in table 8.1.

<table>
<thead>
<tr>
<th>Name</th>
<th>Feature of type of organisation</th>
</tr>
</thead>
<tbody>
<tr>
<td>TransTwo</td>
<td>A utility company formed from the organisation on which the model was designed, this provided the opportunity to investigate how different management undertook the procurement of the same projects.</td>
</tr>
<tr>
<td>AirportCo</td>
<td>Utility companies formed from public bodies which have been privatised, these companies own infrastructure and their core business involves the management of this infrastructure. The central management issue is the same as for TransTwo, but the technologies, organisational culture, project types and project portfolio are different. These give the opportunity to investigate whether the model holds true from different industries within the utility sector.</td>
</tr>
<tr>
<td>GenR8</td>
<td></td>
</tr>
<tr>
<td>AllGas</td>
<td></td>
</tr>
<tr>
<td>WaterCo</td>
<td></td>
</tr>
<tr>
<td>HotBed</td>
<td>These commercial companies were created in the private sector. Infrastructure is key to their operations, but is not the central reason why they are in business. These companies give the opportunity to investigate the accuracy of the model in non-utility infrastructure projects.</td>
</tr>
<tr>
<td>ReadyFuel</td>
<td></td>
</tr>
<tr>
<td>FastFood</td>
<td></td>
</tr>
</tbody>
</table>

Table 8.2 provides an analysis of the data quality available from each. Later in the chapter, a brief description is given on each company.

---

2 Ibid p 14
Table 8.2
Client Portfolios for which data has been analysed to give Whole Value graphs

<table>
<thead>
<tr>
<th>Client Portfolio</th>
<th>Analysis done</th>
<th>Reasons</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1 TransTwo</td>
<td>yes</td>
<td>Excellent data to allow calculation of whole value; principally drawn from Investment Authority document; Project progress reports; Financial monitoring systems; interviews with key staff.</td>
</tr>
<tr>
<td>C2 AirportCo</td>
<td>yes</td>
<td>Good data to allow calculation of whole value; principally drawn from Investment Authority document; Project progress reports; Financial monitoring systems; interviews with key staff.</td>
</tr>
<tr>
<td>C3 ReadyFuel</td>
<td>yes</td>
<td>Adequate data to allow calculation of whole value; principally drawn from Investment Authority document; Project progress reports; Financial monitoring systems; interviews with key staff.</td>
</tr>
<tr>
<td>C4 GenR8</td>
<td>yes</td>
<td>Fair data to allow calculation of whole value; principally drawn from Investment Authority document; Project progress reports; Financial monitoring systems; interviews with key staff.</td>
</tr>
<tr>
<td>C5 AllGas</td>
<td>yes</td>
<td>Adequate data to allow calculation of whole value; principally drawn from Investment Authority document; Project progress reports; Financial monitoring systems; interviews with key staff.</td>
</tr>
<tr>
<td>C6 HotBed</td>
<td>yes</td>
<td>Adequate data to allow calculation of whole value; principally drawn from Investment Authority document; Project progress reports; Financial monitoring systems; interviews with key staff.</td>
</tr>
<tr>
<td>C7 FastFood</td>
<td>yes</td>
<td>Fair data to allow calculation of whole value; principally drawn from Investment Authority document; Project progress reports; Financial monitoring systems; interviews with key staff.</td>
</tr>
<tr>
<td>C8 WaterCo</td>
<td>yes</td>
<td>Good data to allow calculation of whole value; principally drawn from Investment Authority document; Project progress reports; Financial monitoring systems; interviews with key staff.</td>
</tr>
</tbody>
</table>

Each of the client organisation descriptions contains the following details:-

- Description of each organisation.
- Whole Value results.
- Discuss whether the Whole Value results were felt to be correct.
- What do these results tell us and do the results accord with what was observed.
- How is the performance related to the fit of the activities with the business.
- Confirm whether the model and measurement tool apply for this particular instance.
8.2.2 Numerical analysis

Whole Value data was collected and analysed according to the process defined by the methodology\(^4\) and used in Chapter 7\(^5\). For each step along the main flow of the model - for each portfolio and project - the following data has been tabulated:-

- Absolute Whole value.
- Whole Value change.
- Activity Cost.
- Absolute WV/COST.
- Activity WV/cost.

The following Whole Value Charts were produced for each:-

- Bar chart of Whole Value change for example project and portfolio against average for organisation.
- Line chart of Whole Value for all projects and portfolios.
- Line chart of Whole Value/Cost for all projects and portfolios.
- Bar chart of Whole Value change/Cost for example project and portfolio against average for organisation.

8.3 ANALYSIS OF THE RESULTS FOR EACH ORGANISATION

Non-normalised values for each organisation are contained in the detailed analysis of each organisation. These were not normalised and were included to show the types of value that are likely to be obtained. The non-normalised values are useful in answering the question:

Is any particular process within the organisation giving “value-for-money” when compared with the costs of undertaking the process?

\(^4\) Ibid p14
\(^5\) Ibid p210
Table 8.3 summarises the normalised Whole Value results obtained for each organisation studied as part of this stage of the research. The figures quoted in the table were the values of Whole Value calculated for key sub-system for each organisation studied.

<table>
<thead>
<tr>
<th>Company</th>
<th>1 Supplier</th>
<th>2 Projects</th>
<th>3 Organisation</th>
<th>4 Benefit Max.</th>
<th>5 Management</th>
<th>6 Induct of Exp</th>
<th>Whole Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>TransOne</td>
<td>3.91</td>
<td>17.64</td>
<td>1.87</td>
<td>17.16</td>
<td>34.90</td>
<td>5.16</td>
<td>80.64</td>
</tr>
<tr>
<td>TransTwo</td>
<td>7.37</td>
<td>54.33</td>
<td>0.25</td>
<td>33.64</td>
<td>15.39</td>
<td>2.00</td>
<td>112.98</td>
</tr>
<tr>
<td>AirportCo</td>
<td>7.00</td>
<td>5.10</td>
<td>15.00</td>
<td>33.04</td>
<td>43.56</td>
<td>0.40</td>
<td>114.10</td>
</tr>
<tr>
<td>ReadyFuel</td>
<td>6.36</td>
<td>19.99</td>
<td>13.63</td>
<td>32.77</td>
<td>30.29</td>
<td>0.06</td>
<td>103.10</td>
</tr>
<tr>
<td>GenR8</td>
<td>2.00</td>
<td>31.03</td>
<td>18.75</td>
<td>21.25</td>
<td>30.34</td>
<td>0.35</td>
<td>103.72</td>
</tr>
<tr>
<td>AllGas</td>
<td>0.30</td>
<td>23.60</td>
<td>0.00</td>
<td>57.52</td>
<td>15.72</td>
<td>3.00</td>
<td>100.14</td>
</tr>
<tr>
<td>HotBed</td>
<td>0.00</td>
<td>26.02</td>
<td>20.00</td>
<td>34.93</td>
<td>30.39</td>
<td>1.23</td>
<td>112.57</td>
</tr>
<tr>
<td>FastFood</td>
<td>1.00</td>
<td>46.52</td>
<td>10.00</td>
<td>14.84</td>
<td>23.70</td>
<td>0.00</td>
<td>96.06</td>
</tr>
<tr>
<td>WaterCo</td>
<td>1.01</td>
<td>30.00</td>
<td>10.00</td>
<td>3.00</td>
<td>45.99</td>
<td>0.00</td>
<td>90.00</td>
</tr>
<tr>
<td>Mean</td>
<td>3.22</td>
<td>28.25</td>
<td>9.94</td>
<td>27.57</td>
<td>30.03</td>
<td>2.27</td>
<td>101.48</td>
</tr>
</tbody>
</table>

The normalised values were useful in providing a comparison of the organisation's ability to add value during the project process. These have been plotted in figure 8.1. To assist in this, benchmark values were calculated to enable the rating of any organisation. Table 8.4 indicates the benchmark values calculated from the results of the work described in this chapter and table 8.5 provides a description of the meanings of each level. These benchmark levels would change if further data were available and the sample size is increased.

The benchmark values allow us to address the question: How does the value added by various activities compare with that in other companies?

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6 The caveat on comparability of the Function between different client organisations, noted earlier on in this chapter, should be borne in mind when making such comparisons.

7 Indeed, it is suggested that additional work is undertaken to make the benchmark value more accurate.
Figure 8.1 - Summary Whole Value for 8 Client Portfolios
Table 8.4
Benchmark value for Whole Value

<table>
<thead>
<tr>
<th>Level</th>
<th>1 Supplier</th>
<th>2 Projects</th>
<th>3 Organisation</th>
<th>4 Benefit Max.</th>
<th>5 Management</th>
<th>6 Induct of Exp</th>
<th>Whole Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2.42</td>
<td>21.19</td>
<td>7.46</td>
<td>20.68</td>
<td>22.52</td>
<td>1.85</td>
<td>76.11</td>
</tr>
<tr>
<td>2</td>
<td>2.90</td>
<td>25.43</td>
<td>8.95</td>
<td>24.81</td>
<td>27.03</td>
<td>2.22</td>
<td>91.33</td>
</tr>
<tr>
<td>3</td>
<td>3.22</td>
<td>28.25</td>
<td>9.94</td>
<td>27.57</td>
<td>30.03</td>
<td>2.27</td>
<td>101.48</td>
</tr>
<tr>
<td>4</td>
<td>3.54</td>
<td>31.08</td>
<td>10.93</td>
<td>30.33</td>
<td>33.03</td>
<td>2.72</td>
<td>111.63</td>
</tr>
<tr>
<td>5</td>
<td>4.03</td>
<td>35.31</td>
<td>12.43</td>
<td>34.46</td>
<td>37.54</td>
<td>3.09</td>
<td>126.85</td>
</tr>
</tbody>
</table>

Table 8.5
Meanings of each Performance Level

<table>
<thead>
<tr>
<th>Performance Level</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>An unacceptable level of performance that should be improved.</td>
</tr>
<tr>
<td>2</td>
<td>A reasonable level of performance that can be bettered with suitable focused analysis.</td>
</tr>
<tr>
<td>3</td>
<td>A good standard performance which all clients should be able to obtain.</td>
</tr>
<tr>
<td>4</td>
<td>A very good performance that represents the best that many clients will be able to obtain.</td>
</tr>
<tr>
<td>5</td>
<td>A &quot;best in class&quot; performance.</td>
</tr>
</tbody>
</table>

Function was normalised in the manner described in Chapter 6. Although Whole Value calculated for one company could be compared with another, two issues were noted. First, actual components of value are defined by the organisation. Second, Whole Value for different organisations (especially those in different industries) were made up of different components. This resulted in the following rules being formulated for the comparison of separate Whole Value charts:

1. Different portfolios (managed by different groups) can be directly compared.
2. Different client organisations in the same industry may be compared, but the actual definition of Function should be compared to ensure that there are no significant differences.
3. Client organisations in different industries should be compared with care. The potentially widely different definitions of Function may prevent direct comparison.
The last of these rules was an important issue and further work would be necessary to determine how, and in what circumstances, Whole Value results are sufficiently similar to allow near direct comparison. The number of organisations in different industries evaluated in this research was not large enough to allow this piece of research to draw definite conclusions on this issue.

8.4 APPLICATION OF THE MODEL TO TRANSTWO

8.4.1 Profile of organisation

TransTwo was formed in April 1994, to take ownership of the railway industry's infrastructure as part of the privatised structure of the rail industry. It was formed immediately after the data collection for this research and has provided a useful test for the model developed from the practices adopted by its predecessor. TransTwo employed contractors to undertake its physical works, which range from maintenance to major projects. It sold the right to use its infrastructure ("train paths") to Train Operating Companies (TOCs) which run passenger and freight services.

The industry was regulated by the Office of the Rail Regulator (ORR) and another government body - the Office of Rail Franchising - awarded franchises to run the central government subsidised passenger services. These were grouped under the shadow Strategic Rail Authority (SRA) together with the residuary British Rail organisation. The majority of TransTwo income came from these services and the obligation to reduce charges to the franchised passenger services ("RPI-X") meant that the secured income source is reducing. The company needed to both increase non-franchised income and reduce costs to develop as a business. The largest costs were derived from the maintenance of the infrastructure which was undertaken by contractors formed from the trade sales of part of the TransOne Direct Labour Organisation.
8.4.2 Profile of Projects and their Procurement

*TransTwo* inherited virtually the entire project portfolio from *TransOne* - with the exception of a small number of projects that were being undertaken for other elements of the industry (mainly the TOCs). The differences mainly occurred because works which were originally undertaken by the *TransOne* Direct Labour Organisation were now undertaken by contractors and treated as projects.

The process for authorising and procuring projects was based on the *TransOne* process and has been modified only slightly. The two main differences were; firstly, the organisation structures in place to develop and deliver the projects and; secondly, the financial objectives of the investments.

Projects were developed by designated Sponsors within the organisation. These were technical specialists or customer oriented managers depending on whether the investment was necessary for technical or business development reasons. The projects were delivered by a separate division who have the project management, planning, procurement and technical resources to undertake all infrastructure projects. The project organisation employed around 2700 staff (either directly or on an agency basis) and managed a spend of approximately £1800 Million per annum.

8.4.3 Value Criteria

The value criteria were identified by an analysis of example projects evaluation reports; Value Management study output and declared corporate objectives - table 8.6 lists those observed. These criteria have some similarity with those of the predecessor organisation (*TransOne*) but different criteria have arisen due to the new commercial environment in which *TransTwo* operates.
Table 8.6
Key Value Criteria

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Measured by</th>
</tr>
</thead>
<tbody>
<tr>
<td>Train Performance</td>
<td>Minutes delay attributable to TOC and <em>TransTwo</em></td>
</tr>
<tr>
<td>Track Quality</td>
<td>Geometry over 70 metre and 35 metre chords</td>
</tr>
<tr>
<td>Infrastructure availability and reliability</td>
<td>Mean time between failure</td>
</tr>
<tr>
<td>Safety (Accidents, “near misses”, SPADs)</td>
<td>Number, number per passenger mile, number per train mile.</td>
</tr>
<tr>
<td>Resource Level</td>
<td>“Headcount” - people</td>
</tr>
<tr>
<td>Spend Level (Capital, AMP(^8), Operational Expenditure)</td>
<td>Achievement of published and budgeted level</td>
</tr>
</tbody>
</table>

8.4.4 **Evaluation of the organisation**

Table 8.7 compares the features observed within the organisation with the features present in the Whole Value charts. Figure 8.2a shows Whole Value graphically and Figure 8.2b shows Whole Value divided by the cost of undertaking the management activity.

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\(^8\) The Asset Management Plan (AMP) is a funding stream, agreed with the industry’s regulator, whereby an operational budget is set aside in a similar manner to capital funds to finance an improvement in asset condition by increased maintenance.
FIGURE 8.2a
WHOLE VALUE CHART FOR CLIENT C1

FIGURE 8.2b
ACTIVITY COST NORMALISED WHOLE VALUE CHART FOR CLIENT C1
Table 8.7
Comparison of Observed Features with Whole Value Chart

<table>
<thead>
<tr>
<th>Observed Features</th>
<th>Features Whole Value Chart</th>
</tr>
</thead>
<tbody>
<tr>
<td>Large and relatively expensive Project Management organisation</td>
<td>Although majority of Whole Value change occurred within management and benefit maximisation subsystem (showing that there was very good control of change and other factors) this was significantly reduced when the normalised Whole Value is considered.</td>
</tr>
<tr>
<td>Moderately sophisticated project portfolio management.</td>
<td>Significant Whole Value added by projects subsystem - especially two key elements.</td>
</tr>
<tr>
<td>Formalised corporate supplier selection processes</td>
<td>Demonstrable value added by the suppliers sub-system. Normalisation was shown to reduce this.</td>
</tr>
<tr>
<td>Widened base of contractors (over TransOne)</td>
<td>Whole Value change at the tendering decision is significant and accounts for majority of value added by the suppliers sub-system. However, the costs of the whole suppliers sub-system reduce this benefit when normalised.</td>
</tr>
<tr>
<td>Externalised construction management.</td>
<td>Adds to on costs of management and benefit maximisation sub-stems which adversely affects normalised Whole Value chart.</td>
</tr>
</tbody>
</table>

8.4.5 **Accuracy of the model and measurement tool**

This gives the following findings:

1. Within this organisation, several important features noted during the analysis occurred in the calculations for Whole Value and were noticeable in the Whole Value Charts developed.

2. The whole value analysis provided evidence to support the results of the case study analysis on the following contingent factors: procurement route, client’s relationship, experience of client, client’s business, nature of project, need for project, communicate need, finance project, pre-requisites, ownership of results, change, restrictions to programme, internal resources, usurping role of the

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9 The chart suggests that more value could be added by supplier management processes other than competitive tendering to maximise the value added by this sub-system - a more balanced addition of value benefits occurs in the analysis of AirportCo (Ibid. p 238).
participants, lack of response to other participants, aims and objectives, direction of project, management of supplier base, management of project base, benefit maximisation, and induction of experience. Conclusive evidence was not provided on other contingent factors.

3. Again, the use of the normalisation chart using cost of activity allows an assessment to be made of the worth of a particular activity. The comparison with the project management approaches of TransOne and TransTwo demonstrates that the TransTwo approach is an expensive way of adding value during the construction process.

8.5 **APPLICATION OF THE MODEL TO AN AIRPORT OPERATOR**

8.5.1 **Profile of organisation**

*AirportCo* was the main UK owner and operator of Airports and had interests in overseas airports. The company was formed from a nationalised operator and was privatised in 1982. During the 1997/8 financial year, the company has sales of £2,350 Million and pre-tax profits of £195 Million\(^{10}\).

Each airport was managed as a separate business unit headed by a General Manager and a senior management team.

8.5.2 **Profile of Projects and their Procurement**

The company had a wide range of projects planned at all its airports and these ranged in size from small access and environmental improvements to public areas in terminal buildings; additional or extended to runways; freight handling facilities and brand new terminal buildings.

\(^{10}\) Source: 1997/8 Report and Accounts.
A formal documented process existed for authorising and procuring projects. This was contained in the project development manuals which outline corporate policy. These documents were clearly readable and provided the outline as to how processes should be operated. They were not overly prescriptive and assumed that the processes would be undertaken by competent professionals.

Projects were developed on behalf of the airport General Manager by designated Project Managers employed by the organisation and organised within a Project Directorate. These Project Managers were supported by a range of support staff particularly to undertake development of the project and appraisal of the financial case.

8.5.3 Value Criteria

The value criteria were identified by an analysis of example projects evaluation reports; Value Management study output; interviews with project and value management professionals and declared corporate objectives. Table 8.8 lists the outcome of this analysis. The similarity with those of the rail companies (TransOne and TransTwo) is limited; which was surprising given that AirportCo also operates transport infrastructure.

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Measured by</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quantity of landing slots</td>
<td>Number</td>
</tr>
<tr>
<td>Safety</td>
<td>Defined standards for accidents and other dangerous occurrences</td>
</tr>
<tr>
<td>Passenger throughput</td>
<td>Quantity per hour</td>
</tr>
<tr>
<td>Passenger facilities</td>
<td>Quantity of concessions, type of concession, passenger perception</td>
</tr>
<tr>
<td>Supply stability</td>
<td>Predictability of supply</td>
</tr>
<tr>
<td>Architectural appeal</td>
<td>Internal and external perception</td>
</tr>
</tbody>
</table>
8.5.4 Evaluation of the organisation

Table 8.9 compares the features observed within the organisation with the features present in the Whole Value charts. Figure 8.3a shows Whole Value graphically and Figure 8.3b shows Whole Value divided by the cost of undertaking the management activity.

