# INFORMATION SYSTEMS EVALUATION IN THE PUBLIC SECTOR

A thesis submitted for the degree of Doctor of Philosophy

by

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Abstract

Investment appraisal techniques (IAT) range from quantitative (financially based) techniques to qualitative (non-financially based) techniques, and represent tools that may be applied during IT/IS evaluation to assess the impact (value, worth or usefulness) of information systems on the organisation. The normative literature review demonstrates that decision makers need to better evaluate their systems as the role of IT/IS systems in organisations and global expenditure on IT/IS continue to rise. In the service oriented public sector, the normative literature indicates that whilst decision makers may continue to depend on financially based IAT to evaluate IT/IS project that cut cost, they may be doing the populace a disservice by not focussing on non-financial benefits of IT/IS (such as improved customer service).

This dissertation investigates the application of IAT in the public sector. To do so, a conceptual model is developed to represent the effect of barriers to the application of IAT. The conceptual model is underpinned by three proposition, which indicate that the organisational investment process, time available for evaluation, and fund accessibility can impede the application of IAT. To test the propositions, a suitable research strategy is selected and developed that essentially adopts a multi-case study for the purpose of testing the proposition, and trialling the applicability of the conceptual model in the public sector. In doing so, the multi-case study investigation is used to produce a frame of references that may be employed by decision makers to recognise barriers to the application of IAT. The frame of reference represents the dissertation's contribution to the body of knowledge.

The empirical evidence demonstrated that barriers, as suggested by the propositions, do surface in all case studies, thus confirming them as permanent elements in the frame of reference. The empirical evidence also demonstrated that the application of traditional IT/IS life-cycle models was not possible where inherited IT/IS systems were considered, as inherited systems did not have a definitive start/stop point.

Key Words: IT/IE evaluation, investment appraisal techniques, case studies, barriers, framework.

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Declarations

I declare that, to the best of my knowledge, no portion of the work referred to in this thesis has been submitted in support of an application for another degree, or qualification to any other university, or institute of learning.

The thesis conforms to British Standard BS 4821: 1990, the 'British Standard Recommendations for the Presentation of Thesis and Dissertations', and follows the Harvard referencing system.

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Table of Contents

4. RESEARCH METHODOLOGY

5. EMPIRICAL DATA ANALYSIS AND PROPOSITIONS TESTING

List of Tables

List of Figures

x

Chapter 1

Introduction

This dissertation is concerned with the research of Information Technology/Information Systems (IT/IS) evaluation practices in the public sector. Specifically, the identification of barriers restricting the application of investment appraisal techniques (IAT) during the evaluation process. Investment appraisal techniques are tools that may be employed by the decision maker to assess impact of technology on the organisation. Assessment of IT/IS may manipulate costs and benefits according to the 'value', 'worth', and/or 'usefulness' of IT/IS as perceived by the decision maker. Although this brief definition is widely accepted in the IT/IS industry, researchers argue that 'value', 'worth', and/or 'usefulness' are troublesome terms to define. The debate is most evident from the many IAT developed to accommodate different decision makers' interpretation of 'value', 'worth', and/or 'usefulness'. Consequently some IAT are only concerned with assessing the impact of quantifiable aspects of IT/IS systems (such as the price of procuring hardware), whilst other IAT are designed to only assess the impact of qualitative properties of an IT/IS system (such as user satisfaction). Investment appraisal techniques may also possess the ability to include in their assessment both the qualitative and quantitative. Researchers do agree however that no single type of IAT is suitable for assessing all IT/IS systems, as the organisational context may factor. Researchers also warn of the risks associated with applying only quantitative (financially based) IAT, stating that hidden costs and defects will often arise from such an action.

This chapter will report on the limited application of IAT in industry, and present an argument for producing the suggested research. That is, using a conceptual model that is underpinned by propositions to develop a frame of reference that can be used by decision makers to recognise barriers to the application of ITA in the public sector. The frame of reference will be empirically tested through the employment of multiple case studies. This chapter will indicate the aims, objectives and structure of this dissertation.

1.1 IT/IS Evaluation

The terms IT and IS are commonly used interchangeably, however, it is important to distinguish that with IT the emphasis is on technology, whilst IS is a much wider term, encompassing technology, as will as the social organisational structure, culture, intellect, and philosophy related to the distribution of information through the organisation (Orlikowski and Baroudi, 1991; Walsham, 1993; Bocij *et al.*, 1999).

IT/IS evaluation has been the subject of research over the last four decades that address conceptual and operational aspects of assessing value, worth, or usefulness of IT/IS. There is no universal definition of IT/IS evaluation due to the many roles it can assume in organisations. For example, IT/IS evaluation can assess the technological efficiency and effectiveness of IT/IS, identify implementation costs and attributing them to specific projects, measure the contribution of IT/IS to business performance, calculate the costs of intangible assets generated from IT/IS, and understand the strategic role of business IT/IS (Dameri, 2001). In addition to the following:

- Ranking alternative IT/IS project proposals (Irani and Love, 2002);
- Planning and strategic IT/IS decision making (Hawgoog and Land, 1988)
- Feedback and learning applications (Walsham, 1993; Baker, 1995)
- Gaining commitment in political surroundings for legitimisation (Powell, 1992; Farbey et al., 1995); and
- Providing insight into the interface between the technology and the fundamental organisational procedures, customs, and politics (Symons, 1988).