<table>
<thead>
<tr>
<th>Observed Features</th>
<th>Features Whole Value Chart</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sophisticated approach to supply management (e.g. “Framework Agreements”)</td>
<td>Significant value added by earlier parts of the supplier sub-system. This is in balance with the competitive tendering decision.</td>
</tr>
<tr>
<td>Value Management applied to projects</td>
<td>Evidence of even improvement of value throughout whole process (especially projects sub-system) resulting from structured approach to the search for added value.</td>
</tr>
<tr>
<td>Risk assessment for projects</td>
<td>Good data available on risk element of Whole Value formula leading to greater sophistication and confidence in Whole Value measurements.</td>
</tr>
</tbody>
</table>

8.5.5 Accuracy of the model and measurement tool

This gave the following findings:-

1. Within this organisation, important features showed up in the calculations for Whole Value and were noticeable in the Whole Value Charts developed.

2. The Whole Value analysis provided evidence to support the results of the case study analysis on the following contingent factors: experience of client, finance project, ownership of results, change, lack of response to other participants, aims and objectives, direction of project, management of supplier base, management of project base, benefit maximisation, and induction of experience. Conclusive evidence was not produced on other contingent factors.
3. The Whole Value charts particularly demonstrated the impact of the development effort deployed prior to the commencement of the project in the management subsystem.

8.6 APPLICATION OF THE MODEL TO AN OIL COMPANY

8.6.1 Profile of organisation

ReadyFuel was a PLC that has grown from the acquisition and merger of smaller oil companies over the last 80 years or so. It was involved in retail sales, refining of crude oil, the production/shipping of crude oil and the exploration for new sources of oil throughout the world. It was one of the major oil companies operating within the UK. The UK turnover of all operations is approximately £750 Million and this generated profits of £79 Million.\(^\text{11}\)

Unlike many of the client organisations examined here, the oil industry was not regulated and was subject to market forces on the price of oil. At the time of the analysis, there was an oversupply of oil on world markets and the oil price is viewed as "depressed". In common with all other oil companies, ReadyFuel has reduced administration and other overhead costs to streamline its operations and maximise profits in this market.

8.6.2 Profile of Projects and their Procurement

The process for authorising and procuring projects was based on internal regulations but these are not translated into fixed formal processes. It was up to the project teams to determine how the regulations will be satisfied and this left a significant leeway for the team - leading to different practices for different projects. The project portfolio was relatively small (£120 Million) and the annual

\(^{11}\) Source: 1996/7 Report and Accounts.
spend in 1997 was £50 Million. It was noted that spend could fluctuate widely if a new refinery or production platform is being introduced.

Projects were developed and managed by specialist development managers, on behalf of business managers. The business managers were generally responsible for product lines or facilities (such as a refinery) in response to some identified business need. The projects were delivered by project teams formed by the internal projects division and by main contractors who are experienced at working within the oil industry. These teams undertook all required Project Management, planning, procurement and technical input to the projects.

8.6.3 Value Criteria

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Measured by</th>
</tr>
</thead>
<tbody>
<tr>
<td>Throughput</td>
<td>Volume per day</td>
</tr>
<tr>
<td>Staffing levels</td>
<td>Number of people</td>
</tr>
<tr>
<td>Quality of product</td>
<td>Ability to meet various rating standards for fuel etc. being produced.</td>
</tr>
<tr>
<td>Environmental impact</td>
<td>Ease of planning process and conformance to emission standards.</td>
</tr>
<tr>
<td>Safety</td>
<td>Accident rate (output measure) and safety rating system (input measure)</td>
</tr>
</tbody>
</table>

The value criteria were identified by an analysis of example projects evaluation reports; interviews with project and value management professionals and declared corporate objectives. A separate list for the refinery business and the exploration business was generated - see Tables 8.10 and 8.11. It can be seen that the Value Criteria were very different from the transport infrastructure providers and were far closer to “pure” financial measures.
Table 8.11

<table>
<thead>
<tr>
<th>Key Value Criteria - Exploration</th>
<th>Measured by</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yield</td>
<td>Volume per day</td>
</tr>
<tr>
<td>Lifespan</td>
<td>Years</td>
</tr>
<tr>
<td>Safety</td>
<td>Accident rate (output measure) and safety rating system (input measure)</td>
</tr>
<tr>
<td>Exploration risk</td>
<td>Likelihood of finding oil</td>
</tr>
<tr>
<td>Construction time</td>
<td>Duration of project and delivery date.</td>
</tr>
</tbody>
</table>

8.6.4 Evaluation of the organisation

Table 8.12 compares the features observed within the organisation with the features present in the Whole Value charts contained in Figure 8.4a (which shows Whole Value) and Figure 8.4b (which shows Whole Value divided by the cost of undertaking the management activity).

Table 8.12

<table>
<thead>
<tr>
<th>Comparison of Observed Features with Whole Value Chart</th>
<th>Whole Value Chart</th>
</tr>
</thead>
<tbody>
<tr>
<td>Observed Features</td>
<td>Features Whole Value Chart</td>
</tr>
<tr>
<td>Limited supplier base for design and contracting</td>
<td>Little evidence of value added by search for new contractors or removal of contractors from list. Main value added by middle two processes.</td>
</tr>
<tr>
<td>Timing driven predominantly by statutory or market deadlines</td>
<td>Highest value projects not always pursued in prioritisation process. Sometimes negative value added during projects process by particular projects but removal of such projects is not always an option.</td>
</tr>
<tr>
<td>Internal Project Management teams - some evidence of “man for man marking” with contractor’s teams.</td>
<td>Some projects show high activity costs which reduced Whole Value.</td>
</tr>
<tr>
<td>Project viability changes with changing (and sometimes volatile) oil prices.</td>
<td>Whole Value difficult to track when significant chances occur in oil process. Need to normalise this as oil price at authorisation, with allowance for actual price at completion - as overlay.</td>
</tr>
</tbody>
</table>
8.6.5 **Accuracy of the model and measurement tool**

This gave the following findings:-

1. Within this organisation, important features showed up in the calculations for Whole Value and were noticeable in the Whole Value Charts developed.

2. The Whole Value analysis provided evidence to support the results of the case study analysis on the following contingent factors: client’s business, nature of project, need for project, change, restrictions to programme, internal resources, management of project base, benefit maximisation, and induction of experience. Conclusive evidence was not provided on other contingent factors.

3. The relatively few defined processes and the different approaches adopted by project teams meant the cost of activities was difficult to ascertain. This made the normalised chart difficult to produce. In addition, the base Whole Value calculations for the portfolio were not as straightforward as for other clients – it can be concluded that well defined procedures made it easier to calculate Whole Value. There was, however, no evidence that well defined procedures actually improve value.

8.7 **APPLICATION OF THE MODEL TO AN ELECTRICITY GENERATOR**

8.7.1 **Profile of organisation**

GenR8 was one of the two major electricity generators in the UK. The turnover of all operations was approximately £2750 Million and this generated profits of £179 Million\(^{12}\).

The electricity industry was a regulated market in that the prices charged to customers are expected to fall in line with the regulatory review - usually at less

\(^{12}\) Source: 1997/8 Report and Accounts.
that the rate of inflation. Although this did not usually directly affect GenR8, it did put pressure on the electricity supply companies who were the customers of GenR8. This reducing price for electricity and the privatisation meant that the company had to (a) reduce administration and other overhead costs and (b) improve the efficiency of generating plants in a bid to maximise profits in this market.

8.7.2 Profile of Projects and their Procurement

The pressures on the business have led to a diverse range of projects: decommissioning and demolition of older less efficient plants; mothballing of some plants; works to improve efficiency of existing plants; environmental improvements (such as gas desulphurisation plants at coal power stations) and the construction of new (gas fired) power stations.

Works were generally constructed by external contractors - these contractors are often the same companies who work in the oil industry. Project teams undertake project management, procurement and development of projects and these are usually staffed with employees.

The process for authorising and procuring projects was documented and includes policies as well as procedures. This mainly covered up front development of the project and selection of consultants and contractors. Also covered in some detail was the commissioning process which the company as client takes a large part in managing.

8.7.3 Value Criteria

The value criteria were identified by an analysis of example projects evaluation reports; feasibility study output; interviews with project and value management
professionals and declared corporate objectives. Table 8.13 summarises the results of this work.

<table>
<thead>
<tr>
<th>Table 8.13</th>
<th>Key Value Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Criteria</td>
<td>Measured by</td>
</tr>
<tr>
<td>Downtime for maintenance</td>
<td>Hours per week, month or year.</td>
</tr>
<tr>
<td>Timing/Delivery date of project</td>
<td>Date of delivery.</td>
</tr>
<tr>
<td>Maximum Power supply available</td>
<td>kW per hour of plant</td>
</tr>
<tr>
<td>Reliability of supply</td>
<td>%age</td>
</tr>
</tbody>
</table>

**8.7.4 Evaluation of the organisation**

Table 8.14 compares the features observed within the organisation with the features present in the Whole Value charts. Figure 8.5a shows the chart for Whole Value and Figure 8.5b shows the chart for Whole Value divided by the cost of undertaking the management activity.

<table>
<thead>
<tr>
<th>Table 8.14</th>
<th>Comparison of Observed Features with Whole Value Chart</th>
</tr>
</thead>
<tbody>
<tr>
<td>Observed Features</td>
<td>Features Whole Value Chart</td>
</tr>
<tr>
<td>Relatively little change during construction phase</td>
<td>Little value added by change control</td>
</tr>
<tr>
<td>Procurement route turnkey contract targeted at incentivising contractor to deliver maximum power output</td>
<td>Significant benefits of procurement route selection.</td>
</tr>
<tr>
<td>Limited supplier base for design and contracting</td>
<td>Little evidence of value added by search for new contractors or removal of contractors from list. Main value added by middle two processes.</td>
</tr>
<tr>
<td>Timing driven predominantly by statutory or market deadlines</td>
<td>Highest value projects not always pursued in prioritisation process. Sometimes negative value added during projects process by particular projects but removal of such projects is not always an option.</td>
</tr>
<tr>
<td>Project viability changes with changing spot electricity prices.</td>
<td>Whole Value needs to be based on price at authorisation, with allowance for actual price at completion as overlay.</td>
</tr>
</tbody>
</table>
8.7.5 **Accuracy of the model and measurement tool**

This gave the following findings:-

1. Within this organisation, important features showed up in the calculations for Whole Value and were noticeable in the Whole Value Charts developed.

2. The whole value analysis provided evidence to support the results of the case study analysis on the following contingent factors: nature of project, need for project, change, aims and objectives, direction of project, management of supplier base, management of project base, benefit maximisation, and induction of experience. Conclusive evidence was not provided on other contingent factors.

3. The different projects within the portfolio gave different profiles of Whole Value chart and different total Whole Value added. Some projects (e.g. gas desulphurisation) gave small or negative Whole Value and the charts showed that the principal value added was the reduction of the negative effect on the whole portfolio.

8.8 **APPLICATION OF THE MODEL TO A GAS DISTRIBUTION COMPANY**

8.8.1 **Profile of organisation**

*AllGas* was the UK market leader in the supply of domestic and industrial natural gas. Privatised in 1982, during the 1996/7 financial year it had sales of £2,000 Million and pre-tax profits of £200 Million\(^\text{13}\). During the course of the research, *AllGas* re-organised into two separate groups - one primarily undertaking energy exploration and distribution and the other targeted at the domestic supply market.

\(^{13}\) Source: 1996/7 Report and Accounts.
8.8.2 Profile of Projects and their Procurement

Principal projects within the company have been the renewal and extension of the pipe network.

Works are generally constructed by external contractors - these contractors are often the same companies who work in the oil industry. Project teams undertake project management, procurement and development of projects and these were usually staffed with employees.

The process for authorising and procuring projects is documented and includes policies as well as procedures. This covers up front development of the project; selection of consultants and contractors; management of the project (including change control) and the commissioning processes required. The relatively high level of detail derives from the gas safety regulations which have been in force for many years.

8.8.3 Value Criteria

The value criteria were identified by an analysis of example projects evaluation reports; Value Management study output; interview with project and value management professionals and declared corporate objectives. Table 8.15 lists the value criteria noted from the analysis.

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Measured by</th>
</tr>
</thead>
<tbody>
<tr>
<td>Downtime for maintenance</td>
<td>Hours per week, month or year</td>
</tr>
<tr>
<td>Timing/Delivery date of project</td>
<td>Completion date</td>
</tr>
<tr>
<td>Maximum Power supply available</td>
<td>KW per hour of plant</td>
</tr>
<tr>
<td>Reliability of supply</td>
<td>%age</td>
</tr>
</tbody>
</table>
FIGURE 8.6a
WHOLE VALUE CHART FOR CLIENT C5

FIGURE 8.6b
ACTIVITY COST NORMALISED WHOLE VALUE CHART FOR CLIENT C5
8.8.4 Evaluation of the organisation

Table 8.16 compares the features observed within the organisation with the features present in the Whole Value charts. Figure 8.6a shows the chart for Whole Value and Figure 8.6b shows the chart for Whole Value divided by the cost of undertaking the management activity.

<table>
<thead>
<tr>
<th>Observed Features</th>
<th>Features Whole Value Chart</th>
</tr>
</thead>
<tbody>
<tr>
<td>Limited supplier base for design and contracting</td>
<td>Little evidence of value added by search for new contractors or removal of contractors from list. Main value added by middle two processes.</td>
</tr>
<tr>
<td>Little formal review</td>
<td>Little evidence of value-added by review sub-system.</td>
</tr>
<tr>
<td>Timing driven predominantly by statutory or market deadlines</td>
<td>Highest value projects not always pursued in prioritisation process. Sometimes negative value added during projects process by particular projects but removal of such projects is not always an option.</td>
</tr>
<tr>
<td>Project viability changes with changing spot gas prices.</td>
<td>Whole Value needs to be based on price at authorisation, with allowance for actual price at completion – as an overlay.</td>
</tr>
</tbody>
</table>

8.8.5 Accuracy of the model and measurement tool

This gave the following findings:-

1. Within this organisation, important features showed up in the calculations for Whole Value and were noticeable in the Whole Value Charts developed.

2. The whole value analysis provided evidence to support the results of the case study analysis on the following contingent factors: experience of client, change, direction of project, management of supplier base, management of project base, benefit maximisation, and induction of experience. Conclusive evidence was not provided on other contingent factors.

3. The portfolio was predominantly one of renewal and replacement coupled with extension of the network to supply new customers. The Whole Value
calculations were seen to apply well to a portfolio of this nature and the data used by the company in the evaluation of projects and the recording of benefits gained (in terms of reduced maintenance or gas flow) meant that calculation of Whole Value for the portfolio (and potentially any project) was the most straightforward of any client organisation studied.

8.9 APPLICATION OF THE MODEL TO A HOTEL COMPANY

8.9.1 Profile of organisation

This Hotel Company (HotBed) was one of the foremost hotel chains in the UK and has an international spread, with 45 hotels providing 6500 beds per night. Formed in 1920 by an entrepreneur, the company diversified and was brought to the Stock Market in 1965. In its 1994/5 financial year it reported sales of £200 Million and pre-tax profits of £2 Million\(^\text{14}\). The company was taken over in 1995 and has been absorbed into the larger group.

8.9.2 Profile of Projects and their Procurement

Relatively few procedures appeared to exist as to what projects should be pursued. The organisation was, in effect, a family firm and the head of the company would decide which project (new or refurbished hotel) would be pursued. This led to a very speedy and efficient decision making process, without the "bureaucratic drag" noted in some of the large corporations studied in this research.

Delivery of the project is entrusted to traditional construction (building) companies who have worked for the client for many years and have proved to be competent at constructing hotels in the way which this client desires.

\(^{14}\) Source: 1994/5 Report and Accounts.
8.9.3 Value Criteria

The value criteria were identified by an analysis of example projects evaluation reports; Value Management study output; interview with project and value management professionals and declared corporate objectives. Table 8.17 lists the value criteria.

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Measured by</th>
</tr>
</thead>
<tbody>
<tr>
<td>Occupancy level</td>
<td>%age of beds occupied.</td>
</tr>
<tr>
<td>Staffing level</td>
<td>Number of staff (per bedroom)</td>
</tr>
<tr>
<td>Rooms</td>
<td>Number</td>
</tr>
<tr>
<td>Size of hotel</td>
<td>Number of rooms</td>
</tr>
<tr>
<td>Facilities in hotel</td>
<td>Types (and hence “number of stars”)</td>
</tr>
<tr>
<td>Location of hotel</td>
<td>Qualitative view that affects occupancy and required size and facilities.</td>
</tr>
</tbody>
</table>

8.9.4 Evaluation of the organisation

Table 8.18 compares the features observed within the organisation with the features present in the Whole Value charts. Figure 8.7a shows the chart for Whole Value and Figure 8.7b shows the chart for Whole Value divided by the cost of undertaking the management activity.
Table 8.18
Comparison of Observed Features with Whole Value Chart

<table>
<thead>
<tr>
<th>Observed Features</th>
<th>Features Whole Value Chart</th>
</tr>
</thead>
<tbody>
<tr>
<td>Company used limited number of contractors with experience of hotel construction.</td>
<td>Little evidence of value added by on-going selection process within the supplier sub-system.</td>
</tr>
<tr>
<td>Judgements about which project to pursue taken quickly at a relatively high level in the company.</td>
<td>Relatively large amount of value added by projects sub-system - especially when normalised.</td>
</tr>
<tr>
<td>Timing driven predominantly by statutory or market deadlines.</td>
<td>Highest value projects not always pursued in prioritisation process. Sometimes negative value added during projects process by particular projects but removal of such projects is not always an option.</td>
</tr>
</tbody>
</table>
8.9.5 **Accuracy of the model and measurement tool**

This gave the following findings:—

1. Within this organisation, important features showed up in the calculations for Whole Value and were noticeable in the Whole Value Charts developed.
2. The Whole Value analysis provided evidence to support the results of route, client's relationship, finance project, aims and objectives, management of project base, and induction of experience. Conclusive evidence relating to other contingent factors was not produced.
3. The benefits of using the business judgement as opposed to detailed and expensive analysis to decide project value and priority was a marked feature of the Whole Value charts (and the noted feature) of this organisation.

8.10 **APPLICATION OF THE MODEL TO A FAST FOOD COMPANY**

8.10.1 **Profile of organisation**

*FastFood* was the UK market leader in fast food, this company was the subsidiary of a US organisation. Sales were reported to be £2,000 Million in 1995/6 with a profit of £300 Million\(^\text{15}\). The company had a forward looking policy of expansion and was opening a new restaurant at the rate of 40 per year, giving a currently total number of 450 restaurants in the UK.

8.10.2 **Profile of Projects and their Procurement**

The process for authorising and procuring projects was subject to defined policies; but few detailed procedures exist.

\(^{15}\text{Source: 1996/7 Report and Accounts.}\)
Projects were developed by a dedicated team who were looking to develop the business in a variety of ways; not always by the improvement or construction of a new piece of infrastructure. This team undertook management of the project from the client’s side but a small number of contractors undertake construction, design and construction management.

\subsection{Value Criteria}

The value criteria were identified by an analysis of example projects evaluation reports; Value Management study output and declared corporate objectives. Table 8.19 lists the outcome of this analysis.

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Measured by</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location of restaurant</td>
<td>Qualitative view only</td>
</tr>
<tr>
<td>Staffing level</td>
<td>No of staff required to run service to defined level.</td>
</tr>
<tr>
<td>Size of restaurant</td>
<td>No of covers</td>
</tr>
<tr>
<td>Throughput of customers</td>
<td>Number per hour (or day/month)</td>
</tr>
<tr>
<td>Throughout of product</td>
<td>Quantity per shift, day or month.</td>
</tr>
<tr>
<td>Size of site</td>
<td>“Footprint” in square metres</td>
</tr>
</tbody>
</table>
FIGURE 8.8a
WHOLE VALUE CHART FOR CLIENT C7

FIGURE 8.8b
ACTIVITY COST NORMALISED WHOLE VALUE CHART FOR CLIENT C7
8.10.4 Evaluation of the organisation

Table 8.20 compares the features observed within the organisation with the features present in the Whole Value charts - the charts are contained in figure 8.8a (which shows the chart for Whole Value) and figure 8.8b (which shows the chart for Whole Value divided by the cost of undertaking the management activity).

<table>
<thead>
<tr>
<th>Observed Features</th>
<th>Features Whole Value Chart</th>
</tr>
</thead>
<tbody>
<tr>
<td>Company used limited number of contractors with experience of hotel construction.</td>
<td>Little evidence of value added by on-going selection process within the suppliers sub-system.</td>
</tr>
<tr>
<td>Judgements about which project to pursue taken quickly at a relatively high level on the company.</td>
<td>Relatively large amount of value added by projects sub-system - especially when normalised.</td>
</tr>
<tr>
<td>Timing driven predominantly by statutory or market deadlines.</td>
<td>Highest value projects not always pursued in prioritisation process. Sometimes negative value added during projects process by particular projects but removal of such projects is not always an option.</td>
</tr>
<tr>
<td>Standardised construction.</td>
<td>Cost of construction small, so value added great in management sub-system. Little change.</td>
</tr>
</tbody>
</table>

8.10.5 Accuracy of the model and measurement tool

This gave the following findings:-
1. Within this organisation, important features showed up in the calculations for Whole Value and were noticeable in the Whole Value Charts developed.
2. The Whole Value analysis provided evidence to support the results of the case study analysis on the following contingent factors: client’s relationship, experience of client, change, aims and objectives, direction of project, management of supplier base, management of project base and benefit maximisation. Conclusive evidence was not produced on other contingent factors.
3. The benefits of standardisation were particularly strongly apparent in the Whole Value charts produced for this client.

8.11 APPLICATION OF THE MODEL TO A WATER COMPANY

8.11.1 Profile of organisation

Privatised in 1986, this water company (WaterCo) was a major player in the UK water supply and sewerage market. It had sales of £2,000 Million and pre-tax profits of £200 Million in the 1995/6 financial year.\(^{16}\)

8.11.2 Profile of Projects and their Procurement

The process for authorising and procuring projects was defined in some detail; as was the process for the management and review of projects once complete.

Projects were developed by designated people within the organisation. These were technical specialists or customer oriented managers depending on whether the investment was necessary for technical or business development reasons. These people were part of the projects division who also undertake all planning, procurement and technical resources to undertake all infrastructure projects.

8.11.3 Value Criteria

The value criteria were identified by an analysis of example projects evaluation reports; interview with project and value management professionals and declared corporate objectives. The analysis suggested that different sets of value criteria applied to potable water supply (listed in table 8.21) and sewerage (listed in table 8.22).

\(^{16}\) Source: 1995/6 Report and Accounts.
### Table 8.21
**Key Value Criteria - Potable Water**

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Measured by</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water purity</td>
<td>Impurities content (parts per million)</td>
</tr>
<tr>
<td>Supply volume</td>
<td>Peak Volume, reservoir capacity</td>
</tr>
<tr>
<td>Customer perception</td>
<td>Qualitative view</td>
</tr>
<tr>
<td>Environmental Impact</td>
<td>Qualitative view</td>
</tr>
</tbody>
</table>

### Table 8.22
**Key Value Criteria - Sewerage**

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Measured by</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water quality</td>
<td>Impurities content (parts per million)</td>
</tr>
<tr>
<td>Quantity dealt with</td>
<td>Volume</td>
</tr>
<tr>
<td>Environmental impact</td>
<td>Qualitative view</td>
</tr>
</tbody>
</table>

### 8.11.4 Evaluation of the organisation

Table 8.23 compares the features observed within the organisation with the features present in the Whole Value charts - figure 8.9a (which shows the chart for Whole Value) and figure 8.9b (which shows the chart for Whole Value divided by the cost of undertaking the management activity).

### 8.11.5 Accuracy of the model and measurement tool

This gave the following findings:

1. Within this organisation, important features showed up in the calculations for Whole Value and were noticeable in the Whole Value Charts developed.
2. The Whole Value analysis provided evidence to support the results of the case study analysis on the following contingent factors: procurement route, finance project, pre-requisites, ownership of results, change, aims and objectives, direction of project, management of supplier base, management of project base, benefit maximisation, and induction of experience. Conclusive evidence was not produced on other contingent factors.
This organisation showed particularly well the benefits to be gained by proper and thorough application of the standard practices of construction procurement. The organisation provides a model of the “standard” good performing client organisation.

<table>
<thead>
<tr>
<th>Table 8.23</th>
<th>Comparison of Observed Features with Whole Value Chart</th>
</tr>
</thead>
<tbody>
<tr>
<td>Observed Features</td>
<td>Features Whole Value Chart</td>
</tr>
<tr>
<td>Good basic management of supplier base</td>
<td>Fairly good Value Added by suppliers sub-system.</td>
</tr>
<tr>
<td>Capital funds availability drives project priority.</td>
<td>Generally low value added by this subsystem. Individual portfolios and projects show large variability in value added. Some projects show negative value added.</td>
</tr>
<tr>
<td>Little formal review.</td>
<td>Little evidence of value added by review sub-system.</td>
</tr>
<tr>
<td>Specialist resources critical to some projects.</td>
<td>Increase in cost and hence reduction in value added at identifiable points within management sub-system. Little evidence of projects sub-system adding value by reprogramming of works to avoid resource problems.</td>
</tr>
<tr>
<td>Experienced in-house design and construction management.</td>
<td>Majority of whole value added comes within management and benefit maximisation sub-system due to good control of design and construction costs with relatively low on-cost of the process.</td>
</tr>
<tr>
<td>Timing driven predominantly by statutory deadlines.</td>
<td>Highest value projects not always pursued in prioritisation process. Sometimes negative value added during projects process by particular projects but removal of such projects is not always an option.</td>
</tr>
</tbody>
</table>
8.12 FINDINGS ARISING FROM THE TEST

The work reported in this chapter has resulted in the following findings:-
1. The model enabled the explanation of the features noted during the case study exercise and measured the impact on the performance of the project.
2. The model provided a numerical representation of the Value added during all of the project processes.
3. The model was demonstrated to be applicable to a range of client organisations undertaking different types of infrastructure project for different business reasons.
4. The concept of Whole Value applied well to the client's perception of project performance and embodies both financial and non-financial criteria.
5. The findings on contingent factors reported in Chapter 5 were further supported by the analysis undertaken during the test process.
6. It was possible to use the model in a variety of ways: for classification and comparison of project activities; suggesting the selection of activities to best fulfil the client role, performance monitoring.
7. By use of the model, the client can determine if the commercial benefits are great enough to justify the "costs" of the additional involvement – or vice versa.

8.13 REVIEW

The test described in this chapter successfully applied the model and analysis method developed during previous chapters to eight more organisations. The formula and Whole Value concept were proven to be applicable to a wide range of situations within organisations that are representative of the types of organisations to which this research relates. This chapter also examined the way in which Whole Value may be plotted for projects and portfolios within eight further organisations. This was particularly important as it validated that the model did measure Whole Value. Furthermore, the work verified that the model may be successfully applied to organisations other than the one from which it was developed.
Therefore, the work of the research was complete and the main aim of the research had been satisfied. The following chapter, Chapter 9, serves to provide a detailed review of the findings of the research and the conclusions that were derived from these.
Chapter 9

CONCLUSIONS

9.1 OVERVIEW

This chapter provides a formal presentation and summary of the findings and conclusions of the research. Some details of the potential for further research are also included.

9.2 WORK UNDERTAKEN

The research set out to test the following hypothesis (see Chapter 1):

If the impact that a client who is a frequent constructor of infrastructure has on the acquisition phase of a project is optimised then this will lead to an improvement in the performance of infrastructure projects that will lead to a commercial benefit for the client.

Many of the terms used in this hypothesis were specifically defined at the outset\(^1\) and, where necessary, confirmed during the research.

The research used a measurement tool (created as part of the research) to evaluate the impact of several clients who were frequent constructors of infrastructure. The research also showed how the results demonstrated that this impact could be

\(^1\) Ibid p 5
optimised. The assertion that the optimisation would lead to an improvement in project performance was supported. The commercial benefit of this improvement was demonstrated by the choice of factors measured by the measurement tool. Therefore, the hypothesis was supported by the research.

The overall aim of the work was stated as:-

To collect data that will enable the creation of a tool which uses a suitable measurement system to allow the impact of the client on the performance of a project to be distinguished and optimised.

This aim was achieved, in the manner reported in the following section.

9.3 FINDINGS

9.3.1 Satisfaction of the Declared Objectives of the Research

In Chapter 1, seven objectives were set which the research would be expected to achieve. This section considers how, and to what extent, these objectives have been satisfied. The consideration refers to the relevant parts of the thesis in order to link this section to the detailed report on the particular work.

1. Create a suitable methodology to direct and structure the research.

Chapter 2 contains a detailed description of the methodology, its design and the strengths and weaknesses embodied in it. The methodology resulted from a major review of various aspects of current practice and a pilot study into the experience of practitioners in one organisation.
2. Identify the factors for which evidence already exists that they may drive the performance of a project.

The pilot study and literature review (reported in Chapter 3) revealed current best practice. The potential factors are derived in Chapter 4.

3. Determine which factors actually drive the performance of a project and are also driven by the client — i.e. the "Client Level Performance Drivers".

An analysis is contained in Chapter 5 and, particularly, new concepts are developed which can explain why problems occur and how they may be avoided. The concepts developed at this stage of the thesis were not perfect. Therefore, the work undertaken as described in Chapters 5 and 6 represented major development in the understanding of this issue.

4. Create a qualitative model which structures the Client Level Performance Drivers and explains how they impact on the performance of a project.

The outcome of Chapter 5 is a qualitative model of the client role that describes the effects that the client can have on a project and its performance. This model allows the impact of the client to be clearly identified and distinguished from the impact of any other project participant. At this stage the model is entirely descriptive and can be used to explain features of client management as well as predict the potential effects of different styles of client management.
Produce a quantitative model which can both measure the impact of the client on the performance of a project and demonstrate where this performance can be optimised.

Chapter 6 develops a qualitative framework, using value analysis, that allows the qualitative model to be extended to give a quantitative method of measuring the impact that the client has on performance. The model is applied to a range of projects and portfolios of projects to both prove that the data available can be used in the model and that the features predicted by the qualitative model appear in a quantitative manner. The ability to analyse the client impact in a quantitative manner, allows the locations where performance can be improved to be located. The reasons for below optimum performance can be determined by inspecting the supporting data. Therefore, a very powerful tool has been created that can measure the impact of the client on the performance of a project and demonstrate where this performance can be optimised.

5. Show how the model demonstrates the impact the client has on the performance of various projects.

The analysis in Chapter 7 indicates how the performance measurement system within the model can be used to identify the impact of the client on the project and how this can be optimised to achieve benefits. The analysis of the model can suggest benefits both on an absolute basis (by demonstrating the value added by a process and comparing it with the cost of the activity) or a comparative basis (by allowing a process to be compared with a similar one elsewhere in the client organisation or in other organisations). The analysis of the organisation considers the following details:-

- Description of each organisation.
- Whole Value results.
- Discuss whether the Whole Value results were felt to be correct.
• What do these results tell us and do the results accord with what was observed.
• How is the performance related to the fit of the activities with the business.
• Confirm whether the model and measurement tool apply for this particular instance.

This work is repeated in Chapter 8 on other organisations (see below) as a method of showing how the model will demonstrate the impact in a range of clients.

6. Demonstrate that the model can be used in a variety of organisations within the scope of this research.

The quantitative model was developed and proved in one organisation. Chapter 8, therefore, shows how the model may be applied to other organisations which may be described as client of infrastructure projects. The features noted in both the quantitative model (considered in Chapter 5) and the qualitative analysis of the prime organisation (considered in Chapter 6) were largely noted in this stage of the work. The demonstration in Chapter 7 also shows how it is possible to analyse the impact of these clients in a quantitative manner, including the locations where performance can be improved to be located. The reasons for below optimum performance were again determined by inspecting the supporting data. Therefore, the powerful tool can be used to analyse organisations outside of that for which it was initially developed.

9.3.2 Validity of the Original Statements

During the research, it was necessary to confirm (or otherwise) the validity of the original statements regarding the situation of the client and the projects that were to be studied. These statements were broadly supported by the findings of the research, and the evidence was reported as follows:-
1. Clients have a significant impact on the performance of construction (as they see it).

In Chapter 2, it was revealed that much evidence existed in support of the assertion that clients can have a significant impact. Although some of the respondents in TransOne (as reported in Chapter 3) suggested that the client input should be minimal, most individuals agreed with this assumption. Chapter 3 and Chapter 4 provide theory to support the assumption.

2. Clients have a different perspective on the construction industry and projects than those who are traditionally part of it.

This was noted during Chapter 2 and Chapter 3.

3. That it is possible to measure the activities of clients and the impact that they have and compare different clients.

Chapter 6 and Chapter 7 provide the measurement tool and the detailed description of its. The tool measures a range of features, including: the cost of activities undertaken, the benefit (in terms of Whole Value) of the activities; the result of the input of the client (in terms of Whole Value); and enables us to compare different clients.

4. That, by the creation of a model which integrates the separate activities/impacts with the processes involved, it is possible to demonstrate how a particular client may improve the process.

The interpretations of the Whole Value graphs presented in Chapter 7 indicated this was possible and demonstrated how it may occur.
5. The use of the model can have a significant impact on improving clients' construction projects.

Although it was outside the scope of the research to introduce actual changes to any client’s activities, it was demonstrated that the model can have a significant impact on improving client’s construction projects.

9.4 CONCLUSIONS

The research work reported in this thesis gave rise to conclusions relating to the hypothesis and the field of study. The conclusions deal with the objectives reported above.

1. The hybrid methodology adopted (being part case study and part statistical analysis) is a justifiable procedure to investigate problems where the mechanisms are not well known. (Objective 1)

2. The factors which affect the performance have been investigated. Some were found to have only a weak affect; others were found to be applicable at the client level and others at the project level. (Objective 2)

3. The client role derived from these activities defined what may be termed “Client Management”. (Objective 3)

4. The client activities determined within this research were crucial to the successful implementation of infrastructure projects. (Objective 3)

5. The client role can be described in terms of three “roles” – Base Role, Added Value Role and Interfering Role. The activities which comprise each were as follows:-
i) Base Role was defined as: Generate need for project; Communicate need and requirements; Finance the project; Provide the essential pre-requisites; Take ownership of the results.

ii) Added Value Role was defined as: Provision of aims and objectives; Direction of project specific activities; Management of Supplier Base; Management of Project Base; Benefit Maximisation; Induction of Experience.

iii) Interfering Role was defined as: Change; Restrictions to programme; Provision of Internal Resources; Controls on technical details; Usurping the roles of other participants; Lack of response to other participants.

(Objective 4)

6. The performance of the project from the client's point of view and the client's own input can be measured using the concept of Whole Value developed in this research. (Objective 5)

7. The performance measurement tool, embodying Whole Value, can be used to measure particular projects, definite project programmes or portfolios within a client or whole client project programmes. This enables the projects or programmes to be examined to improve efficiency and, in certain circumstances, compared. The model created can be used for; classification and comparison, selecting the best role, performance monitoring. (Objective 6)

8. The client role should be crystallised and co-ordinated in one position. The client role should also include direction at a high enough level within the client organisation to ensure that the organisation's true objectives are satisfied. (Objective 6)
9. If the commercial benefits are great enough to justify the "costs" of the additional involvement, the client should have a more active involvement in the procurement process. This can be solved by the use of the tool developed here. (Objective 7)

10. The active involvement of a frequent client in the procurement process - particularly the "super-contractual" elements - can result in a better commercial outcome to the project and hence an enhanced commercial benefit to the client’s business. (Objective 7)

11. There is a need for clients to examine the role they are currently adopting in the light of the contingent factors highlighted by the research and develop their role to better match them. (Objective 7)

9.5 RECOMMENDATIONS

It was noted that the construction industry and its clients have attempted to improve project performance over a great many years – the Latham target of 30% reduction in costs by the year 2000 has not been achieved\textsuperscript{2}. In Chapter 3, it was noted that Egan (1998) set ambitious targets and a framework for achieving these. Although progress has been made, these targets have not yet been achieved. One weakness of current research and development was found by the research to be the lack of a "common currency" in the tools used to measure and report performance. If the construction industry and the clients that are its customers are to realise the benefits they desire, then the results for this research can play an important part. In particular, the following recommendations can be made in addition to the conclusions already drawn:

1. That a model system of measuring the client role and procurement be adopted. The model developed here would be a suitable one.

\textsuperscript{2} Ibid p25
2. That client organisations use the model to identify the strength of their procurement organisation in the light of this research.

3. The model developed here should be used to benchmark any clients involved in infrastructure development.

4. The research should be extended as described in the following section “Ideas for Further Work”.

9.6 CONTRIBUTION OF CURRENT RESEARCH WORK

It is only relatively recently that research and thinking has focused onto the key role of the client in the success of a construction project. The research reported in this thesis contributes to this in the following ways:

1. Identifies the inherent weaknesses of the direction of a great deal of the developments in procurement from the war until the current time.

2. Uses the data collected during the research to confirm recommendations of the recent reports following Egan. It enables an explanation of why particular recommendations are important and the benefits that may be expected.

3. Identifies the limitations of the report for infrastructure clients and examines how benefits expected are contingent upon other factors.

4. Provides a means of mapping the strength of client procurement activity.

5. Provides a framework of determining the performance of client activity to be mapped.
6. Establishes a common framework and system of procurement that unifies those currently available and allows mix and match. Client organisations can see where the scope for continuous improvement lies.

7. Allows the benefits of a more proactive form of client activity to be demonstrated.

8. Sets limits to the extent of client involvement so that dysbenefits are not to occur.

9. Constructs a holistic systems based view of the process, which has been used to produce findings so that all the significant contingencies are considered.

10. Uses the concept of inventories and control points developed by industrial dynamics to identify where benefits will accrue.

9.7 **IDEAS FOR FURTHER WORK**

9.7.1 **Potential papers arising from the research**

The research would lend itself to the papers on the following subjects:-

1. A description of the methods available for the procurement of infrastructure projects and the selection of participants within these types of project.