Smithson and Hirschheim (1988) offer one definition of IT/IS evaluation as the assessment of the value, worth, or usefulness of an information system. Smithson and Serafeimidis (1996) expand on that definition, indicating that evaluation is a process (as opposed to a singular activity) that is used to utilise resources and manage anticipated benefits. Remenyi *et al.* (2000) explains that IT/IS evaluation has traditionally been performed to predict future costs and benefits. For example, a pre-implementation evaluation (or *ex-ante*) may be carried out to initially justify an IT/IS project and following the deployment of the system, a post-implementation evaluation (or *ex-post*) may be conducted to assess the current situation.

IT/IS evaluation may be conducted to serve an organisational learning objective (formative evaluation, Finne *et al*, 1988), which can occur at any point during the life of the system (that is not specific to *ex-ante* or *ex-post*). IT/IS evaluation may also be summative in nature, where the objective of the evaluation is to assess the final impact of the system (Remenyi *et al*, 2000). Willcocks and Lester (1999) maintain that IT/IS evaluation (formative and summative) is necessary throughout the life of the system as it can fulfil many roles in the organisation.

1.2 The Need to Evaluate IT/IS Investments

There are at least two main reasons motivating research in the area of evaluation. First, research by the World Information Technology and Services Alliance (WITSA) forecasts global spending on IT (not IS) to reach $3 trillion by 2004, representing a 33.3% increase from 2000. As noted in section 1.1, IS is a much wider term and encompasses technology as well as the human and organisational components of IT (Bocij *et al.*, 1999). As such, it would seem that corporate expenditure, as predicted by the WITSA, does not necessarily reflect the actual cost of developing an IS infrastructure (only IT). Increasing competition among organisational departments for investment capital, and continuing expenditure on IT/IS projects can amplify pressure on decision makers to better justify their IT/IS proposals (Strassmann, 1985; Remenyi, 1995).

Second, the role of IT/IS is growing in the modern organisational context (Irani and Love, 2001). As such, the need for IT/IS evaluation research stems from the increasing role of IT/IS in organisations. Smithson and Hirschheim[a] (1998) state that:

> "*Information systems have become (i) much more sophisticated, multi-functional, physically interlocked, and with a wider scope (ii) more towards being a communication and information infrastructure than supporting an individual business group (iii) in some cases, part of the product or service (iv) strategic in usage which will make it difficult to evaluate*". (Page 124)

Systems are moving away from the traditional role of automation and support towards a more strategic function (Remenyi *et al.*, 1999; Lycett and Giaglis, 2000), closer to the core operation of the organisation, and having the ability to give the organisation the added advantage in the midst of growing competition. Bannister (1998) argues that organisations continue to invest in IT/IS whilst questioning the effectiveness of evaluation process, thus pointing to the increasing role of IT/IS in organisations. Small and Chen (1995) suggest that organisations may want to evaluate systems better, but may not have the ability to do so. In such cases where managers fail to justify investment proposals with traditional IAT, organisations will employ one of three alternatives when deciding on their IT/IS investment:

- Refuse to undertake IT/IS projects that could be beneficial to the long-term competitiveness of the organisation;
- Invest in projects as an act of faith; or
- Use creative accounting to pass the budgetary process.

Consequently, increasing dependency on IT/IS further supports the interest in IT/IS evaluation research, as it remains the most scientific procedure of assessing the impact of IT/IS investment in organisations.

1.3 Investment Appraisal Techniques

Investment appraisal techniques (IAT) are discussed by (among others) Farbey *et al.* (1992); Irani *et al.* (1997) and Renkema (2000) and represent tools that may be applied during IT/IS evaluation to assess the impact of technology on the organisation. IT/IS evaluation may address value, worth, or usefulness of the IT/IS (Smithson and Hirschheim[b], 1998), which will represent different things to different decision makers. As such, there are at least 65 IAT that can account for the different interpretation of decision maker's value, worth, or usefulness (Renkema, 2000). Accordingly, IAT range from quantitative, which typically target direct tangible costs and benefits and are based on accounting and financial techniques such as among others Net Present Value (NPV) and Internal Rate of Return (IRR), to complex and highly detailed qualitative techniques that address intangible/indirect cost and benefits, such as among others Value Analysis and Critical Success Factors (Farbey *et al.*, 1993).

1.4 Application of Investment Appraisal Techniques in Industry

Research by Ballantine and Stray (1998), as well as Lycett and Giaglis (2000) suggest that most IT/IS investment decisions use quantitative or financially based IAT. Tables 1.1 present surveys conducted during the last decade and demonstrate heavy use of financially based IAT among decision makers.

	Farragher et al. (1999)	Ballantine & Stray (1998)	Lefley & Sarkis (1997)	Tayles & Drury (1994)	Lefley & Sarkis (1994)	Sangster (1993)	Remer et al. (1993)	Drury et al. (1993) survey conducted in 1991
	% Used In Each IT/IS Project							
Accounting Rate on Return (ARR)	34	43	79.7	61	18.8	31	N/A	41
Payback	52	60	46.2	39.2	46.2	78	78	63
Internal Rate of Return (IRR)	80	25	44.8	48.6	44.8	58	75	57
Net Present Value (NPV)	78	24	47.6	61.4	47.6	48	52	43
Cost Benefit Analysis (CBA)	N/A	72	N/A	N/A	N/A	N/A	N/A	N/A

Table 1.1: Survey of IT/IS Evaluation Practices

Although financially based IAT are relatively simple assessment techniques, they tend to exclude what might be termed softer project variables such as political influence, culture, attitude (Griffiths, 1994; Pennington and Wheeler, 1998). Furthermore, financially based IAT are not capable of dealing with modern strategic uses of the IT/IS system (Kaye et al., 1995). As such, organisations purely applying financially based IAT are susceptible to (at least) two types of failure in assessing the impact of technology on the organisation:

1. Hidden costs and softer benefits may not be accounted for if financially based IAT are used, which in turn can cause the overall IT/IS budget to increase up to four times the initial investment (Hochstrasser, 1992). In most situations, many of the costs associated with the deployment of new technologies cannot be easily quantified and therefore decision makers tend to ignore them during the initial justification of the IT/IS project proposal.