2. The qualitative model to describe the role that a client should play in a project.
3. The quantitative model – particularly the derivation of the Whole Value formula, the systems model of the client role and the resultant graphs which may be obtained.

4. The interpretation of features apparent with particular types of client using the model.

9.7.2 Further research on this topic

The research has provided a series of ideas for further work that may be undertaken to improve or extend knowledge in the field of the research reported in this thesis:

1. The model would benefit from further testing and monitoring of how the system works in practice. This would allow the data included within the model to be more representative of the industry as a whole and would support numeric benchmarking. This level of accuracy of the data was not required to prove the hypothesis.

2. Collection of fuller and detailed quantitative data to allow more precise assessment of the benefits of various decision points.

3. Develop a tested model system for the Development and Appraisal of infrastructure projects. Several of the companies surveyed have good systems.

4. Investigate the extent to which the model provides good results when comparing different organisations in different industries. Calibrate the model, where necessary, to enable the comparison to occur.
9.7.3 Further research in this field

The research has touched upon a variety of issues that were not explicitly investigated as they were outside the scope of study. There remain various questions that could be studied using the tool produced. Some key questions are:-

1. Do different projects with different characteristics require the client to adopt a different role? Such characteristics would include the risks embodied in project, the size of the project (either absolute or in relation to the participants or the client) and importance to client's business.

2. How does client experience affect the role that they do or should play? Are more experienced clients more successful with their projects and if so why?

3. What impact does procurement route have on the performance of the project as measured by Whole Value?

4. What does the type, strength and quality of relationship between participants do to the role of the client? In addition, how does past experience, relative sizes and business styles affect the outcome of the project?

5. Does the type and amount of internal resources available within the client organisation affect the role to be played and the success of the project?

6. Should the same client adopt different roles in different circumstances?

7. Can we investigate the nature and impact of the effect that the client role has?

8. Is there a potential mismatch between what clients feel they should do and what they actually need to do?
9. Is there a mismatch between what participants feel that they require and what the client feels that they are able to provide?
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**RESEARCH METHODS**

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VALUE ANALYSIS/ENGINEERING/MANAGEMENT


Raven, A D. *Profit improvement by value analysis, value engineering and purchase price analysis*. Cassel, 1971.


Appendix A

DATA COLLECTION TOOLS USED

PURPOSE

This Appendix contains copies of the various tools used in the collection of data in the research. The tools used and reproduced here are:-

1. Pilot Study Semi-structured Interview Sheet.
2. Initial Project Case Study Questionnaire.
3. Project Case Study Structured Interview Sheet.
4. Company Case Study Structured Interview Sheet.

This appendix should be read in conjunction with the relevant chapter which describes the research work undertaken – particularly the sections on methodology.

PILOT STUDY SEMI-STRUCTURED INTERVIEW SHEET

The sheet is 2 pages in length containing 23 questions. It took approximately 45 minutes to complete, but interviews generally lasted slightly over one hour since other issues were often explored. The sheet was used 32 times. The sheet is contained on pages 296 and 297.
INITIAL PROJECT CASE STUDY QUESTIONNAIRE

The questionnaire is 4 pages in length and contains 20 questions. It was sent to 87 respondents in 89 projects. The response rate was 91%; rising to 98% following visits/interviews with the remaining projects. One project was discounted and no response was forthcoming. Feedback from respondents revealed that the questionnaire took 30 to 40 minutes to complete. The questionnaire is reproduced on pages 298 to 302 inclusive.

PROJECT CASE STUDY STRUCTURED INTERVIEW SHEET

The sheet is 5 pages in length; containing 56 questions. The sheet was used 33 times on 24 projects. It took approximately 75 minutes to complete the interview. Where necessary, other issues were explored at the end of the interview. The sheet is reproduced on pages 303 to 307.

COMPANY CASE STUDY STRUCTURED INTERVIEW SHEET

The sheet is 5 pages in length containing 66 questions. The sheet was used 15 times with 8 organisations. It took approximately 80 minutes to complete; with other issues explored at the end of the interview. In some cases the interview was given to two or more people in the organisation - especially where no one individual felt competent to fully answer all questions. The sheet is contained on pages 308 and 312.

CONTINGENT FACTORS RATING SHEET

The sheet is one page in length although instructions were attached on how to complete the ratings. It was estimated that the questions could be answered in around 10 minutes. 53 questionnaires were sent out and 49 were completed – the
high response rate was due to individual contact between the researcher and the respondent. The sheet is reproduced on page 313.

**WHOLE VALUE DATA COLLECTION SHEET**

The sheet is 2 pages in length. One master sheet was completed for each project and portfolio evaluated. It was completed by the author from source documents located in project files. Where source documents were not available; respondents were asked to estimate data values and these were cross correlated with data that was more readily available.

The sheet contains details of activities; cost and further remarks. It has not been reproduced here.
# PILOT STUDY SEMI-STRUCTURED INTERVIEW SHEET

LOUGHBOROUGH UNIVERSITY  
DEPARTMENT OF CIVIL & BUILDING ENGINEERING

<table>
<thead>
<tr>
<th>PhD - CLIENT ROLE</th>
<th>Page 1 of 2</th>
<th>Prepared by: JOHN PETTIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>PILOT STUDY</td>
<td></td>
<td></td>
</tr>
<tr>
<td>INTERVIEW SHEET</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## 1 BRIEFING
1.1 How do you typically ensure the Client’s requirements are:
   (a) Known
   (b) Met
1.2 How do you feel that this process may be improved?
1.3 What are the Client’s prime objectives for:
   (a) His entire programme
   (b) A particular project.
1.4 Who is involved? Roles?
1.5 Who should be involved? Roles?

## 2 PERFORMANCE
2.1 How do you measure performance? What do you mean by Performance?
2.2 How do you ensure project performance is kept to, in respect of:
   (a) Time
   (b) Cost
   (c) Function
2.3 How do you feel that this process may be improved?
2.4 What/who has an impact on performance? What is this impact?
2.5 Critical Success Factors:
   (a) Input
   (b) Output
   (c) Linkage

## 3 TIMING
3.1 What effects do you feel that timing decisions have on projects?
3.2 How much control do you have over project timing?
3.3 How much would you like to have?
3.4 What are the main objectives of the project timing?

## 4 CHANGE
4.1 How do you control change?
4.2 Who is involved in the change process? Their roles?
4.3 Who should be involved in the change process? Their roles?
4.4 What are your objectives for change?
4.5 Who causes change? The most?
# PILOT STUDY SEMI-STRUCTURED INTERVIEW SHEET (continued)

## 5 ORGANISATION
5.1 How would you describe the organisation used?
5.2 What control do you have over the organisation used?
5.3 What control would you like to have? Why?
5.4 Who decides organisation? Who should?
5.5 What are the strengths/benefits of the organisation used?
5.6 What are the weaknesses/problems of the organisation used?
5.7 What forms of contract do you use?
5.8 Who decides forms used? Roles?
5.9 Who should decide? Roles?
5.10 Why do you select different ones? Technology, etc.
5.11 What problems do you get from specific forms?
5.12 What improvements would you like to see in forms?

## 6 PARTICIPANTS
6.1 What action do you take in the selection of participants?
6.2 What action would you like to take? Why?
6.3 Who else is involved in the selection process? Their roles?
6.4 Who should be involved in the selection process? Their roles?
6.5 What do you feel are the most important attributes of participants?
6.6 What describes a good participant?
6.7 What describes a bad participant?
6.8 Who do you use/like to use? Why? Key Behaviours?
6.9 Who do you not like to use? Why? Key Behaviours?

## 7 REVIEW
7.1 How do you review the performance of projects?
7.2 What criteria do you use? Who is involved? Their roles?
7.3 What criteria should be used? Who should be involved? Their roles?
7.4 How long after completion does this take place?
7.5 What are the findings?
7.6 How do the findings affect the progress of future projects?
7.7 What are the objectives of the review process?

## 8 MISCELLANEOUS
8.1 Is there anything further you consider important?
INITIAL PROJECT CASE STUDY QUESTIONNAIRE

The information opposite has been taken directly from IMPS. Would you please check to see that it is correct.

1(a) IMPS Project No ........................
1(b) Authority No. ...........................
2. Project Name .............................
3. Forecast Total Cost (FTC) .............
at base

Could you please supply the further information requested by the following parts of the questionnaire.

Some questions may not be relevant to your project. If this is so, please skip that question and go on to the next one.

If any questions, words etc. are not clear, please circle them and answer the question as best you feel able.

Feel free to give additional information at any point.

4. Description of project in your own words.
5. What is the current state of the project?

Not fully appraised
Appraisal completed
Full Financial Authority obtained
Detailed Design commenced
Construction commenced
Construction completed
In operation

6. If not already obtained, in which year do you envisage Full Financial Authority to be obtained? ..................................................

7. What is the expected/actual date for START of CONSTRUCTION?
...................................................................................

8. What is the expected/actual date for COMPLETION of CONSTRUCTION?
...................................................................................

9. Is the Forecast Total Cost (FTC) based on emerging costs? YES NO

10. Does the FTC include Extended Project Costs? YES NO

11. If there are ANY other costs not included, please enter an estimate for them here:

12. Which types of TECHNOLOGY are involved in the project?

P.Way
Works (Civil & Structural)
Building
Electrical (MV & LV)
Electrical (HV)
Mechanical
Signalling
Telecommunications
Computer Systems
OTHER (please specify)

13. Which BR Departments are involved in the project?
14. Is the project to be broken down into identifiable parts?  

15. If so, would you enter the breakdown in the table below; including, if possible, the source of the resources involved.

<table>
<thead>
<tr>
<th>Description</th>
<th>Est. Total Cost</th>
<th>Groups involved</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>BR Dept</td>
<td>Consultant</td>
</tr>
<tr>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

16. Please name any EXTERNAL consultants, contractors or suppliers already involved.

17. Which one of the following provided the MAIN advice on WORK BREAKDOWN for the project (so far)?

- Project Manager
- Project Engineer(s)
- Director of Procurement
- Quantity Surveyor
- Other (please specify)
18. Who has **also** provided advice on WORK BREAKDOWN for the project (so far)?

   - Project Manager
   - Project Engineer(s)
   - Director of Procurement
   - Quantity Surveyor
   - Other (please specify)

19. Which one of the following provided the **main** advice on CONTRACTUAL MATTERS for the project (so far)?

   - Project Manager
   - Project Engineer(s)
   - Director of Procurement
   - Quantity Surveyor
   - Other (please specify)

20. Who has **also** provided advice on CONTRACTUAL MATTERS for the project (so far)?

   - Project Manager
   - Project Engineer(s)
   - Director of Procurement
   - Quantity Surveyor
   - Other (please specify)

21. Which would you say best describes the Project Management organisation for this project?

   - Co-ordination
   - Project team
   - Departmental control
   - Matrix

22. Who do you feel is the Client?

23. Who defined the Client's requirements to you?

24. How were the Client's requirements defined to you?
25. Has there been any alteration to the Client's requirements?

- No alterations so far
- Before Full Financial Authority
- After Full Financial Authority (FFA)
- During Detailed Design (for FFA)
- After start of Construction
- During Commissioning
- During Operation (1st 12 months)

26. Please give the following details for the person who actually filled in this questionnaire.

Name: ........................................................... Phone: ..................................
Job Title: ........................................................................................................
Address: ..........................................................................................................
........................................................................................................................

27. Have you been on a Project Management Training Course?  YES  NO

28. Was there a project manager for this project before you?  YES  NO

29. If so, on what date did you take over? ..............................................................

30. Thank-you for taking the time to answer this Questionnaire. If you would like to add any more information, please feel free to do so below or on a separate piece of paper.
## Nature of infrastructure projects
1. What types of project are you involved in?
2. What technologies are involved (e.g., Construction, M&E, control systems)?
3. What size are they (value, duration)?
4. What is your total annual turnover?

## Programme Organisation
5. What is your company organisation structure like?
6. How many people are involved?
7. What professions/specialisms are involved?

## Project Organisations
8. What is the typical structure of the organisation used to manage an individual project?
9. Who decides on the size and type of organisation?
10. Who is best able to decide this?
11. What factors influence the size and type of project organisation?
12. How does your company first become involved in a project?

## Investigation of implications
13. Are you involved at the planning stage of the project?
14. What analysis of the proposed project is undertaken (financial, technological, impact on service, marketing, etc)?
15. How are the analyses reported?
16. Who is involved in the analysis?
17. What are the aims and objectives of the analysis?

## Project funding arrangements
18. Is your company involved in providing finance for a client's project?
19. What are the typical sources of the funding?
20. What are you looking for from the client when you are deciding whether to assist in the provision of funding?
21. Who is responsible for organising funding?

## Financial control
22. What procedures exist to monitor and control finance at the project level?
23. Who is responsible for controlling project funding?
24. What are the financial objectives of a project?
**PROJECT CASE STUDY STRUCTURED INTERVIEW SHEET (continued)**

| LOUGHBOROUGH UNIVERSITY  
DEPARTMENT OF CIVIL & BUILDING ENGINEERING  
PhD - CLIENT ROLE  
CLIENT ACTIVITIES  
INTERVIEW SHEET |
<table>
<thead>
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</tr>
</thead>
<tbody>
<tr>
<td>Prepared by: JOHN PETTIT</td>
</tr>
</tbody>
</table>

**Arrangements for payment to participants**

25. What procedures are involved in the payment of the various participants (designers, contractors, managers etc)?

26. What are the aims of the payment system?

27. Who is responsible for the payment of participants?

28. What mechanisms are used to pay participants (e.g., terms of contract)?

**Terms of Contract**

29. On what terms are you normally engaged?

30. What forms of contract are used?

31. What are the key particular requirements of the terms of contract?

32. What do you see as the main strengths of the forms of contract in use?

33. What are the weaknesses of the forms of contract in use?

**Selection of participants**

34. How do client organisations decide to select you in preference to other organisations?

35. Do you feel this process can be improved?

36. What are the strengths of this process?

37. What do you feel are the key criteria for selection?

38. To what extent do you clients employ internal or external resources?

**Briefing participants**

39. How are the detailed requirements of each project communicated to each participant?

**Definition of CLIENT project objectives**

40. What do you feel are the most important CLIENT objectives for each project (financial, service etc)?

41. Are the client's project objectives formally defined, usually?

42. How are the client's objectives recorded?

43. Who is responsible for ensuring that client's project objectives are adequately defined?

44. Do client project objectives change over the life of a project?

45. How does this occur?

46. Who is responsible for ensuring that client project objectives remain relevant?
## Your project objectives

47. What are your company’s objectives for a project?
48. Are these formally defined?
49. How are they recorded?
50. Who is responsible for ensuring the objectives are adequately defined?
51. How are project objectives communicated to each participant?
52. Do they know what is expected of them?
53. Who is responsible for ensuring that project objectives are adequately communicated?
54. Do your project objectives change over the life of a project?
55. How does this occur?
56. Who is responsible for ensuring that your company’s client project objectives remain relevant?

## Generation of options

57. Do clients always alternative options considered at the outset?
58. How are they generated?
59. Who is responsible for revealing the various options - is your company ever involved?

## Analyse options

60. What techniques are used to analyse a clients options?
61. How powerful do you feel they are?
62. Are they always appropriate for the purpose?
63. Who is responsible for analysing options?
64. Who else is involved?

## Selection of best option

65. What criteria are used to select the best option for the client?
66. What processes or techniques are used to select the best client option?
67. Are these sufficiently powerful and/or appropriate?
68. How does the client take the decision to pursue the best option?

## Supplier Market intelligence

68. What information do clients keep on potential project participants (e.g. contractors)?
69. Why is this information kept?
70. How does your company make itself known to the client?
71. What information is important?
Super-contractual co-ordination
72. What contact does the client have with your company outside any particular contract?
73. What is the purpose of these contacts?
74. What benefit accrues to your company?
What benefits do you feel this has for the client?

Project Review
75. Does any form of review take place at the end of the project?
76. What data collection occurs?
77. What forms of information analysis are used?
78. Does this review result in an alteration to practice?
79. How does the alteration occur?
80. What can be done to improve the process?

Change control
81. What change control systems are used?
82. What is the objective of change control?

Value management
83. Do you ever use any type of value management?
84. What value analysis techniques are used?
85. How do you feel value management techniques can be use in construction?

Other benefit improvement
86. How are non-financial benefits monitored?

Project Management
87. What do you see as the role of the Project Manager (PM)?
88. Do clients normally use a PM from their own staff or employ one from an external company?