5

Consequently, projects whose costs are underestimated may underperformer, potentially leading to failure because the financial resources have not been set aside to account for undetected costs.

2. The successful deployment of an IT/IS system relies not only on accounting for all project costs, but also on identifying any benefits. Financially based IAT may not take into account qualitative benefits. Such as among others improved customer services and employee satisfaction. As such, unaccounted for qualitative benefits from the application of financially based IAT will not be managed, and will therefore be lost (Pennington and Wheeler, 1998). Only by recognising the benefits (and drawbacks) can project managers fully utilise them. Farbey et al. (1992) stated that most benefits sought are not easily measured. As such, traditional IAT tend to ignore human and organisational components of various stakeholder groups, focusing instead on technical aspects of the IT/IS project, such as number of users and cost of hardware (Serafeimidis and Smithson, 2000). This places the IT/IS evaluation process at risk of failure to accommodate the needs of the employee (Pouloudi and Whitley, 1997). This view was supported by Beynon-Davies and Blyth (2000) who claimed that IT/IS failure will occur if the system does not meet user expectations.

A number of barriers are identified that explain the limited application of IAT. For example, the needs of top management may push the organisation to implement systems that deliver short-term visible results as opposed to long-term strategic benefits (Irani et al., 1999). Here, the IT/IS evaluation process would employ IAT that emphasise the visible results and downplay hidden costs, thus producing a specific positive (or negative) result (Kumar, 1996). Furthermore, Clemons (1991) supposes that most IAT are not used because managers are ignorant about their existence, which frequently results in an act of faith or gut feel type of investment, which ignores the use of any IAT (Kaplan, 1984; Ward and Taylor, 1996). Other research suggests the existence of a gap between theory and practice, rendering some IAT useless in the modern dynamic organisation (Bannister, 1998). Consequently, the drive to identify and control barriers to the application of IAT continues as more and more organisations continue to devote resources to their IT/IS systems.

6

1.5 Information Technology Evaluation and the Public Sector: A Direction for Research

Beaumaster (2002) argues that IT/IS in the public sector may often be operated out of backrooms, are owned by department rather than the organisation. Adding that IT/IS may also be developed by staff who do not appreciate the dynamics of the government operation. As such, there are some difficulties associated with evaluation in the public sector. On the one hand, the public sector has traditionally been described as a bureaucratic system, which (in part) aims to provide impartial implementation of policy and continuity of administration (Murray, 1990). In this bureaucratic environment, decision makers follow a specific set of rules and regulations that enable them to manage their employees in delivering a stable and cost efficient service to the populace. Guaranteeing stability and cost efficiency will promote the investment in proven technology and discourage exploration of risky projects with long-term benefits. As such, Joyce (1985) claims that the management style in the public sector has been accused of practising risk aversion decision-making when it comes to IT/IS investments which will in turn support the employment of financially based IAT, such as among others NPV and IRR as they tend to address the tangible and ignore the intangible (thus risky).

On the other hand, IT/IS systems in the public sector are designed to ultimately deliver quality services to the populace, the assessment of which may or may not be quantifiable with financially based IAT. For example, customer satisfaction and perceived quality of service may not be assessed with IRR and NPV. As such, justifying IT/IS proposals on the basis of financially based IAT can do a disservice to the client (the populace), as most benefits passed on by the IT/IS system to the populace can be intangible. Quinn and Bailey (1994) support this view by stating that development of IT/IS in the public sector is at a disadvantage as some IAT, such as value added and productivity, are easy to define in the private sector (for example in a manufacturing environment) but can be troublesome to apply in the public sector.

However, the bureaucratic nature of the public sector may not be the only issue complicating IT/IS evaluation. Pye (1992) reports that during the period 1960 to 1990 the UK public sector has struggled to develop IT/IS projects that deliver services to their ultimate clients (the populace).

7

Adding that complications in the development of IT/IS investments were amplified by indifferent senior management who could not agree on an IT/IS solution, inadequate staff resources who could not maintain IT/IS as required by the organisation, lack of direction of the central government as to what role does IT/IS assume, lack of political will to place the needs of the populace above that of the organisation, and departmental (rather than corporate) governing of affairs (Pye, 1992). Bannister (2001) claims that IT/IS development problems still exist in the public sector as a result of IT/IS evaluation related complications, including:

1. How does evaluation address the value of IT used to support policy making?
2. How does evaluation define the customer in the public service context?
3. Much of the research in IT/IS evaluation has been devoted to the private sector, rendering standard business measures of productivity, financial payback etcetera. to have little or no meaning in public management.
4. Public organisations focus on the segment that uses their services, which may result in departments becoming too close to lobby groups, losing objectivity and perspective.
5. Public administration IS are frequently driven by the current political need or most effective constituent lobby.

Value for Money (VFM) (National Audit Office, 1996) has been the main evaluation concept in the public sector for over ten years. Value for Money has three dominant criteria (the three Es):

1. Efficiency: measuring the ratio of inputs to outputs (for example cost per student).
2. Effectiveness: although difficult to define, effectiveness will occur if objectives are achieved.
3. Economy: as defined by the UK Audit Commission (1986) to be "ensuring that the assets... and services purchased are procured and maintained at the lowest possible cost consistent with a specific quality and quantity".

Value for Money promotes IAT that address direct costs and financial/tangible benefits. This gives little or no room for IAT that can take into account the soft benefits and hidden costs that may be associated with IT/IS.

As such, Value for Money has being criticised for looking at services from the perspective of the taxpayer rather than the customer/citizen (Bannister, 2001), which fundamentally readdresses the issue of bureaucratic system delivering services to a large population. Information Technology has gained particular importance as of 31 July 2001, as Councils received a directive from the regional government to implement an electronic government (e-gov) project by 2005. The UK Audit Commission raised concerns in a 2002 report about key issues with regards to the e-gov project. They included the following:

- Councils agree that the successful e-gov requires fundamental change. Do councils understand what changes to make?
- Councils say that e-gov important and can deliver real benefits. However, is it a top priority for councils?
- Councils say that the benefits to local people are the most important outcome, yet it is national targets that seem to drive what they do. Will local people see significant benefits?
- Will councils meet national targets, yet not achieve significant benefits for local people?

The report adds that key factors for the success of e-gov project from the perspective of counsels includes potential cost savings, the influence of IT suppliers, and perceived benefits to local people. The e-gov project has a direct relation to IT/IS evaluation as it can benefit form the many roles that IT/IS evaluation can provide (section 1.1). as such research into IT/IS evaluation needs to continue investigating the application of IAT in the public sector.

1.6 Aim, Objectives, and Scope of Dissertation

1.6.1 Aim of Dissertation

Identify those barriers restricting the application of investment appraisal techniques in the public sector. In doing so, develop a *frame of reference* for managers that translates into a decision-aiding model that recognises those barriers. The *frame of reference* can be used by decision makers to recognise barriers to the application of IAT in the public sector.

1.6.2 Objectives of Dissertation

- Critical review of the published literature on system life-cycles, focusing on IT/IS evaluation by reviewing IT/IS life-cycle modes and the presence of evaluation within them. The review will also critique IAT taxonomies to highlight the similarities and differences between IAT. Finally, the review will highlight barriers to the application of IAT in IT/IS evaluation.

- Develop a conceptual model underpinned by propositions that represents the effects of barriers to the application of IAT.

- Identify through the empirical data those barriers restricting the application of IAT.

- Test the proposition and draw parallels from the public sector case studies.

- Present conclusions from the literature and the empirical data and offer a novel contribution.

1.6.3 Scope of Dissertation

The dissertation will focus on the public sector for case study material. Furthermore, the case studies will only include Councils in the United Kingdom.

The dissertation will further reducing the Council selection to those that underwent reorganisation in the past five years and will be further restricted to *one* region in the United Kingdom (that is Scotland, Wales, or England). In the case studies, the investigation will consider pre-implementation evaluation practices by analysing the authorities IT/IS decision-making actions during the reorganisation effort of 1995. The case studies will also look at IT/IS investment processes and evaluation practices of the organisation after the reorganisation period. As generalisation is beyond the scope of this dissertation, novelty will be claimed from a *frame of reference*; primarily resulting from the drawing of parallels between case study findings.

1.7 Structure of Dissertation

Phillips and Pugh (1994) presented a methodology to structure PhD dissertations. This generic structure is composed of four elements, namely (i) background theory (ii) focal theory (iii) data theory and (iv) novel contribution.

10

As such, the structure of this dissertation will be based on the methodology of Phillips and Pugh (1994).

1.7.1 Background Theory

Here, the task is assessing the field of research and identifying the problem domain. The background theory will encompass issues such as developments, limitations, controversies and breakthroughs associated with system life-cycle and IT/IS evaluation. To that end, a literature review is carried out and presented in Chapter 2. The review will first focus on information system life-cycle models and development methodologies. A critique of IAT taxonomies will also be given to emphasise classifications of IAT and achieve understanding of their characteristics. This is followed by a discussion of those barriers to the application of IAT as presented in the normative literature.

1.7.2 Focal Theory

The focal theory identifies the research area, as well as the nature of the issues under investigation. The main task here is to generate a conceptual model, followed by propositions to carry the academic discussion forward. The conceptual model will be used as a tool to drive the formulation of the frame of reference. Therefore the conceptual model does not represent the novel contribution of this research, just a catalyst towards the development of the *frame of reference*.

A narrow focus on the research is also given, laying out the structure of the dissertation and establishing the need to support any research propositions with data. As such, the focal theory of the research is described as the conceptual model and research propositions, which are presented in Chapter 3. In effect, Chapter 3 stresses the need to recognise barriers restricting the application of IAT during the justification of IT/IS investments. It displays the barriers in a model, thus allowing managers to recognise them.

11

1.7.3 Data Theory

This section aims to address the weight and reliability of the material that supports the dissertation. To do so, the following must be addressed:

1. The conditions affecting the choice of the research strategy.
2. The most appropriate epistemological stance to adopt.
3. The development of research method(s).

Consequently, Chapter 4 will discuss: the methodology by which the research will be carried out; the alternative research strategies; and the justification of the chosen research strategy. Essentially, the units of analysis (drawn from the propositions) will dictate the employment of multiple case studies for a research strategy, as well as an interpretive epistemological stance. Chapter 4 will also present and discuss the case study skeleton, a method used to uniform the display and analysis of the case studies. Finally the chapter will present and discuss the reasoning behind the selected research methods. Chapter 5 will show the organisation and analysis of empirical data collected in accordance with the methodology presented in Chapter 4.