Contractual mechanisms
89. What contractual arrangements do clients use for construction, design and other services?
## Change (in Client requirements)

<table>
<thead>
<tr>
<th>Question</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>90.</td>
<td>When would a client make a change to the project?</td>
</tr>
<tr>
<td>91.</td>
<td>Who would originate that change?</td>
</tr>
<tr>
<td>92.</td>
<td>How is the change controlled/recorded?</td>
</tr>
<tr>
<td>93.</td>
<td>How is change valued?</td>
</tr>
</tbody>
</table>

## Restrictions on project progress

<table>
<thead>
<tr>
<th>Question</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>94.</td>
<td>Does the client impose any limitations on how the project can progress?</td>
</tr>
<tr>
<td>95.</td>
<td>What are the limitations?</td>
</tr>
<tr>
<td>96.</td>
<td>What effect do these have?</td>
</tr>
<tr>
<td>97.</td>
<td>What is the reason for the limitation?</td>
</tr>
</tbody>
</table>

## Provision of own resources

<table>
<thead>
<tr>
<th>Question</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>98.</td>
<td>Does the client provide their own internal resources for the project?</td>
</tr>
<tr>
<td>99.</td>
<td>What proportion of the project value would they typically be?</td>
</tr>
<tr>
<td>100.</td>
<td>Why are internal resources used?</td>
</tr>
<tr>
<td>101.</td>
<td>What effect does the use of internal resources have on the project?</td>
</tr>
</tbody>
</table>

## Requirements for technical detail

<table>
<thead>
<tr>
<th>Question</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>102.</td>
<td>Does the client impose technical standards over and above what the industry is accustomed to providing?</td>
</tr>
<tr>
<td>103.</td>
<td>Why are these used?</td>
</tr>
<tr>
<td>104.</td>
<td>What effect does this have on the project?</td>
</tr>
</tbody>
</table>

## Involvement in the activities of participants

<table>
<thead>
<tr>
<th>Question</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>105.</td>
<td>Does the client ever feel the need to become involved in the day to day activities of any participants?</td>
</tr>
<tr>
<td>106.</td>
<td>How often does this occur?</td>
</tr>
<tr>
<td>107.</td>
<td>What form does the involvement take?</td>
</tr>
<tr>
<td>108.</td>
<td>Why does the client become involved?</td>
</tr>
<tr>
<td>109.</td>
<td>What effects does this involvement have?</td>
</tr>
</tbody>
</table>

## Failure in response to participants

<table>
<thead>
<tr>
<th>Question</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>110.</td>
<td>How do clients delay the progress of a project?</td>
</tr>
<tr>
<td>111.</td>
<td>How much delay does the project experience?</td>
</tr>
<tr>
<td>112.</td>
<td>Why does this delay occur?</td>
</tr>
<tr>
<td>113.</td>
<td>What effects does the delay have on the project?</td>
</tr>
</tbody>
</table>
### COMPANY CASE STUDY STRUCTURED INTERVIEW SHEET

**LOUGHBOROUGH UNIVERSITY**  
**DEPARTMENT OF CIVIL & BUILDING ENGINEERING**

**PhD - CLIENT ROLE**  
**CLIENT ACTIVITIES**  
**INTERVIEW SHEET**  
**Prepared by: JOHN PETTIT**

<table>
<thead>
<tr>
<th>Nature of infrastructure projects</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. What projects (types) are undertaken?</td>
</tr>
<tr>
<td>2. What technologies are involved (e.g. Construction, M&amp;E, control systems)?</td>
</tr>
<tr>
<td>3. What size are they (value, duration)?</td>
</tr>
<tr>
<td>4. What is the total annual spend?</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Programme Organisation</th>
</tr>
</thead>
<tbody>
<tr>
<td>5. What structure of organisation is used to manage the entire programme of projects?</td>
</tr>
<tr>
<td>6. How many people are involved?</td>
</tr>
<tr>
<td>7. What professions/specialisms are involved?</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Project Organisations</th>
</tr>
</thead>
<tbody>
<tr>
<td>8. What is the structure of the organisation used to manage an individual project?</td>
</tr>
<tr>
<td>9. Who decides on the size and type of organisation?</td>
</tr>
<tr>
<td>10. Who is best able to decide this?</td>
</tr>
<tr>
<td>11. What factors influence the size and type of project organisation?</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Generation of ideas</th>
</tr>
</thead>
<tbody>
<tr>
<td>12. How are potential projects generated?</td>
</tr>
<tr>
<td>13. Are there different ways and if so do the procedures for handling them differ?</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Investigation of implications</th>
</tr>
</thead>
<tbody>
<tr>
<td>14. What analysis of the proposed project is undertaken (financial, technological, impact on service, marketing etc)?</td>
</tr>
<tr>
<td>15. How are the analyses reported?</td>
</tr>
<tr>
<td>16. Who is involved in the analysis?</td>
</tr>
<tr>
<td>17. What are the aims and objectives of the analysis?</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Agreement to undertake project</th>
</tr>
</thead>
<tbody>
<tr>
<td>18. What procedures apply to formally authorise the project?</td>
</tr>
<tr>
<td>19. What do these procedures aim to look for?</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Project funding arrangements</th>
</tr>
</thead>
<tbody>
<tr>
<td>20. What are the sources of the funding?</td>
</tr>
<tr>
<td>21. Who is responsible for organising funding?</td>
</tr>
</tbody>
</table>
## COMPANY CASE STUDY STRUCTURED INTERVIEW SHEET

(continued)

<table>
<thead>
<tr>
<th>LOUGHBOROUGH UNIVERSITY</th>
<th>DEPARTMENT OF CIVIL &amp; BUILDING ENGINEERING</th>
</tr>
</thead>
<tbody>
<tr>
<td>PhD - CLIENT ROLE</td>
<td>Client Activities</td>
</tr>
<tr>
<td>INTERVIEW SHEET</td>
<td>Prepared by: JOHN PETTIT</td>
</tr>
</tbody>
</table>

### Financial control

22. What procedures exist to monitor and control finance at the project level?
23. Who is responsible for controlling project funding?
24. What are the financial objectives of a project?

### Arrangements for payment to participants

25. What procedures are involved in the payment of the various participants (designers, contractors, managers etc)?
26. What are the aims of the payment system?
27. Who is responsible for the payment of participants?
28. What mechanisms are used to pay participants (eg terms of contract)?

### Access to site

29. Who is responsible for ensuring timely access to the site for participants?
30. What problems occur with this process?
31. What procedures exist to reduce problems?

### Terms of Contract

32. What forms of contract are used?
33. What are the key particular requirements of the terms of contract?
34. What do you see as the main strengths of the forms of contract in use?
35. What are the weaknesses of the forms of contract in use?

### Definition of requirements

36. How are project requirements formulated?
37. What are the key requirements/objectives for each project?

### Selection of participants

38. How are the various participants (designers, contractors, project managers) selected?
39. What are the key criteria for selection?
40. To what extent are internal or external resources used?

### Briefing participants

41. How are the requirements of each project communicated to each participant?
**COMPANY CASE STUDY STRUCTURED INTERVIEW SHEET**

*(continued)*

<table>
<thead>
<tr>
<th>LOUGHBOROUGH UNIVERSITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>DEPARTMENT OF CIVIL &amp; BUILDING ENGINEERING</td>
</tr>
</tbody>
</table>

**PhD - CLIENT ROLE**

**CLIENT ACTIVITIES**

**INTERVIEW SHEET**

Prepared by: JOHN PETTIT

<table>
<thead>
<tr>
<th>Definition of project objectives</th>
</tr>
</thead>
<tbody>
<tr>
<td>42. What are the most important objectives for each project (financial etc)?</td>
</tr>
<tr>
<td>43. Are project objectives formally defined?</td>
</tr>
<tr>
<td>44. How are objectives recorded?</td>
</tr>
<tr>
<td>45. Who is responsible for ensuring that project objectives are defined?</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Communication of project objectives</th>
</tr>
</thead>
<tbody>
<tr>
<td>46. How are project objectives communicated to each participant?</td>
</tr>
<tr>
<td>47. Do they know what is expected of them?</td>
</tr>
<tr>
<td>48. Who is responsible for ensuring that project objectives are adequately communicated?</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Development of Project Objectives</th>
</tr>
</thead>
<tbody>
<tr>
<td>49. Do project objectives change over the life of a project?</td>
</tr>
<tr>
<td>50. How does this occur?</td>
</tr>
<tr>
<td>51. Who is responsible for ensuring that project objectives remain relevant?</td>
</tr>
</tbody>
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<table>
<thead>
<tr>
<th>Generation of options</th>
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</thead>
<tbody>
<tr>
<td>52. Are alternative options considered at the outset?</td>
</tr>
<tr>
<td>53. How are they generated?</td>
</tr>
<tr>
<td>54. Who is responsible for revealing other options?</td>
</tr>
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<table>
<thead>
<tr>
<th>Analyse options</th>
</tr>
</thead>
<tbody>
<tr>
<td>55. What techniques are used to analyse options?</td>
</tr>
<tr>
<td>56. How powerful do you feel they are?</td>
</tr>
<tr>
<td>57. Are they always appropriate for the purpose?</td>
</tr>
<tr>
<td>58. Who is responsible for analysing options?</td>
</tr>
<tr>
<td>59. Who else is involved?</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Selection of best option</th>
</tr>
</thead>
<tbody>
<tr>
<td>60. What criteria are used to select the best option?</td>
</tr>
<tr>
<td>61. What processes or techniques are used to select the best option?</td>
</tr>
<tr>
<td>62. Are these sufficiently powerful and/or appropriate?</td>
</tr>
<tr>
<td>63. How is the decision taken to pursue the best option?</td>
</tr>
</tbody>
</table>
COMPANY CASE STUDY STRUCTURED INTERVIEW SHEET
(continued)

LOUGHBOROUGH UNIVERSITY
DEPARTMENT OF CIVIL & BUILDING ENGINEERING

Doctoral - Client Role Page 4 of 5
Prepared by: JOHN PETTIT

**Programming Projects prior to start**
64. Is a record kept of all projects which the company is interested in pursuing?
65. What is the purpose of this?
66. What decisions are taken to ensure that the project is commenced?
67. How is the project programme matched to the available budget?
68. Are projects merged or grouped to ease management or ensure benefit?

**Supplier Market intelligence**
69. What information is kept on potential project participants (e.g. contractors)?
70. Why is this information kept? What information is important?
71. How do participants become known to the client?

**Super-contractual co-ordination**
73. What contact does the client have with potential participants outside any particular contract?
74. What is the purpose of these contacts?
75. What benefit accrues to the client?

**Project Review**
76. Does any form of review take place at the end of the project?
77. What data collection occurs?
78. What forms of information analysis are used?
79. Does this review result in an alteration to practice?
80. How does the alteration occur?
81. What can be done to improve the process?

**Change control**
82. What change control systems are used?
83. What is the objective of change control?

**Value management**
84. Is any type of value management used?
85. What value analysis techniques are used?

**Other benefit improvement**
86. How are non financial benefits monitored?

**Project Management**
87. What do you see as the role of the Project Manager (PM)?
88. Is the PM an internal employee of the company or external?
## COMPANY CASE STUDY STRUCTURED INTERVIEW SHEET

(continued)

<table>
<thead>
<tr>
<th>Change (in Client requirements)</th>
</tr>
</thead>
<tbody>
<tr>
<td>90. When would a change be made in the project?</td>
</tr>
<tr>
<td>91. Who would originate that change?</td>
</tr>
<tr>
<td>92. How is the change controlled/recorded?</td>
</tr>
<tr>
<td>93. How is change valued?</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Restrictions on project progress</th>
</tr>
</thead>
<tbody>
<tr>
<td>94. Are there any limitations on how the project can progress?</td>
</tr>
<tr>
<td>95. What are the limitations?</td>
</tr>
<tr>
<td>96. What effect do these have?</td>
</tr>
<tr>
<td>97. What is the reason for the limitation?</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Provision of own resources</th>
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</thead>
<tbody>
<tr>
<td>98. What internal resources would you provide for the project?</td>
</tr>
<tr>
<td>99. What proportion of the project value would they typically be?</td>
</tr>
<tr>
<td>100. Why are internal resources used?</td>
</tr>
<tr>
<td>101. What effect does the use of internal resources have on the project?</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Requirements for technical detail</th>
</tr>
</thead>
<tbody>
<tr>
<td>102. What technical standards do you impose, over and above what the industry is accustomed to providing?</td>
</tr>
<tr>
<td>103. Why are these used?</td>
</tr>
<tr>
<td>104. What effect does this have on the project?</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Involvement in the activities of participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>105. Does the client ever feel the need to become involved in the activities of any participants?</td>
</tr>
<tr>
<td>106. How often does this occur?</td>
</tr>
<tr>
<td>107. What form does the involvement take?</td>
</tr>
<tr>
<td>108. Why does the client become involved?</td>
</tr>
<tr>
<td>109. What effects does this involvement have?</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Failure in response to participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>110. What type of delays occur in the client organisation?</td>
</tr>
<tr>
<td>111. How much delay does the project experience?</td>
</tr>
<tr>
<td>112. Why does this delay occur?</td>
</tr>
<tr>
<td>113. What effects does the delay have on the project?</td>
</tr>
</tbody>
</table>
## CONTINGENT FACTORS RATING SHEET

<table>
<thead>
<tr>
<th>No.</th>
<th>Factor</th>
<th>RELATIONSHIP</th>
<th>+ RELATIONSHIP</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Procurement Route</td>
<td>10 9 8 7 6 5 4 3 2 1 0 1 2 3 4 5 6 7 8 9 10</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Client relationship</td>
<td>10 9 8 7 6 5 4 3 2 1 0 1 2 3 4 5 6 7 8 9 10</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Experience of client</td>
<td>10 9 8 7 6 5 4 3 2 1 0 1 2 3 4 5 6 7 8 9 10</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Nature of clients business</td>
<td>10 9 8 7 6 5 4 3 2 1 0 1 2 3 4 5 6 7 8 9 10</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Project team experience</td>
<td>10 9 8 7 6 5 4 3 2 1 0 1 2 3 4 5 6 7 8 9 10</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Nature of project</td>
<td>10 9 8 7 6 5 4 3 2 1 0 1 2 3 4 5 6 7 8 9 10</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Generate need</td>
<td>10 9 8 7 6 5 4 3 2 1 0 1 2 3 4 5 6 7 8 9 10</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Communicate need</td>
<td>10 9 8 7 6 5 4 3 2 1 0 1 2 3 4 5 6 7 8 9 10</td>
<td></td>
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<tr>
<td>9</td>
<td>Finance for project</td>
<td>10 9 8 7 6 5 4 3 2 1 0 1 2 3 4 5 6 7 8 9 10</td>
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<td>10</td>
<td>Essential pre-requisites</td>
<td>10 9 8 7 6 5 4 3 2 1 0 1 2 3 4 5 6 7 8 9 10</td>
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<tr>
<td>11</td>
<td>Take ownership</td>
<td>10 9 8 7 6 5 4 3 2 1 0 1 2 3 4 5 6 7 8 9 10</td>
<td></td>
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<tr>
<td>12</td>
<td>Change</td>
<td>10 9 8 7 6 5 4 3 2 1 0 1 2 3 4 5 6 7 8 9 10</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Restriction to programme</td>
<td>10 9 8 7 6 5 4 3 2 1 0 1 2 3 4 5 6 7 8 9 10</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Provision of resources</td>
<td>10 9 8 7 6 5 4 3 2 1 0 1 2 3 4 5 6 7 8 9 10</td>
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<td>15</td>
<td>Usurping role</td>
<td>10 9 8 7 6 5 4 3 2 1 0 1 2 3 4 5 6 7 8 9 10</td>
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<td>16</td>
<td>Lack of response</td>
<td>10 9 8 7 6 5 4 3 2 1 0 1 2 3 4 5 6 7 8 9 10</td>
<td></td>
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<tr>
<td>17</td>
<td>Aims &amp; Objectives</td>
<td>10 9 8 7 6 5 4 3 2 1 0 1 2 3 4 5 6 7 8 9 10</td>
<td></td>
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<tr>
<td>18</td>
<td>Direction of activity</td>
<td>10 9 8 7 6 5 4 3 2 1 0 1 2 3 4 5 6 7 8 9 10</td>
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<tr>
<td>19</td>
<td>Manage Supplier Base</td>
<td>10 9 8 7 6 5 4 3 2 1 0 1 2 3 4 5 6 7 8 9 10</td>
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<tr>
<td>20</td>
<td>Manage Project base</td>
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<td>21</td>
<td>Benefit Maximisation</td>
<td>10 9 8 7 6 5 4 3 2 1 0 1 2 3 4 5 6 7 8 9 10</td>
<td></td>
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<tr>
<td>22</td>
<td>Induction of experience</td>
<td>10 9 8 7 6 5 4 3 2 1 0 1 2 3 4 5 6 7 8 9 10</td>
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</tbody>
</table>
Appendix B

PROJECT CASE STUDIES

OVERVIEW

Contained in this section are descriptions summarising 24 Case Studies of projects undertaken in one organisation. They range in value from just below £1M to £140M and represent the spread of significant projects which the company undertakes.

The infrastructure construction work can be described in several categories. The categories are the author’s but the authorisation and contracting control arrangements largely agree with them:

- **Day to day maintenance** work is currently undertaken mainly by the direct labour organisation under the control of the Area Engineers; noted in a previous section. Budgetary arrangements are made by the provision of an annual amount of money under control of the engineer and agreed prior to the financial year. Amendments to this "block vote" can occur depending upon the financial situation of the company during the financial year.

- **Small Scale** works also tend to come under the control of the Area Engineer. These are typically up to £50K in value with finance under specific sums or the maintenance block depending upon size and type. Design would generally be in-house, but construction would be undertaken by DLO or contract depending upon resource availability etc. They require authorisation at the highest levels and the decision to proceed is heavily influenced by the restrictions on the raising of public sector funds. Project Management and design may well be undertaken by external organisations, although if staff with the right skill are available internally these are likely to be employed. Construction work would normally be by contract - the classic exception again being signalling systems.

- **Medium size** works require specific approval and are in the range £50k to £500k. Design is normally internal but construction tends to depend upon the technology
involved. Mechanical Electrical, Civil and Building works would tend to be contracted but track works (especially on operating lines) and Signalling systems would still be in house.

- **Larger size** projects (i.e. £500k upwards) would still be often both project managed and designed in-house, but construction would almost certainly be undertaken by contractors - all but for a few exceptions. Signalling and Permanent Way will still typically be undertaken by the DLO.

- "**Mega"** projects (multi million pound schemes of £100M upwards) are generally those of strategic significance.

The descriptions contained here are summaries of the data available and the source data is referenced for each case study. To ensure a consistency of presentation, a focus on the key factors and ease of reference; each description consists of the following aspects of the project:

- Duration
- Start Date
- Client
- Outline of Project
- Client Details
- Project Organisation
- Planning, Monitoring and Management Tools
- Procurement Strategy
- Performance
- Client Role
- Discussion
- Conclusions

The Case Studies fall into three groups. The first are minor improvement projects, generally of less than £1M in value and they are included because their complexity demonstrates particular features. (P2, P3, P6, P15). The second, and the largest group are mainstream projects (P4, P5, P7, P8, P9, P12, P13, P14, P18, P19, P20). They are in the value range £1M to £1OM although examples may be found with value up to £20M or so. The projects are generally “self-contained” and do not impact on other projects. The final group - many of which are termed "mega-projects" - are very complex projects (P1, P10, P11, P17). Typically they involve the reconstruction of all or part of a route. Generally they are £20M+ but here one example (P1) is around £16M.
The final four projects considered in the case study analysis are not construction projects and hence fall outside the defined boundaries of the research. They have been included because they enable the investigation of effects noted in the main Case Studies to be studied in projects with a slightly different purpose. The format of the data is the same as used for the previous case studies to ensure consistency and to focus on the same characteristics.

The first two (P21 & P22) are development projects based almost entirely on electronic technology and thus have very little construction involvement. They were managed in the same way as construction projects and have been included here as they provide an interesting contract to the procurement systems normally adopted.

The third project (P23) is apparently a traction and rolling stock project but was managed in a similar way to the construction projects analysed. It was interesting in that the selection of Project management and procurement Strategy was driven to a large amount by the perceived weaknesses in normal T&RS procurement. It proved very successful for a complex set of reasons and has proved of great use to the research as a whole.

The fourth project (P24) contrasts with the previous one in that different procurement styles - those normally used for Traction and Rolling Stock - were apparent and it was significantly less successful. This project contrasts sharply with the previous project.

Also contained at the end of the section is a profile of TransOne.
CASE DESCRIPTION NO: P1

Title: Avonmouth - Coal Import Facilities
Value: £16,537,000
Duration: 2 years 4 months
Start Date: January 1992 (Construction)
Client: BR - Trainload Coal

Outline of Project:
Redoubling of track between Filton West and Halten Marsh Junction; remodelling of Halton Marsh and Holesmouth Jcns; provision of new double track from Halten Marsh to new terminal at St Andrews; resignalling of route throughout (inclusive of new Power Signal Box at Swindon) and signalling of new terminal.

Client Details:
Requirements defined by Freight Infrastructure and Development Manager, Nottingham.

Project Organisation:
Nominated people but functional control. External contractors for main signal contract (ABB) and cable route laying (Balfour Kilpatrick). Reasons for external resource were that internal resources not able to resource quickly enough, sufficiently out of railway operation to make this not critical consideration, large enough contract to make large players interested.

Planning, Monitoring and Management Tools:
Work breakdown undertaken by Project Manager with help from Project Engineer, this mapped onto sub-authorities. Bar charts of key elements of work agreed by Project Manager. No sophisticated integrated planning tool used. However, planning tools felt to be sufficient as most of key works locked in by agreed occupation schedule. This forced good planning on participants and PM did not have to impose detailed milestones on participants.

Procurement Strategy:
Internal resources used where available and external contractors employed to meet programme where internal resources were not available. External contracts let by competitive tender using traditional contracting arrangements using a design and construct methodology. Design and construct was chosen because this most closely resembled the manner in which internal resources were provided and installers were also one of the main design organisations.
Performance:
Generally felt to be good by all parties. Client pleased with progress and felt it was significantly better than obtained in other projects in past. Client felt that his projects had improved in performance since a recent reorganisation as this gave more control over the definition of needs and brief. Also he felt closer to the “direction former” in his company and to the Project Manager and his team. Project Manager commented on the ease with which critical decisions could be made. The client could make decisions quickly when required and the Project Manager felt the Client stayed in touch with the project throughout. The Client had provided a good, clear brief of his requirements and had not altered this. The client felt that this was because he was responding to a lucrative, high profile need by one of his key customers and was clear about how much he was prepared to pay for the project. Because of the direct linkage between his customer and the need for the project, the Client felt that this gave him more autonomy than usual in Railway projects. The Client felt that he may have paid more "than the absolute minimum possible" for this project but was pleased with the outcome so far.

Client Role:
Individual undertaking client role had operations and engineering experience; but little experience of promoting construction projects. Main role undertaken was to define (a) operational; (b) business and (c) some engineering requirements. Little interference, but also little added value activities so would classify this client as Basic Role only. Client believed he should define objectives of project, satisfy himself that project manager had been appointed and was able to properly manage project; ensure project manager understood project and the objectives; and oversee that objectives were being achieved in accordance with the plan. Client would only become involved in details (for instance provision of resources) if he felt there were problems.

Discussion:
1. Client can become involved in detail to benefit of projects - this involves resources, plan and finance.

Source material:
1. Questionnaire to Project Manager
2. Structured Interview with Project Manager
3. Part structured interview with Designer/Project Engineer

1 Particular details relating to Procurement Strategy
4. Part structured interview with Procurement Manager\(^2\)
5. Telephone interview with Client\(^3\)

\(^2\) Check on details provided by Project Manager and Project Engineer
\(^3\) Mainly to confirm details provided by Project Manager and to ascertain views of client manager.
CASE DESCRIPTION NO: P2
Title: Bristol - New Spine Road
Value: £759,000 (1Q92)
Duration: 2 years 2 months
Start Date: May 1992
Client: Bristol Development Corporation/ BR Parcels

Outline of Project:
Provision of new road giving access to former Railway property and to current station parcels depot.

Client Details:
Joint promotion by external client (Bristol Development Corporation) and internal commercially driven department (BR parcels). These had different objectives: BDC wished to improve look and access to adjacent sites; BRP wished to improve access to exiting depot for its customers.

Project Organisation:
BR project manager responsible for project, but additionally reported into BDC project management function who undertook a watching brief to ensure that their objectives were served. Majority of work under the control of the Civil Engineering department design and construction group; whose Project Engineer provided all day to day management and was effectively the de facto project manager.

Planning, Monitoring and Management Tools:
None other than periodical project meetings. Discrete work packages had intended start and finish dates which were generally flexible. No overall fixed completion date. Contractors or internal resource managers produced their own plans and justified to the project manager any overrun or overspend. These justifications were in outline only and there was no requirement to substantiate with significant details.

Procurement Strategy:
Internal resources used for works deemed to be safety related - basically track and signals. Contracts let for demolition/clearance, civil engineering and M&E - basically all new works.
Performance:
Project was not viewed as strongly time critical by Bristol DC or Parcels since there was no apparent commercial case for the work other than to release land for sale and improve access. Cost viewed as more important. Due to the large quantity of contracted work and the competitive state of the construction market at the time, prices for most work were well within budget and project was completed at original budget.

Client Role:
Note roles of different stockholders and role of PM to be to integrate these. Very little management of project as such but since the works were straightforward this was not required. Single point responsibility and management to contractual deadlines might have improved speed and had some impact on costs but much of the early work surrounded planning activities (planning consent/integration of stakeholder requirements/location and diversion of services) and this might have not had a positive impact at these stages.

Discussion:
Raised the question as to whether we always need a definite individual to manage the project - can it sometimes be the client’s representative?

Source material:
1. Questionnaire to Project Manager
2. Interview with Project Manager
3. Interview with Procurement Manager
CASE DESCRIPTION NO: P3
Title: Bristol Temple Meads - Forecourt Improvements
Value: £880,000
Duration: 6 months (Construction)
Start Date: February 1992
Client: BR InterCity Great Western/ Bristol Development Group

Outline of Project:
Refurbishment of Bristol Temple Meads Station forecourt and Approach Road including drainage, car park layout, new paving, street lighting and furniture.

Client Details:
Jointly promoted by division of BR and local development corporation. Funded 40% by BR.

Project Organisation:
Nominated people but functional control.

Planning, Monitoring and Management Tools:
Periodic progress meetings between BR (Project Manager) and BDC representatives, to review progress. Periodic meetings chaired by Project Manager with representatives of all project participants.

Procurement Strategy:
Advice on Contractual matters by Project Manager, Quantity Surveyor, external consultant (Sterling), BRB solicitor, Bristol Development Corporation.

Performance:
Average performance when compared with other development projects; especially considering that no major problems were encountered during the project and that there were no time pressures on the works.

Client Role:
Base roles only provided by BDC and BR - no added value activities - these were provided by project participants. Little interference was noted.

Discussion:
This project suffered from none of the problems or pressures noted in other case studies and the final product was as required. Although no criticism was levelled...
as to the costs of the works; they were more expensive than usual in the city centre development works. BDC believed the difference was due to the complexities of working within the railway environment but this seemed unlikely as the main restrictions arising from this source were not apparent in the sources which documented project progress. Reduced costs could have been achieved by the application of some of the added value roles identified.

Source material:
1. Questionnaire to Project Manager
2. Interview with Project Manager
3. Interview with Procurement Manager
CASE DESCRIPTION NO:  P4
Title:  Reading - Depot Shed Extension
Value:  £2,084,000
Duration:  1 year 1 month
Start Date:  August 1992 (Construction)
Client:  BR - Network SouthEast Thames & Chiltern

Outline of Project:
Extension of an existing six track servicing and maintenance shed at Reading Lower Triangle depot to enable longer sets of Networker Trains to be stabled and maintained. The work entailed demolition of end wall and single story offices at end of depot, provision of temporary wall to allow operation of other end of shed and construction of new shed and mess rooms offices. Shed was steel frame with plastic coated steel cladding. Reinforced concrete floor including extension of jacking points. Services in shed extension were required to match existing shed services which had been installed three years previously. The site was quite tight for space. Contractor's offices and mess rooms had to be sited across road from site of work and it was necessary to construct a temporary scaffold footbridge adjacent to an existing railway bridge. Delivery of men/material needed to be across this or through depot - since depot was operational at all times, special arrangements needed to be made for delivery of material - e.g. ready mixed concrete.

Client Details:
Promoted by internal department who wished to improve operational effectiveness of depot in connection with introduction of new trains\(^4\).

Client Involvement:
Employment of Project Manager (see organisation). Authorisation of funds and provision of project objectives by authorisation at investment panel. Senior Manager received reports from project manager but little evidence of direct intervention.

Project Organisation:
Project Manager part of Clients organisation. Traditional separate design and construction. Contractor used for civil engineering and building work (G Osbourne), but internal resources used for permanent way work. All design by

\(^4\) See project P22 for discussion of the development of trains.
internal BR design group retained as consultant on informal terms of engagement - provide resources to pre-agreed resource plan and deliver by pre-agreed time scales.

Planning, Monitoring and Management Tools:
Network used to build up bar chart. Monthly project management meeting with project manager and other internal managers - more frequent during critical periods. Monthly Contract Management meetings with contractor at which PM was present - chaired by resident engineer. Separate planning charts used by PM, RE and contractor - no integrated planning system in use. Data flow could have been improved.

Procurement Strategy:
Separate design and construction. There were no nominated sub contractors and domestic sub contractors were intended to be drawn from the BR select list. However, Contractor was able to persuade PM that two sub-contractors offered better value for money. They were supposed to be cheaper than those off select list. Out of two s/c one performed so well that they are now on select list, other went bankrupt as a result of debts owed from another contract - not for this main contractor. New sub contractors were allowed mainly on trust of main contractor who had performed well on previous jobs although substantiation of past work was required. No formal checks made on financial status of sub contractor as these were domestic. Contractor chosen by competition from list of five potential contractors. Selected contractors was lowest price, but also had quality advantage over nearest other bids. Contractor had been involved with the construction of another depot. Medium sized regional contractor for whom BR is one of two main client organisations. Contractor was particularly interested in building up its relationship with BR and senior management interest in all BR contracts.

Performance:
Generally felt to be good by PM. Contractor was happy with performance. Client was "very pleased" and believed that the project was completed to time to cost with little disruption to working of depot. Contractor felt to have performed to high standard. There were, however, several claims for alteration to scope of works required, restrictions placed on Contractor by depot. PM felt that these had impacted on project and made value-for-money not as good as it could have been, even though felt value-for-money was still "quite good". Input/Output for Contract Price around +15% at agreement of final account. Bankruptcy of one s/c was not felt to have significantly affected programme for works although it was
acknowledged as requiring additional effort for project participants. There was felt to be additional effort in initial supervision of other sub-contractor as they had not previously worked for BR but this was contained within the resources already planned for the project.

Client Role:
Client provided basic role to a reasonable standard. The input was believed to have been a significant factor in improving the performance of the project.

Discussion:
Key positive factors were held by the project team to be (a) relationship with Contractor; (b) good project management and (c) clear and challenging objectives from the client.

Source material:
1. Questionnaire to Project Manager
2. Interview with Project Manager
3. Interview with Procurement Manager
CASE DESCRIPTION NO: P5
Title: Woolwich Arsenal - Station reconstruction.
Value: £1,724,000
Duration: 1 year
Start Date: May 1992
Client: BR - Network SouthEast - South West Division

Outline of Project:
Construction of new Ticket Office building and the refurbishment of the existing station footbridge and staircases to the platforms involving new cladding and roof structures. External works to station forecourt and car parking. Refurbishment of station buildings including upgrading of lighting on platforms, painting, new services and architectural treatments to platform buildings and waiting rooms.

Client Details:
Client was part of one of the major operating divisions.

Project Organisation:
Architect designed and supervised works; engineering design undertaken by the BR Croydon design office. Contractor had done a variety of work for BR in the past and were not noted as inclined to over claim for variations - they were understood to be one of the most positive Contractors.

Planning, Monitoring and Management Tools:
BR Project Manager dealt with Architect who was the lead professional for the project - project meetings normally arranged by either Architect or Project Manager. No planning tools were used by BR staff; although contractor used bar charts to plan work and monitor progress.

Procurement Strategy:
A traditional approach using JCT5 contracts managed by Architect.

Performance:
Project generally accepted to be a success. Several significant increases in project value due to alterations to design and details. Client did not order significant variations to the scope of the works but felt that the resulting works were excellent.

5 Joint Contracts Tribunal form of contract for building works.
- mainly due to the aesthetics of the main booking hall. Additional costs were not particularly important since they were within "acceptable" limits.

**Client Role:**
Client provided basic definition of requirements (i.e. to renew station to acceptable environment) and Architect used design to define details. This was refined; but little review of whether the objective could be achieved at lower costs.

**Discussion:**
Better indications of costs could have been gained if details etc. had been sorted out prior to letting main contract. Risk here that if contractor was claims conscious, then the cost of this could have escalated.

**Source material:**
1. Questionnaire to Project Manager
2. Interview with Project Manager
3. Interview with Procurement Manager
CASE DESCRIPTION NO:  P6
Title: Isle of Grain - Route Clearance
Value: £886,000 (2Q92)
Duration: Stage 1 - 6 months; Stage 2 - 11 months
Start Date: October 1992
Client: BR - Railfreight Distribution (RfD)

Outline of Project:
Objective of project is to obtain standard structural clearances at eight overbridges between Hoo Junction and Hithergreen. This will allow RfD to operate 8'6" height containers, from the new container terminal at Thamesport on the Isle of Grain in Kent, on standard freightliner wagons. At present containers are transported on a small dedicated fleet of special low platform wagons necessitating double handling at Stratford and Wilsden. The work is in two stages over two years. The first stage consists of slewing tracks at all eight bridges and ballast gluing at two of these bridges. The completion of the first stage will actually allow the new container traffic to start. The second stage is to reconstruct the two bridges where ballast gluing took place to provide standard structural clearances permanently.

Client Details:
Client was commercial operating division of BR and provided clear objectives for the project which were derived from a commercial need to allow container traffic to use the route.

Project Organisation:
Project Manager had small support staff (assistant project manager and clerical assistant) to assist with management of project. These principally maintained a register of work required and progress. This allowed for “progress chasing” to be undertaken - a function rarely given great resource within the organisation generally.
Most work was undertaken by internal resources and detailed work packages were agreed with project manager team at all stages. This provided for good control of the specification.

Planning, Monitoring and Management Tools:
Bar charts were produced at the project level showing all work packages and any key milestones within these (such as possessions). “Stage 1” completed to programme; but “Stage 2” suffered some delay due to difficulty obtaining possessions - a feature more under the control of the client than the project.
Procurement Strategy:
The default strategy used in this organisation was used here: namely that internal resources were used unless no internal experience expertise existed. Although there were some problems with the internal resources being provided; the work packaging was designed to reduce these if possible.

Performance:
Project was deemed to be delivered to a good standard to within project contingency - client was satisfied; but would have liked to have been able to plan the project to have occurred more quickly. The client understood the reasons why this could not occur, but wished to investigate ways of improving the situation for future projects.

Project manager was objective about project problems - which were derived mainly from the inability of internal departments to deliver to the agreed programme in certain instances and the lack of any mechanism for penalising this.

Client Role:
Client provided the base role; but added value activities were undertaken by the project team. The project team managed the problems that would have arisen due to interference by other parts of the client organisation - and were successful to a large degree.

Discussion:
This project provided a good model of how the client organisation could pursue relatively complex projects with a minimum of project management staff.

Source material:
1. Questionnaire to Project Manager
2. Interview with Project Manager
3. Interview with Procurement Manager
CASE DESCRIPTION NO:    P7
Title:                     East Croydon - Station Re-development
Value:                    £8,994,000
Duration:                 2 years
Start Date:               January 1992
Client:                   BR - Network SouthEast - South Central

Outline of Project:
Refurbishment of existing station, particularly construction of new entrance, booking hall, concourse and new ramps.

Client Details:
Client was NSE Divisional Manager. No single authority was granted for this project, it was approved as a series of separate schemes.

Project Organisation:
Project Manager acted as co-ordinator of internal resources. External resources - e.g. Civils and Building Contractors were controlled by functional departments.

Planning, Monitoring and Management Tools:
No formal tools used. Main reporting tool used by PM was monthly meeting. Intermediate milestones not fully fixed and were subject to delay. Architect did no planning and caused significant delay to project - including his contractor - which gave rise to increased costs. Reporting structure for project shown in figure, at first sight not an unreasonable structure for planning and reporting progress. Little interface between levels.

Procurement Strategy:
No overall strategy was documented. Interviews revealed that internal resources were used where available, but external resources were used where they had been traditionally employed - e.g. construction contractors. No thinking was apparent regarding relative benefits and risks involved in the implementation of this strategy.

Performance:
Rated as poor by Project Management, Client and most participants.
Client Role:
Client was generally inexperienced. The internal promoting department did not give explicit brief, not clear what client had in mind. The role adopted was at best basic but did not communicate sufficiently with project team. Client felt he gave project very little except he was able to push the project (even though he did not feel he should have done). Did not feel particularly successful at this pushing. When interviewed, participants felt that they gave the same as they normally give projects - no more no less.

Discussion:
Co-ordination role needs more input from Client.
PM needs formal brief from Client - to make client clear about what he is getting as much as instructing the PM. Interviewees somewhat reluctant - presumably due to perceived weaknesses in project.

Source material:
1. Questionnaire to Project Manager
2. Interview with Project Manager
3. Interview with Procurement Manager
CASE DESCRIPTION NO: P8
Title: Chichester to Havant - Resignalling
Value: £4,543,000
Duration: 18 months
Start Date: August 1991
Client: BR - Network SouthEast South Central

Outline of Project:
Resignalling with colour light signals and modernisation of level crossings. The line consists of 8.5 miles double electrified (3rd rail DC) track with 11 crossings. 1 existing crossing is CCTV controlled from Havant Signal Box, 5 manned gate crossings have been converted to Automatic Half Barriers (AHB) monitored from Chichester Signal Box, 3 existing AHB's monitored by Chichester SB were modernised, 1 manned barrier crossing has been converted to CCTV controlled from Chichester SB and 1 pedestrian crossing has been converted to miniature warning light monitored from Chichester SB.

Client Details:
Sub division of major operating division - client was infrastructure manager.

Project Organisation:
Project Manager part of sub-division's New Works group. Signalling design group provided Project Engineer and team responsible for outline design, procurement and supervision of installation and commissioning. Signalling contractor undertook detailed design, installation and commissioning. Civil Engineering department provided enabling works to track and structures. Co-ordination between signalling department and civil engineering department overseen by Project Manager; but normally occurred between two departments.

Planning, Monitoring and Management Tools:
Planning and programming undertaken by signalling contractor under supervision of Project Engineer. Regular monthly progress meeting chaired by Project Manager.

Procurement Strategy:
Design and install contract awarded to signalling contractor using M&E blue book form of contract following competitive tender. Variations issued during contract accounted for 16% increase in costs.
Performance:
Felt to be good performing project as disruption to normal train service was relatively small for project of this type - especially as the commissioning and testing was undertaken to more stringent rules introduced following the Clapham rail accident. Cost increase was above contingencies (which were 10%) and re-authority had to be gained by the Project Manager.

Client Role:
Client provided overall objectives which were:-
1. Replacement of life expired signalling system.
2. Increase in line speed to give agreed decrease in journey time (original predictions of this were, of course, provided by the signalling department who undertook the project works - so effectively the signal engineers defined their own objective of what was possible here).
3. Increase in capacity at peak times - again the original estimates of what were possible were provided by the signalling department.

Client only provided the barest of the base role and involved no added value role. No added value roles were undertaken (by the client or the project team) and there was very little interference by the client. The client relied very heavily on the signalling department to predict the costs and duration of the project prior to authorisation and there was evidence that significant reductions in costs could have been achieved with particular added value activities.

Discussion:
The client and project participants believed that this project was delivered well and that performance was good. The significant increase in costs over the life of the project were notable and could have been avoided - neither the client or the project team caused a cost plan to be produced and this led to there being no yardstick to measure whether the project was producing good value for money. The only evaluation of value-for-money was undertaken at appraisal stage and the comparison with other re-signalling projects was fairly rudimentary. No back check was made to the original case and the final project was more expensive than the comparative average used in the appraisal. This may have called the viability and business case of the project into question; but the work was never undertaken.
Source material:
1. Questionnaire to Project Manager
2. Interview with Project Manager
3. Interview with Procurement Manager
CASE DESCRIPTION NO: P9
Title: London Victoria - Retail No 9 Block
Value: £5,248,000
Duration: 2 years 1 month
Start Date: December 1993
Client: BR - Network SouthEast - South Central

Outline of Project:
Demolish old buildings between two parts of station and construct new retail development adjacent to Platform 9.

Client Details:
Client was property manager for the sub division.