1.7.4 Novel Contribution

In this final element of the dissertation structure developed by Phillips and Pugh (1994) Chapters 6 and 7 are presented to confirm the novel contribution of the dissertation to the body of knowledge, as will as limitations of the research and direction for further work. Chapter 6 first addresses the contribution of the research to the background theory. This is accomplished by drawing parallels between the case studies and using the results to modify the conceptual model so that it can serve as a *frame of reference* for managers.

Chapter 6 will discuss why, and in what way, the *frame of reference* adds to the background theory. Chapter 6 also discusses the effect of the dissertation on the focal theory, focusing on the contribution of the methodology to the research area. In Chapter 7, the research is summarised, leading to a discussion of the contribution of this research to the area of IT/IS evaluation. Chapter 7 also assesses the data theory, states the limitations of the research and gives direction for future research.

1.8 Summary and Conclusions

This chapter has presented evidence from the normative literature that support continued interest in IT/IS evaluation. Specifically, rising expenditure on IT/IS projects and the increasing role of IT/IS in organisations may force decision makers to improve their evaluation practices whilst competing in a resource limited organisation. The concern is that surveys from the normative literature show that IT/IS evaluation practices over the last decade have depended heavily on financially based IAT, which can result in ignoring hidden costs and intangible benefits. The dominance of financially based IAT over the last decade demonstrates that non-financial IAT are not usable, or that there is a gap between the theory and practice of IT/IS evaluation, both of which warrant further research. As such, this dissertation has set out to investigate barriers to the application of IAT, with a focus on the public sector.

The public sector is of particular interest to IT/IS evaluation research as little or no attention has been given to this sector. One source of potential barriers to IAT may be due to the imbalance between the traditional cost cutting IT/IS projects in the public sector and the quality of service they deliver to the populace, as they may be at odds with one another. Prioritising the role of public sector organisations would place the needs of delivering quality services above that of running a bureaucratic operation. However, changing the bureaucratic system may require long durations of time to complete and the cooperation of politicians, staff and the populace. The price of which might be too high to pay for improved service.

Chapter 2

System Life Cycle and Evaluation

This chapter critically reviews the normative literature on the subject of IT/IS system life-cycle models and evaluation for the purpose of establishing a foundation that will be used to develop a conceptual model and proposition. The chapter defines and discusses traditional system life-cycles and establishes the element of IT/IS evaluation within those types of models. The discussion on system life-cycle models is followed by a presentation of alternative models to illustrate similarities and differences between them and the effect of IAT. The chapter then critiques IT/IS Investment Appraisal taxonomies and establishes that IAT have different characteristics, which may interfere with their application during IT/IS evaluation.

Finally, the chapter presents and discusses challenges to IT/IS evaluation naming barriers such as: nature of direct/indirect costs, tangible and intangible benefits; characteristics of IAT; evaluation practices of the organisation; forced IT/IS projects; system development and operation; different platforms, operating systems, and languages; and evolving IT/IS systems. This will facilitate the development of theoretical propositions in the next chapter for the purpose of theory testing.

2.1 Introduction

This dissertation aims to identify barriers to the application of investment appraisal techniques (IAT) in the public sector. To achieve this aim, the dissertation needs to demonstrate an understanding of how and why decision makers assess the value, worth and usefulness of their IT/IS investments. This will be based on a detailed review of IT/IS evaluation literature, which will establish a foundation by which the rest of the dissertation can develop a conceptual model and proposition, as well as identifying a suitable research strategy. The literature review will need to address the application of IAT, which involves reviewing IT/IS life-cycles and the evaluation element within them. Also, the review will look at IAT, which involves a close look at their features and characteristics. Finally, the review will consider barriers to the application of IAT, which involves studying challenges to IT/IS evaluation and discussing perceived barriers to IAT.

2.2   Information System Life Cycle Models and Development Methodologies

Information system life-cycle models guide the organisation of activities that produce the IT/IS system. They include those activities should be conducted, how the activities may be ordered, the nature of outputs from each activity and the conditions under which the changeover should be made from one phase to another (Galal, 1996). Life-cycle models should not be confused with development methodologies, which aim to systematically analyse an organisational need and design a solution to meet it. Avison and Fitzgerald (1995) define IT/IS development methodologies as:

> "A collection of procedures, techniques, tools, and documentation aids which help the system developers in their efforts to implement a new system. A methodology will consist of phases, themselves consisting of sub-phases, which will guide the system developers in their choice of techniques that might be appropriate at each stage of the project and also help them plan, manage, control and evaluate information systems projects". (Avison and Fitzgerald, 1995; Page 10)

As such, whilst development methodologies aid the engineering activities (analysis, design, deployment and evaluation) of an IT/IS system, life-cycle models guide the engineering activities. It would therefore be correct that some development methodologies encompass life-cycle models, but not the reverse (Avison and Fitzgerald, 1995). Examples of development methodologies include among others: Structured System Analysis and Design (DeMarco, 1979) and Jackson System Development (Jackson, 1983).