Project Organisation:
Project manager was responsible for project along with two others. BR Architect led design and development and supervised construction. Support to Architect provided by civil engineering design group (for structural and building services issues). Architect was real leader of scheme and Project manager provided the client input in terms of defining objectives, arranging funding, approving procurement, ensuring procedures were followed and monitoring progress.

Planning, Monitoring and Management Tools:
No tools used by client, Project Manager or Architect. Architect held regular meetings with contractor and supporting designers. Architect frequently met property manager (including on site).

Procurement Strategy:
Construction undertaken by external contractor under JCT form of contract, with Bill of Quantities - awarded following competitive tender. This was proposed by the Architect.

Performance:
The scheme was successful in that it improves the station environment; provided a high quality "let-able" retail unit and was delivered on time. However, the cost per square metre was extremely expensive and did not provide a viable commercial proposition if the business case was viewed in isolation.
Client Role:
Client (Property Manager) was not experienced as developer; but had experience in property letting. Objectives defined as providing predetermined area of "let-able" property to outline design agreed with retail customer (W H Smith). Project Manager left to scope the brief in detail and approve this on behalf of the client. In practice, brief was only the details provided in authority documentation and Architect dealt direct with property manager for a range of issues.

Discussion:
The final product was a notable piece of architecture, but suffered as a business proposition due to the expense of constructing the building. Delays occurred due to unforeseen ground conditions beneath the demolished structure.

Source material:
1. Questionnaire to Project Manager
2. Interview with Project Manager
3. Interview with Procurement Manager
CASE DESCRIPTION NO: P10
Title: East Coast Main Line - Electrification
Value: £70,000,000
Duration: 3 years 10 months
Start Date: July 1990
Client: BR InterCity - East Coast Main Line

Outline of Project:
Electrification of route from London Kings Cross to Edinburgh - including provision of new trains; re-signalling; simplification of track; reconstruction of structures where necessary and refurbishment of stations.

Client Details:
Project was approved by main Board and promoted by Board Director.

Project Organisation:
Senior Project Director appointed with full project team able to plan, control and monitor all works. Internal resources used where they were most appropriate; but external consultants and contractors used for defined roles - mainly design and construction of new works.

Planning, Monitoring and Management Tools:
Sophisticated network analysis tools used by project team; designers and contractors. These were used to analyse programme and optimise plans. Regular progress meeting held at various levels and outline reports on progress - together with summary of problems - provided to client.

Procurement Strategy:
Traditional contracting arrangements were in place with all contractors (and design consultants) who were chosen by competitive tender of bidders drawn from select lists. Plans agreed with internal resources; which included summary of resources and predicted costs. Internal departments were expected to deliver to the plans and cost estimates unless changes authorised by appropriate member of the project team.

Performance:
Performance was regarded as very good by client, project team and contractors. Project was delivered on time with virtually no major technical problems - this was rare for a major electrification programme. Performance was measured in absolute
terms by comparison with the original business case and by comparison to historic data (the data on the electrification of the West Coast Main Line was available).

Client Role:
Client (in terms of board Director) only provided the smallest of roles beyond promoting the project at board level and organising the provision of funds. Project Director undertook other Base roles. Some added value roles implemented - e.g. management of suppliers undertaken by project team in connection with corporate procurement function.

Discussion:
This project was a very large project, even for a major client such as BR. This allowed the involvement of the main Board and the appointment of a very competent Project Director. Key features included the detail of the evaluation of the Business Case (including a back check on project completion); availability of historic data from a previous project; size and skills of the Project Director’s team who were able to undertake a large amount of development work on behalf of the project promoter.

Source material:
1. Questionnaire to Project Manager
2. Interview with Project Manager
3. Interview with Procurement Manager
4. Interview with Project Engineer
CASE DESCRIPTION NO: P11
Title: London North Pole - New International Depot
Value: £59,247,000 (2Q89)
Duration: 2 years 2 months
Start Date: February 1993
Client: BR - European Passenger Services

Outline of Project:
Construction of new depot for Eurostar international trains in connection with Channel Tunnel works on long narrow site. Works consisted of groundworks, trackwork, services and various train sheds. Typical buildings included Bogie Drop Shed involving a complicated reinforced concrete ground slab including a number of pits, ducts and the like all within a steel framed shed.

Client Details:
Internal group promoting project specifically for new customer. These undertook some project management activities and some client development activities.

Project Organisation:
Buildings designed by external architect. Internal BR project Engineer in detailed day to day control of the project on site.

Planning, Monitoring and Management Tools:
Key delivery dates (completion of main elements of project) defined by client to fit with delivery and commissioning of train units. Computerised tools in use by construction manager used to detail how these dates would be met and to substantiate any delays.

Procurement Strategy:
Construction Management chosen since it afforded:
1. Ability to programme works so that a series of widely different packages were properly sequenced and interfaced to meet timescales.
2. Ability to review and update plans and programmes and respond quickly to changes.
3. Ability to produce contingency plans to deal with late decisions or key design issues.
4. Cost, control, budgeting and sound financial administration.
5. Quality control and assurance.
Performance:
Generally good as required product was delivered without significant timescale problems. Several claims resulting from delays caused by interference between works contractors. Construction manager minimised time delays although some slippage in key dates occurred. Main issue was increased cost due to “acceleration” to meet the key dates; which were borne by the client.

Client Role:
Client staff effectively formed an experienced client. The construction management route was chosen by this team following detailed evaluation of the requirements of the contract. Certainly went beyond the basic role to provide more added value issues.

Discussion:
Procurement route chosen following detailed evaluation. Good performance related from level of input by client development team - who seemed to undertake part of the project management activity but leave the majority to the construction management team. Project appeared to have delivered client’s requirements - only major cause for client dissatisfaction was the cost escalation, but given the project objectives and procurement route this was to be expected.

Source material:
1. Questionnaire to Project Manager
2. Interview with Project Manager
3. Interview with Procurement Manager
4. Interview with Construction Manager
CASE DESCRIPTION NO: P12
Title: East London - A406 Bridge Construction
Value: £6,300,000
Duration: 2 years 3 months
Start Date: January 1991
Client: BR - Network SouthEast - Great Northern

Outline of Project:
Construction of a new bridge under east London line for new A406 road. Work required by department of transport.

Client Details:
Client was Department of Transport, who specified need for bridge. BR and its Internal departments were keen to ensure that the railway disruption was minimised and that future maintenance risks were borne by the DTp.

Project Organisation:
Project managed by Project Manager from New Works Organisation. On site Construction Manager was provided with small site team - this team reported to the Project Manager.

Planning, Monitoring and Management Tools:
Overall planning undertaken by Project Manager; detailed planning undertaken by the contractor in conjunction with the construction manager. Regular progress meetings were chaired by the Project Manager and were held on site - during the construction period these included the construction Manager and the contractor.

Procurement Strategy:
A traditional procurement route was used; with competitive tender for the construction works to bidders agreed with the client but taken from the BR select lists.

Performance:
Completed on time. Cost not critical but within budget restrictions - 11% increase in cost was within the contingency agreed for the project. Client agreed to pay all reasonable expenses of BR (including profit, overheads and nominal train delay costs).
Client Role:
Client provided objective - to construct bridge by given completion data. Costs of project were produced by BR and agreed with client. Client took possession of the bridge when complete. Hence the DTp fulfilled the Base Role but no more. Project team applied activities that fall within the added value role - particularly management of the supplier.

Discussion:
This project was a fairly traditional project; which BT and the DTp (as organisations) had co-operated on several times previously. The individuals involved had not all been involved in a new bridge construction for a major new trunk road but were experienced in project management within the railway industry.

Source material:
1. Questionnaire to Project Manager
2. Interview with Project Manager
3. Interview with Procurement Manager
4. Interview with New Works Manager
CASE DESCRIPTION NO: P13

Title: Great Eastern - Resignalling

Value: £82,850,000

Duration: 5 years 2 months

Start Date: November 1990

Client: BR - Network SouthEast - Great Eastern

Outline of Project:
Re-signalling of existing electrified route; including modifications to track layout and signalling. Small improvements to station in connection with the works.

Client Details:
Board Director for operating division undertaking passenger transport in London. Criteria important to client were: Time, Specification, authorised sums, disruption, safety record, satisfaction of users with product.

Project Organisation:
Project Director appointed (due to size of spend) from Director of Projects organisation. Project Director reported to New Works Manager for the purposes of the project only. Functional department for signalling provided technical support to the project - this included Scheme Design and estimates. Signalling contractor provided detailed design; installation and commissioning of signalling works. Internal departments undertook track and station improvements.

Planning, Monitoring and Management Tools:
Regular monthly progress meetings chaired by Project Director and included all internal departments. Separate progress meetings chaired by the Project Director with the signalling contractor. Signalling contractor produced a Bar Chart programme which was used by the Project Director’s team.

Procurement Strategy:
Signalling contractor appointed following negotiation - a competitive tender process was not undertaken although other contractors were canvassed. The reason for this was that there were a significant number of other re-signalling projects which meant that other contractors were busy and did not possess the appropriate resources to undertake the project.
Performance:
Delays and costs escalation occurred due to: (a) escalation of specification; (b) difficulty of obtaining possessions on which to undertake work; and (c) solving technical problems with new infrastructure.

Client Role:
Client provided base role activities by reactive response to Project Director - it was the Project Director who was responsible for crystallising the client's objectives for authorisation. The brief was developed from the original authorisation documents and the inadequacy of the authority documents were an early reason why the scope of the project increased. No added value role was undertaken by the client or the project team. Interference came from difficulties experienced with reliability of internal resources and restricted possession availability.

Discussion:
The project was viewed by the client and Project Director as extremely expensive. Potential reasons for this were claimed to be: difficulty and expense of resources in the London area; shortage of signalling design and installation resources within contractors organisation and difficulty of obtaining possessions. It was possible to compare the costs of this project with other projects within this case study analysis and results suggest that the project was approximately 4 times more expensive than the average prevailing at the time.

Data Sources:
1. Questionnaire to Project Director
2. Interview with Project Director
3. Interview with New Works Manager
CASE DESCRIPTION NO: P14
Title: Salisbury - Maintenance Depot
Value: £8,555,000
Duration: 18 months
Start Date: June 1993
Client: BR - Network SouthEast

Outline of Project:
Construction of new depot and maintenance facilities for new Diesel Multiple Unit Trains on Waterloo-Salisbury-Exeter route. Involves clearance of existing disused sidings, design and construction of new depot and handover to client.

Client Details:
Objectives provided by Infrastructure Manager for sub division of this operating division and funding provided by division’s investment panel.

Project Organisation:
Project Manager undertook co-ordination of internal civil engineering design group who undertook scheme design and site supervision. Contractor undertook detailed design and construction.

Planning, Monitoring and Management Tools:
Design work took from June to November; construction work took from December to December of following year.

Procurement Strategy:
Design and construct project chosen due to client timescales and problems with supplying internal design resources. All sub-contractors selected by main contractor from own pool. Since some of these were deemed not sufficiently financially stable, main contractor was required to provide specific performance bond for these.

Performance:
Time delay due to bankruptcy of sub-contractors. Performance bond was not called; but contractor covered cost of these bankruptcies - hence project was delivered to within 2% of spot estimate (against a 15% contingency). Overall project was accepted as a success by the client; end users and the Project Manager.
Client Role:
Client undertook all Base role activities with no delays (or other similar) deficiencies noted. Some added value roles were revealed - particularly supplier management activities undertaken by corporate procurement. No interference noted - mainly because main contractor undertook virtually all works (including track works) and the depot was segregated from the operational railway for the duration of the contract.

Discussion:
The project was deemed to be a success because:-
1. High quality contractor was used.
2. Appropriate procurement route was chosen.
3. Site construction manager responded directly to the Project Manager.

Data Sources:
1. Questionnaire to Project Manager
2. Interview with Project Manager
3. Interview with New Works Manager
4. Interview with Contractor
5. Client project brief document
6. Investment Panel authority documentation
7. Project progress reports
CASE DESCRIPTION NO: P15
Title: Watford - Tip Sidings
Value: £356,912
Duration: 6 months
Start Date: July 1993
Client: BR - Network SouthEast - North

Outline of Project:
Creation of new sidings for NSE trains on site originally used to tip spent ballast etc. Reduction of the existing 3 sidings to 2 sidings. The existing sidings to have track renewed, slewed and 3rd rail DC electrification added linked to the existing track adjacent to the Down fast from Euston station. On one siding a new carriage washing machine to be installed to service 313 units. Additional siding access, lighting, CCTV and fencing.

Client Details:
The Sponsor (i.e. internal client) was Network North and the end user would be the depot train operators. Brief initially provided by the sponsor but more details were provided by the users. This approach was championed by project manager.

Project Organisation:
Project manager acted as individual who crystallised client requirements and drew up brief. Actual management of the project was undertaken by the functional departments and the project manager undertook co-ordination duties.

Planning, Monitoring and Management Tools:
Progress meetings held on an ad hoc basis chaired by the project manager with representatives of various functional departments present. No planning tools were used other than details given in progress meetings.

Procurement Strategy:
Internal resources used throughout.

Performance:
Generally accepted as quite good - which was surprising as labour and plant was also used for maintenance and reaction to equipment failures (see below).
Client Role:
Client was generally inexperienced and left all arrangements to the project manager - who undertook most of the client role duties. Actual “project management” of the delivery was left to the functional departments who had their own priorities. This appeared to lead to delays and cost increase in the project.

Discussion:
The date of implementation was severely delayed due to lack of Civil Engineer taking long time to complete the track work (reasons given: plant breakdown, manpower shortages etc. - “the list of excuses was endless” quote from Project Manager). This was a complicated project with a number of disciplines being involved and at the end of the day everything had to be correctly completed before the approval of the railway inspectorate could be given.

Source material:
1. Questionnaire to Project Manager
2. Interview with Project Manager
3. Interview with Procurement Manager
CASE DESCRIPTION NO: P16
Title: Stratford - Jubilee Line Enabling Works
Value: £6.466,000
Duration: 3 years 6 months
Start Date: September 1991
Client: London Underground Limited

Outline of Project:
Various works (including the construction of new platforms and associated buildings) in connection with the Jubilee Line Extension and to the Docklands Light Railway adjacent to the present BR station. BR were required to carry out clearance, construction and other works including, access bridge, offices, workshops, plant facilities, new telephone exchange, electricity substation relocation, construction of access roads, fencing drainage etc.

Client Details:
Ultimately, work was required by London Underground Limited (LUL) who provided the overall objective to clear the site that would be required for purchase of the land. Internal department was client for new works to enable existing activities to continue on re-developed site.

Project Organisation:
Works contracts managed by BR. LUL required approval of all tender documents. LUL entered into Works Agreement with BR (LUL drafted this). Internal groups generally did not work to a written agreement with the exception of BR telecommunications; York design office; Croydon design office and BR Projects. BRT used local consultants as did project manager.

Planning, Monitoring and Management Tools:
Bar charts produced for programme and these were updated to show changes. Progress meetings held with key internal departments. Planning (bar chart) was created for original agreement but this was stretched with the agreement of the client. No sophisticated methods of planning. Lower order plans made by designers etc. Client involvement (and potential for delays), not highlighted in original programme, and these should have been. Original programme was created using a network analysis programme (HORNET).
Procurement Strategy:
Generally, internal departments were canvassed to indicate if they could undertake work for the project and, if so, what work could be done. Estimates were produced and work given to those departments where the estimate seemed reasonable. For internal resources, no formal agreement put in place that they could do work. Contractors were employed on most physical works as this has been the traditional method with the design and projects groups. Tender lists were vetted by LUL.

Performance:
In project terms the performance was poor due to the cost and time overrun. The time overrun was not significant as these were enabling works and did not have any impact on the main project. Extended project costs were 80% over budget for design and management.

Client Role:
Project participants were unclear as to who was the client. LUL had the need for the works and the BR departments were merely interested in getting new facilities for as little disruption as possible. LUL did not perform many of the base role activities and this appeared to lead to most of the project problems.

Discussion:
The client budget rose to £12.8M after £6.4M original estimate. The BR financial objective was to achieve a positive cash flow and the project manager had been successful at this. The original agreement with LUL allowed the billing of estimated costs in next quarter and this was felt to be a good model. The project was still required to satisfy BR Board rules for investment and sponsor (inside BR) was in the lead in driving the project. Although all BR costs were recoverable, there were weaknesses in master contract as BR pays when they are at default - hence recovery of all costs was not fully secured.

Two contractors went bankrupt but no money was lost by BR. One contractor did not turn up on site so work was let to another, other went bankrupt towards end of work and receiver carried out work. No motivation to look for costs to be recovered from LUL "It all comes out of the public purse" (Project Manager). Weaknesses in the main works agreement were covered by a good relationship with the ultimate client (presumably that he was prepared to pick up all cost increases). However, the project manager did not feel that the client should have say on Contracts and potential tenderers. This caused contractors to be used who were financially unstable and caused delay in the appointment of others.
Source material:
1. Questionnaire to Project Manager
2. Interview with Project Manager
3. Interview with Procurement Manager
CASE DESCRIPTION NO: P17
Title: London Waterloo - International terminal
Value: £140 Million
Duration: 2 years 1 month
Start Date: February 1991
Client: BR - European Passenger Services

Outline of Project:
Construction of new three platform terminal building for new Eurostar service through Channel Tunnel to Paris. Included demolition of existing goods platforms and construction of concourse; customs hall; and glazed canopy roof.

Client Details:
Client was European Passenger Services - a new operating subsidiary of BR. Objective was to deliver project by start date of new service (actually delivery date of first new train to allow trial running).

Project Organisation:
BR formed client team under Project Director. This team undertook all client duties and development of project. They also undertook monitoring of delivery team. Client team were resident on site for the duration of the project. Delivery was undertaken by a Construction Management team provided by a construction management contractor - this team was headed by the contractor's Project Director.

Planning, Monitoring and Management Tools:
Sophisticated computerised planning and programming tools used by both client team and construction management team - these were regularly updated. Regular progress meetings were held between the client team and the project team at all levels. Client Project Manager provided brief back to senior managers and Directors.

Procurement Strategy:
Construction Management was selected following in depth evaluation of options. Reasons for choice were (a) complexity of the project and (b) need to get project under way quickly to deliver by required completion date.

Performance:
Project was delivered on time with a close match to the defined specification. Some cost escalation occurred due to additional works that were unforeseen at
planning stage. Construction Management fee was high (15% of total project cost).

**Client Role:**
Client undertook base role; but the activities were undertaken very thoroughly. In addition, a large amount of monitoring was undertaken by the client team. This was not an interference and was held to be necessary given the large contractor’s construction management team on the project. Added value role activities (such as supplier management) were undertaken by the construction manager but were not as successful as has been seen on other projects.

**Discussion:**
This project expended a large amount of money on management fees to produce a quickly constructed high quality product. The client team ensured that development activities (such as the brief) was produced to a high standard and was modified as amendments became necessary. Locating this team on site ensured that the client was able to give decisions quickly and delays to the project from this source were minimised.

**Source material:**
1. Questionnaire to Client Project Director
2. Interview with Client Project Director
3. Project brief
4. Interview with Procurement Manager
5. Procurement Strategy paper
6. Interview with Construction Management Project Director
CASE DESCRIPTION NO: P18
Title: South Wales - River Scour Protection Works
Value: £585,000
Duration: 11 months
Start Date: May 1990
Client: BR - Regional Railways - South Wales & West

Outline of Project:
Provision of protection from river erosion and "scour" to enable bridges (and hence route) to remain open during periods of high river levels and flooding.

Client Details:
Client was operating division who had discovered defect in bridge structures that restricted train operation during flooding.

Project Organisation:
Project manager provided to client by civil engineering design group. Three Project Engineers led design and construction supervision of three routes affected. Design and site supervision were all internal resources; construction resources were provided by external contractors.

Planning, Monitoring and Management Tools:
Bar chart programmes produced to demonstrate that fast track project would be completed on time. Contractors own programmes were also "manually" produced detailed bar charts. Progress meetings between Project Manager and Project Engineers held on a two or four weekly basis due to "fast track" nature of project. The Project Manager met the client on a four weekly basis to review progress and request help in locating funds.

Procurement Strategy:
Traditional procurement route was selected as this was able to be undertaken within timescale - demonstration that traditional procurement routes can be "fast tracked". Contractors were selected by compilation of bid list from select list; followed by competitive tender. Lowest price tenderer was awarded work.

Performance:
Performance was generally accepted as good by the client and project manager. The Project was delivered on time (i.e. prior to next winter and onset of wet weather). Little information on average costs for this type of work was available at
Pettit, J.H., PhD, 2000  

Appendix B : Project Case Studies

the outset but solutions applied to each bridge showed a reduction in price over the whole project.

Client Role:
Client could be classified as absent as he did not undertake all but a few of the base role activities. Project Manager undertook most activities on behalf of the client. No written brief was produced.

Discussion:
Problems occurred at one bridge due to the presence of a thin rock layer. Piling proved impossible and a reinforced concrete cut-off wall had to be substituted - paid for on a cost reimbursable basis. This project demonstrated the importance of adequate site investigation and also that cost reimbursable payment mechanisms can be advantageous.

Source material:
1. Questionnaire to Project Manager  
2. Interview with Project Manager  
3. Interview with Procurement Manager
CASE DESCRIPTION NO:  P19
Title: Exeter - New Depot
Value: £1,050,000
Duration: 1 year 2 months
Start Date: February 1991
Client: BR - Regional Railways - South Wales & West

Outline of Project:
The depot was required to provide a base for part of the BR fleet of rail borne Civil Engineering plant. The project was undertaken in five separate phases: (1) demolition of redundant buildings; (2) recladding and re-roofing of building to be used for depot; (3) Civils and main M&E works to buildings and depot, including fencing; (4) fitting out of buildings, commissioning and moving in of staff from two other depots; and, (5) demolition of remaining buildings which had been used on a temporary basis and landscaping of grounds. The conversion of a redundant freight depot provided a cheaper option than the construction of a new depot. The works involved the extension and construction of new inspection pits and jacking points, the inclusion of heating, lighting and fume extraction services, drainage and separation tank, a new staff mess block, a refuelling point and associated trackworks.

Client Details:
Infrastructure Manager of operating division provided objectives and agreement to funding.

Project Organisation:
Project Manager at HQ undertook client role and liaison with project Engineer and site supervision. Brief and specification developed by the Project Engineer. Internal resources used for design and three contractors used for civil engineering, building services and fuel delivery systems respectively. Internal resources used for most track works.

Planning, Monitoring and Management Tools:
Bar chart programmes only used for planning purposes (by Project Manager and contractors). Monthly meetings on site were held by Project Manager with internal staff. Weekly contract meetings held by Resident Engineer - also on site.
Procurement Strategy:
Traditional Procurement route adopted since this was default used by the design engineering group involved. No consideration of benefits of other routes such as design and build.

Performance:
Performance was fair as project was completed on time and to the specification originally defined. Project costs increased - partially due to client wishing to improve surfacing around depot. No value-for-money consideration were given to this; money had become available and was being spent at end of budget year.

Client Role:
Client did not become overly involved and project team ensured that Base role activities were covered. Interference mainly came from late change to include greater surfacing. No added value roles adopted; and there was evidence that these would have improved cost performance.

Discussion:
Evidence that project team will ensure that base client roles are undertaken even if client does not provide these.

Source material:
1. Questionnaire to Project Manager
2. Interview with Project Manager
3. Interview with Project Engineer
4. Interview with Resident Engineer
5. Project Management reports and financial reporting information.
CASE DESCRIPTION NO: P20

Title: Reading Broken Brow - New bridge

Value: £2,400,000

Duration: 1 year 7 months

Start Date: June 1989

Client: Berkshire County Council

Outline of Project:
Provision of new reinforced concrete bridge under the railway to allow new road to be constructed.

Client Details:
Client was Local Authority; who provided full funding for construction and future maintenance costs.

Project Organisation:
Project Manager provided by lead specialism (Civil Engineering) and this individual also undertook role of chief designer and Project Engineer.

Planning, Monitoring and Management Tools:
Network analysis used to analyse programme and Bar Charts produced regularly to indicate progress. Progress meetings held by Project Manager on two monthly basis.

Procurement Strategy:
Traditional procurement route adopted using ICE 5th Edition form of contract. Contractor appointed following competitive tender process of bidders drawn from company select list.

Performance:
Bridge was delivered on time with little disruption to railway operations - design specifically reduced this disruption in a number of ways. Cost of the project was higher than normal due to type of design used but both client and BR were satisfied with this.

Client Role:
Client did not provide any interference with project - nor did they apply any added value activities. Base role activities were undertaken with the support of the Project Manager.
Discussion:
This project demonstrates that a traditional procurement route can give a well performing project if the base client role is undertaken; but that there is the opportunity for improved value-for-money if the added value roles are included.

Source material:
1. Questionnaire to Project Manager
2. Interview with Project Manager
3. Interview with Procurement Manager
CASE DESCRIPTION NO: P21
Title: Inductive Loop Warning System
Value: £2,757,000 (3Q88)
Duration: 5 years +
Start Date: October 87
Client: BR Director of Civil Engineering

Outline of Project:
Development of electronic safety system using inductive loop radio technology to enable staff on sites to be warned of the approach of trains before they come into visual range. This system enables work on track to be undertaken without full possession of the line.

Client Details:
Director of Civil Engineering is sponsor, but funds authorised via Investment sub-committee. Funding was further complicated by a five way split of development support from the five main operating businesses.

Project Organisation:
Project Manager controlling project. Spending authority of £24,000 before re-approval required. BR PM responsible for formal issue contractual communications (Variation Orders etc.).

Planning, Monitoring and Management Tools:
No formal pre-planning at Project Manager or Project Engineer level. Contractor undertakes detailed planning to meet key milestone dates agreed with Project Manager when the relevant development work is nearing completion. Project Manager produces six-monthly reports primarily to investment panel; but these also serve as reports to Sponsor. Client role fragmented between Sponsor Investment Panel and Project Manager. Project Manager is main driving force behind project. Proposed performance improvement targets have been set, Cost Benefit Analysis has been undertaken - but there will be no way of feeding the actual benefit data back. The data will be used to feed forward into future remanning calculations, but there appears no way of including actual benefits in this.
Procurement Strategy:
The overall strategy is in three parts: (1) research and initial development of concept/feasibility work - BR Research an internal body; (2) development of system in practice (this contract); and, (3) commercial free tendering for production manufacture and installation. Heavily driven by development nature of project. Master contract for initial development based on proposals by three potential suppliers. Supplier required to implement project management processes; including sub-contractor control, reporting relationships, product support, progress reporting. The contract is firmly defined as a development contract and as such contains several concepts akin to partnering. These were: development of system including abandonment of items if necessary, concept changes, a simple mechanism for directing the costs (rather than management of control or monitor), and choice of sourcing of derived data from BR or supplier.

Performance:
The Sponsor believed good progress had been made and was reasonably happy with progress. This view rested heavily on results of test site which he and other interested parties had visited which included test working by labour force. No quantitative data had been presented to back up perceptions at this point. Sponsor would not seem to change viewpoint until next key milestone had been reached - the end of the development stage and actual implementation on a wide basis. Investment Panel were too remote to have any but the most outline idea of performance and their views were based on quality of project management reporting and analysis that had gone into the work (this is a feature of most BR projects, without which no project would receive funds) which is mainly a theoretical exercise and also the good reports from the test site.

Client Role:
Complex client role here consisting of Investment Committee, Director of Engineering and Project Manager. Other stakeholders were the signal and telecommunications (S&T) directorate and Director of Projects organisation. Client was broadly experienced with a well developed but bureaucratic process for directing projects. The client role covered the basic activities but few added value activities were undertaken. Client interference occurred in following ways; amendment of specification to include for up to six tracks (from 4) and the need to provide BR resources (mainly S&T to facilitate on track works). These resulted in a £274,000 increase in costs. Not all costs were collected as part of the authority - notable missing items are Project Management costs, BR support costs and on-site support costs. These costs are hence effectively uncontrolled.
Client input centred around money (investment panel/contributors) and specification (Director of Civil Engineering). The specification was only half a page long and the Project Manager's roles were; develop the specification to a fully contractual brief, agree milestones, act as internal champion and monitor, report and agree direction of project. Project Engineer provided key technical input to direction process.

Key project management expertise in terms of detailed reporting and all planning was provided by the contractor.

Discussion:
It was essential to set up a control mechanism that restricted but also when necessary enabled the client to make changes. Here the mechanism was not sophisticated and there was little information available to the client at the point of taking the decision exactly what impact this would have on the project (costs/time/specification) but it did highlight the need for the sponsor to actively vary the brief if changes were to be implemented.

Development project has some differences from ordinary construction project mainly in terms of the flexibility required during the early stages and the speed at which the project will progress.

Source material:
1. Questionnaire to Project Manager and Sponsor
2. Interview with Project Manager
3. Interview with Sponsor
4. Cost benefit Analysis
5. October 1988 Authority Paper
7. Work Programme showing Key Milestones
CASE DESCRIPTION NO: P22

Title: Automatic Train Protection
Value: £10,540,000
Duration: 2 years 10 months
Start Date: June 1989
Client: BR Director of Civil Engineering

Outline of Project:
Pilot and implementation of advanced form of automatic train protection which is, in effect, half-way to in cab signalling. Involves fitting of electronic units to cabs of locomotives and signalling line-side. Undertaken in three phases: (1) research and initial development; (2) two pilot schemes to determine and solve practical problems; and, (3) “roll-out” implementation to selected sites.

Client Details:
A multi headed client due to the existence of several sponsors/stakeholders. However, identification on single lead sponsor to take forward all issues on behalf of others prevented different views from clouding progress. The investment approving body is the Railway Management Group (effectively a subset of the main board consisting of all the full time executive directors with responsibility for running the company).

Project Organisation:
A full time high level Project Director throughout the project. At the move into implementation phase a two level project structure was enacted that focuses system design, procurement and control on a central project team then delegates individual scheme management (up to 15 schemes) to profit centres where responsibility for the resources involved for implementation and subsequent operation exists. Phase one team focused at central project team with split between train and lineside features and the two pilot schemes.

Planning, Monitoring and Management Tools:
Computerised planning tool used by project organisation which was run by full time project planning assistant.

Procurement Strategy:
Two stage process in which a range of contractors were asked to submit Design and Build proposals based on an outline specification. Three best bids in terms of
cost and specification were asked to provide detailed bids and contractors were chosen based on these detailed bids.

**Performance:**
Development phase of project deemed to be good as it delivered on time and to cost. Technical problems with trial sites prolonged this phase.

**Client Role:**
Client provided Base role activities; but one issue effected delivery of project - see below.

**Discussion:**
The final product was deemed too expensive for the installation in the range of sites requires. A cheaper system - based on allowed specification was developed from ATP. The ATP project, as such, did not deliver what the client required.

**Conclusions:**

Source material:
1. Questionnaire to Project Manager
2. Interview with Project Manager
3. Project Strategy for Implementation Phase
4. Procurement Evaluation of bids for Implementation
5. Study of Option for Implementation Phase based on Pilot Projects
CASE DESCRIPTION NO: P23
Title: SKAKO Ballast Train
Value: £1,400,000
Duration: 1 year 1 month
Start Date: February 1991
Client: BR - Network SouthEast - South Central

Outline of Project:
Procurement of self-discharging ballast train to improve the productivity of track maintenance operations and allow works to result in less disruption to train services. The ballast train had been developed for use on the continent but significant work was required to ensure a version was produced which would operate successfully in Britain.

Client Details:
Client (and internal sponsor) South East Division Infrastructure Manager who provided a written remit. Clarification work to develop this came from the infrastructure manager, New Works Manager and Project Manager. The Client issues amended details of requirements in the later stages of the project but the impact of these were not explicitly quantified.

Project Organisation:
Full time dedicated Project Manager responsible for project from start to finish, nominated people in other departments but essentially functional control. Support from various areas of BR organisation including Project Engineer for technical items and help with work breakdown, procurement/Solicitor for Contractual matters. Majority of resource for enacting the project came from outside suppliers. The structure of the project organisation is shown in the figure 23a.

Planning, Monitoring and Management Tools:
Generally simple tools only. A manual bar chart and key milestones were produced by the project manager but these were subject to change and were not explicitly fixed. Since the main element - the ballast train - could be produced in isolation to anything else, the need for linkage was slight.
Procurement Strategy:
The project management of the delivery of the train was treated as a “New Works Project” i.e. using the construction Project management team, rather the rolling stock team:
(a) enabled the Divisional team to keep full control rather than use central resources,
(b) T&RS projects did not enjoy a reputation for success;
(c) the train is a piece of construction plant which is being introduced with the central purpose of improving the performance of construction projects.
The supplier had a high degree of skill in successfully producing the plant itself and the key input (and risks) would be in its application to the construction works and other (mainly infrastructure) systems. This shows a high degree of sophisticated thinking on the Project Strategy and the efforts seem to be borne out by the success of the project.

Figure P23a: The SKAKO Project Organisation

Performance:
Rated by Client as very good - client felt instrumental to the success as he was a key player in the decision to use the type of project management actually adopted. The project was delivered on budget and time scale was acceptable even though it was longer than original estimates.

Client Role:
Exhibited a high degree of experienced characteristics although this project was the first of its kind undertaken. Although the Client had a significant input at all levels and stages of the project, very little of this could be viewed as interference. There was a high degree of integration of different suppliers required and the key supplier was not based in Britain. The ballast supplier, who had a large stake in ensuring that he could operate the train (give a competitive advantage over other suppliers of ballast) was key to the success of the project.

Discussion:
Of note was the use of providers who had a high degree of specialism and competence in their own areas.
This project was essentially the procurement of a specialist piece of traction and rolling stock, and it is interesting to note the difference in perceived performance between this and the T&RS example. Indeed the SKAKO train was a one off item which needed to be integrated with a complex construction process to be successful. The differences are:
- Client involved in success of project
- Success criteria simple (work when required, costs within limits, allow speedier re-ballasting)
- Little involvement with actual manufacture of plant, involvement concentrated on its integration
- High skill key supplier.
- Other suppliers with significant gains if plant worked.

Source material:
1. Questionnaire to Project Manager
2. Interview with Project Manager
3. Interview with SKAKO Manager
4. Interview with Astra Training
5. Interview with Client
6. Interview with New Works Manager
CASE DESCRIPTION NO: P24
Title: Networker Trains
Value: £114,000,000
Duration: 3 years (manufacture)
Start Date: April 1990
Client: BR - Network South East

Outline of Project:
Part of a programme to manufacture a new fleet of trains for the London and South East services to replace life expired trains.

Client Details:
Client was a large operating division of BR providing train services to London and the South East.

Project Organisation:
Full time dedicated Project Director with core dedicated support team and further support from involved departments. New build T&RS is a periodic requirement which normally results in the parts of the organisation involved being dedicated to a particular project as they occur. Thus although procurement and mechanical engineers (particularly) where still functionally based, they were working almost exclusively on the one project during the greater part of the project and had a high amount of identification with the project - they were to all intents and purposes part of the dedicated project team. Project Engineer maintained presence at manufacturers works to assist with detailed problems that might occur.

Planning, Monitoring and Management Tools:
Project Director’s team used high-level project planning software and identified key milestones. Detailed planning was left to the contractor and there was not formal link between the low level plans and the PM programme. Feedback of problems occurred at the regular (mainly monthly) contract meetings with the contractor and it was difficult to see how the project management could be anything but reactive to problems that occurred.

Procurement Strategy:
A common strategy which involved initial bids from UK and European train builders; followed by negotiation with any that appeared to give reasonable value-for-money at defined specification and performance levels.
Performance:
Project performance held to be fairly good by project team and client.

Client Role:
Individuals within client were inexperienced at new build since it was some 30 years since similar trains had been constructed; although many individuals were drawn from similar projects that had constructed trains for other operating divisions.

Discussion:
The method of organising the project seemed to be reasonable; being based on a “tried and tested” way of obtaining new trains. Weaknesses seemed to arise from the fact that each new build of trains seemed to be starting from scratch and the train builders attempted to bring in new ideas from their work around the world.

Source material:
1. Questionnaire to Project Manager
2. Interview with Project Manager
3. Interview with Procurement Manager
TABLE B.1
SUMMARY OF CLIENT PERSONNEL RESPONDANTS

<table>
<thead>
<tr>
<th>No.</th>
<th>Name</th>
<th>Role</th>
<th>Organisation</th>
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<tr>
<td>C1</td>
<td>Dr M Armstrong</td>
<td>Investment Director - Regional Rail</td>
<td>TransOne</td>
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<tr>
<td>C2</td>
<td>Mr K Bence</td>
<td>Fleet Maintenance Engineer</td>
<td>TransOne</td>
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<tr>
<td>C3</td>
<td>Mr D Booth</td>
<td>Planning &amp; Investment Manager</td>
<td>TransOne</td>
</tr>
<tr>
<td>C4</td>
<td>Mr A Bisby</td>
<td>InterCity Plant Engineer</td>
<td>TransOne</td>
</tr>
<tr>
<td>C5</td>
<td>Ms M Faulkener</td>
<td>Investment Programme Manager</td>
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<tr>
<td>C6</td>
<td>Mr R Lindop</td>
<td>Works &amp; Buildings Manager</td>
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<td>C7</td>
<td>Mr F Mackintosh</td>
<td>Area Fleet Manager</td>
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<td>C8</td>
<td>Mr G Merchant</td>
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<tr>
<td>C9</td>
<td>Mr J Plumb</td>
<td>Business Investment Controller</td>
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<td>C10</td>
<td>Ms L Phipps</td>
<td>Planning &amp; Investment Manager</td>
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<td>C11</td>
<td>Mr M Satchwell</td>
<td>Change Agent - Added Value</td>
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<td>Mr R Temple</td>
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<td>Ms R Williams</td>
<td>Commercial Trading Accountant</td>
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<td>C14</td>
<td>Mr J Abbott</td>
<td>Head of Procurement,</td>
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<td>Mr W Canning</td>
<td>Procurement Manager - New Works</td>
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<td>Mr H Crumpler</td>
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<td>Mr A Green</td>
<td>Senior Contract Manager</td>
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<td>Mr P Guildford</td>
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<td>C30</td>
<td>Mr D Putley</td>
<td>New Works &amp; Project Manager</td>
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### Table B.2

**SUMMARY OF MANAGERS OF THE PROJECT ACTIVITY RESPONDANTS**

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<td>Mr S Calvert</td>
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<td>Mr D Chalkley</td>
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