2.3 Traditional Life Cycle Model

The Waterfall model (Royce, 1970) represents one of the early life-cycle models. The model (figure 2.1) divides the IT/IS life-cycle into a series of phases, with the output of each phase representing the input to the next phase. As such, the phases guide decision makers in breaking down the main tasks into sub-tasks, thus giving decision makers a stronger grip on the management of resources and the development of the system. The Waterfall model has seven phases (also discussed in Appendix A1) as follows:

- **Phase 1 Initiation:** where the need for a new information system is determined.
- **Phase 2 Feasibility Assessment:** where a feasibility report is developed to determine if the proposed IT/IS investment is a viable business proposition.
- **Phase 3 Systems Analysis:** where a detailed list of system requirements is established, as specified by users.
- **Phase 4 System Design:** where IT/IS system developers will translate those requirements to different design alternatives.
- **Phase 5 System Build:** where the database is physically constructed and populated, programming (code writing) of the software commences, pre-deployment testing, user guide manuals are written, as well as systems documentation for maintenance purposes.
- **Phase 6 System Implementation and Changeover:** where the system is deployed as a whole, or in phases.
- **Phase 7 Review and Maintenance:** where a review will determine if defects in the system can be amended. Also in this phase, the system can be improved through maintenance with the addition of specific performance enhancers.

16

Figure 2.1: Waterfall Model

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                              ┌────────────────────────┐
                              │ Phase 1: Initiation    │
                              └────────────────────────┘
┌────────────────────┐        ┌────────────────────────┐
│ System not feasible│────────│ Phase 2: Feasibility   │
└────────────────────┘        │ Assessment             │
                              └────────────────────────┘
   ┌────────────────────┐      ┌────────────────────────┐
   │ Change in system   │──────│ Phase 3: System        │
   │ requirements       │      │ Analysis               │
   └────────────────────┘      └────────────────────────┘
      ┌──────────────────────┐ ┌────────────────────────┐
      │ Requirements unclear │─│ Phase 4: System        │
      │ or cannot be met     │ │ Design                 │
      └──────────────────────┘ └────────────────────────┘
         ┌──────────────────┐   ┌────────────────────────┐
         │ Design error or  │───│ Phase 5: System Build  │
         │ oversight        │   └────────────────────────┘
         └──────────────────┘
            ┌────────────────┐  ┌────────────────────────┐
            │ System error   │──│ Phase 6: Implementation│
            │ discovered     │  │ and Changeover         │
            └────────────────┘  └────────────────────────┘
                                 ┌────────────────────────┐
                                 │ Phase 7: Review and    │
                                 │ Maintenance            │
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```
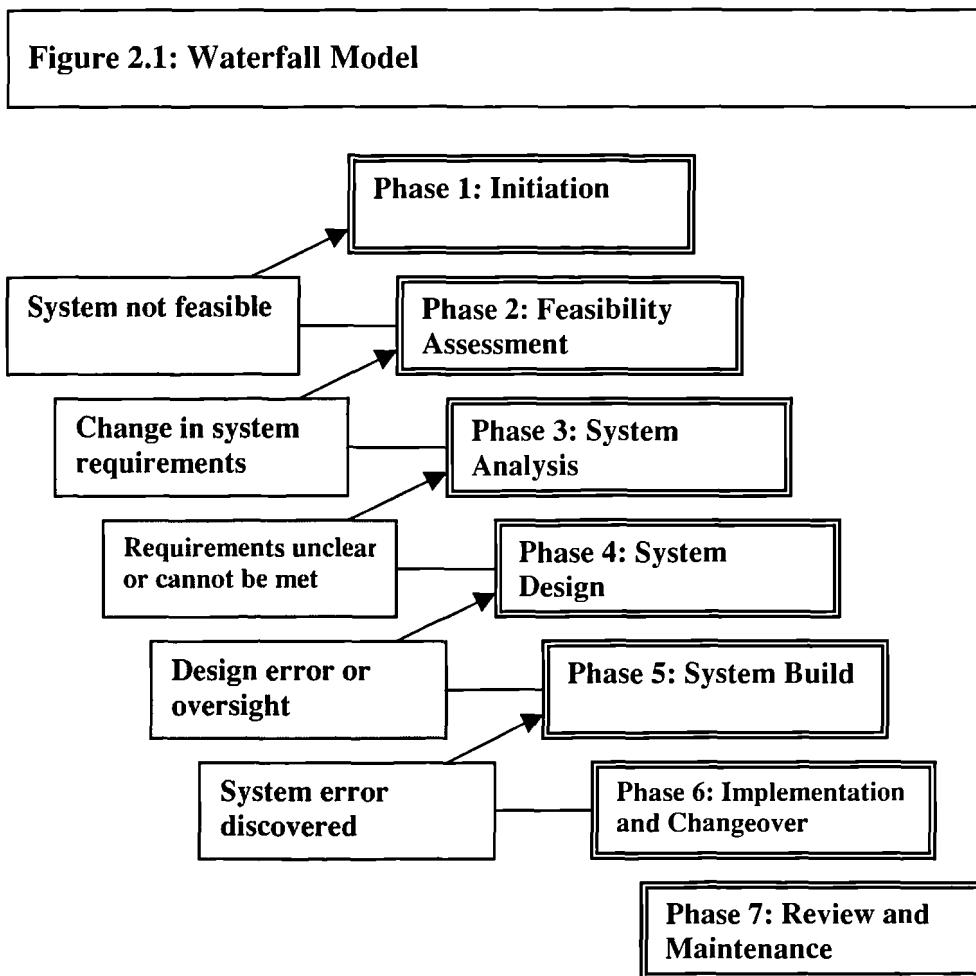
The Waterfall model has been widely accepted as it is seen to have these strengths:

- The model has been extensively tested.

- The model enables the employment of standards to ensure the completion of specifications.

- The model allows for the involvement and training of system users.

- The defined phases allow the placement of project schedules.

- A review of phase deliverables is possible at the end of each phase.

- The phases allow the management of tasks.

However, the Waterfall model has a number of potential weaknesses. Bocij *et al.* (1999) claims that traditional life-cycles can fail as the result of the following:

- The traditional life-cycle model requires a long duration to complete, leaving the possibility that business needs change during the development process, which can in turn modify the original need for the project in some way, such as a change in the requirements list.

- The model assumes that all requirements from the project can be identified before designing begins and that those requirements are stable.

- The traditional life-cycle model is phase sensitive, forcing system designers to make initial assumptions that may not be reversible during the later phases

- A gap of understanding in design requirements between users and system designers may occur if users (or system designers) have not successfully communicated their ideas and needs.

- System designers have a tendency to isolate themselves from users, which may produce a system that meets specifications, but is alien to users.

- Focusing on delivering an IT/IS system according to specifications, rather than an IT/IS system that satisfies user needs, may deliver a system that is not suitable for the expanding needs of the organisation.

The Waterfall has a Feasibility Assessment and a Review phase, which permits IT/IS evaluation to take place. However, during other phases of the life-cycle, only a review of deliverables is possible at the end of each phase. As a result, the Waterfall may not allow for continuous evaluation as recommended by Willcocks and Lester (1999).

2.4 Non-Traditional Life Cycle Models

As noted in section 2.2, life-cycle models represent philosophies that aim to guide the organisation of activities that engineer the IT/IS system. Potential weaknesses in the philosophy of the Waterfall model motivated researchers to suggest other life-cycle models (non-traditional or non-sequential), which can be used to guide the analysis, design, deployment and evaluation activities. The next three sub-sections present a discussion of non-traditional life-cycle models, highlighting their strengths over the Waterfall model and the role of IT/IS evaluation within them.

2.4.1 Prototyping

Prototyping was suggested by Dearnley and Mayhew (1983), as well as Boar (1984), to overcome two pitfalls of the traditional life-cycle models. Namely, to reduce the duration needed to complete the cycle and increase feedback between developers and users. Essentially, prototyping advocates the quick development of a working model that is illustrative of the final information system. This allows users to review the prototype and provide feedback without waiting until Phase 6 of the Waterfall model (Implementation and Changeover). Once the prototype has served its purpose (that is allowed users to preview the final version of the information system) it can either be thrown away or expanded to form a physical base of the final IT/IS. Avison and Fitzgerald (1995) suggest that prototyping is useful when:

- The application area is not well defined.
- The organisation is not familiar with the technology.
- The communication between system designers and users is not good.
- The cost of rejection by users is very high.
- There is a requirement to assess the impact of prospective IT/IS on a continuous basis.

Hickman *et al.* (1989) criticised the prototyping philosophy for encouraging undisciplined development, which could result in low technical quality. Smith (1991) agrees with this view, stating that poor development can produce a working IT/IS system that agrees with user needs, but may not be appropriate for the organisation. However, the main criticism of prototyping is that it evaluates on the basis of feedback from users, which potentially allows large volumes of quantitative and qualitative data to go unrecognised (Galal, 1996).

2.4.2 Spiral Model

The Spiral model (Boehm 1988) builds on the weaknesses of the traditional life-cycle model and prototyping by providing a more solid guidance on the way alternative designs should be generated and evaluated, whilst maintaining the prototyping philosophy. Each spiral consists of five main tasks:

- Planning to include the establishment of project objectives and alternative solutions.
- Risk analysis of each alternative solution.
- Engineering.
- Building phase with coding and testing.
- Customer evaluation.

The advantage of using the Spiral model includes its ability to modify the project at several stages during development, due to its design flexibility. As such, it guides system developers into accounting for risk, by making decisions on which additional life-cycle models should be employed to eliminate the risk (Davis, 1982). Also, building an information system in phases allows better calculation of costs, thus potentially simplifying the IT/IS evaluation task. Furthermore, by applying the Spiral model, users have a stronger grip on the development direction of the system's functionality. Finally, as the level of user participation is high, they are more knowledgeable about the system and therefore more likely to use it.

The Spiral model has been criticised for relying too heavily on identifying potential risk, which can be a complex task and dependant on the knowledge and experience of the developer (Boehm, 1988). Boehm adds that the greatest difficulty in applying the Spiral model is with prioritising the importance of the identified risk. On the IT/IS evaluation side, the Spiral model promotes continuous evaluation, but fails to provide guidance on the appropriateness of the evaluation criteria.

2.4.3 Gilb's Evolutionary Development

On the premise that project specifications can never be complete, as organisations move through an ever changing context, thus continually altering their requirements, Gilb (1988) proposed an evolutionary model to cope with these evolving IT/IS needs. Essentially, the model advocates identifying the smallest useful part of the system, which can be constructed and delivered quickly, at the lowest possible cost. Gilb labels the identified parts of the IT/IS system as deliveries. Gilb's philosophy (as represented by the model) is that the final outcome from implementing the system can not be established until the event takes place. As such, the model guides system developers towards constructing small parts of the system in periods not to exceed a few weeks, so that changes to the organisational context will have a minimal effect on the delivery.

This life-cycle model may not be unproductive if the deliveries did not belong to some master plan. Gilb insists that at the outset of implementing the Evolutionary life-cycle model, a global solution should be established, where the organisation has decided on the ultimate strategic purpose of the IT/IS investment. The global solution needs to be flexible enough to accommodate micro projects that produce the deliveries, without deciding on the specifications of those deliveries. Details of the deliveries are only addressed when their construction becomes necessary and then they have to be evaluated for contributing to the global solution. Furthermore, when the magnitude is big enough, feedback from the deliveries may be used to alter the global solution, which further stresses the need for a flexible global solution.

In addition to its flexibility, the model differs from the Waterfall life-cycle by allowing for the incremental development of the IT/IS system, which makes user feedback an essential part of the model's philosophy. In terms of similarities with the Waterfall life-cycle, Gilb's Evolutionary model prescribes a sequence of activities to guide the development of the deliveries in a systematic fashion. This life-cycle model does not have a defined start point, and it does not believe that IT/IS systems terminate, but go on moving from one delivery to another. As such, traditional evaluation is limited to assessing the impact of a delivery whilst keeping the global solution in mind. The model does suggest quantifying the opinion of experts by using an ordinal scale, but fails to account for data that may not be quantifiable.

The discussion of traditional and non-traditional life-cycle models (sections 2.3 and 2.4 respectively) demonstrate the need for IT/IS evaluation, whilst giving different emphasis on the inputs and outputs to the evaluation process. As such, different life-cycle models with different philosophical emphases may encourage the application of some IAT, whilst acting as a barrier to others.

2.5 Critique of IT/IS Investment Appraisal Taxonomies

As discussed in section 1.1, one definition of IT/IS evaluation is the assessment of value, worth, or usefulness. However these may represent different things to different decision makers. To reflect different representations of value, worth, or usefulness researchers over the years have proposed different taxonomies of IAT.

21

This section of the literature review critiques three taxonomies to establish that IAT have different characteristics, which may interfere with their application during IT/IS evaluation.

Firstly, Farbey *et al.* (1992) presented a taxonomy of ten IAT that included the level of detail required, the management process, data characteristics and the features of the method. The IAT range from simple quantitative techniques that address tangible/direct cost and benefits, to complex highly detailed qualitative techniques that address intangible/indirect cost and benefits. Farbey *et al* (1992) have two main classifications of the IAT:

- *Quantification and Comparison*: IAT that endeavour to provide precise quantification of costs and benefits and methods that enable decision makers to compare the technical characteristics of the system against other systems or against other competing projects.
- *Exploratory and Experimental*: IAT that aim to reach consensus on the objectives through the course of exploring and experimenting.

Secondly, a taxonomy of eighteen IAT is proposed by Naik and Chakravarty (1992) and further developed by Irani *et al.* (1997). The taxonomy classified IAT as economic, strategic, analytical and integrated.

- *Economic* IAT focus on tangible costs and benefits, are used to assess the cash value of the IT/IS system and are typically used by accountants. Furthermore, they ignore intangible costs and benefits, but are capable of representing project risk through the manipulation of variables. This category includes techniques such as Payback (Huang and Sakurai, 1990), Return on Investment (ROI) (Pavone, 1983) and Net Present Value (NPV) (Kaplan, 1984).
- *Strategic* IAT are not as structured as Economic IAT, but take into account tangible and intangible costs and benefits. Strategic IAT also take into account the long-term implications of the IT/IS system on the organisation. This category includes techniques such as Technical Importance/Research and Development (Meredith and Suresh, 1986), Competitive Advantage (Parker *et al.*, 1988) and Critical Success Factors (Rockart, 1979).

- *Analytical* IAT are subjective in nature, but are highly structured. They account for tangible and intangible costs and benefits. Furthermore, they are able to accommodate the risk factor in the assessment. This category includes techniques such as Non-numeric (Suresh and Meredith, 1985), Scoring Models (Nelson, 1986) and Risk analysis (Swamidass and Waller, 1991).

- *Integrated* IAT have the ability to combine financial with non-financial dimensions of IAT, by assessing weighting factors with intangible implications of the project. Also, these types of IAT accommodate the risk factor. This category includes techniques such as Multi-Attribute Utility Theory (Sloggy, 1984), Information Economics (Parker *et al.*, 1988) and Balanced Scorecards (Kaplan and Norton, 1992).

Finally, another taxonomy is that presented recently by Renkema (2000). In it is an alphabetical list of sixty-one IAT gathered for a survey during the mid 1990s. Renkema (2000) acknowledges that the list is not extensive due to continuous development and publishing of IAT in the general literature. Furthermore, Renkema claims that consulting companies use specific IAT and will not discuss them to maintain the competitive advantage. Renkema (2000) also gives a list of ten IAT that are classified according to their type and key characteristics (as discussed in section 2.5). Renkema's categories against the characteristics of the of IAT are as follows:

- *The Financial Approach* includes IAT that must translate all impacts to a monetary value. They focus on cash flows that are directly attributable to the investment, are traditionally used to justify investments in large corporations, and function by forecasting financial returns before the IT/IS project is implemented.

- *The Multi-Criteria Approach* combines quantitative and qualitative decision making criteria. The IAT function by developing a list of decision criteria and assigning a score to each item, as well as assigning the level of importance to each alternative, by means of weights. By multiplying the scores to each alternative, the most suitable choice should appear.

- *The Ratio Approach* places financial criteria in ratios, such as IT/IS expenditure versus total income. These IAT may accommodate non-financial impacts. For example, financial expenditure versus total number of employees.

23

- *The Portfolio Approach* plots in a grid several IT/IS investment alternatives against decision-making criteria. This approach has less decision-making criteria than the *Multi-Criteria Approach*.

Critiquing IAT taxonomies demonstrates that whilst applying IAT, decision makers need to take into consideration the type of data that is to be produced (quantitative, qualitative, or a mixture), the type of system to be evaluated (Appendix A2) and the detail with which the organisation is willing to participate in the evaluation process. Failing to do so may cause the employment of an unsuitable IAT, thus acting as a potential barrier to the application of the appropriate IAT.

2.6 IT/IS Evaluation Challenges (Barriers To Investment appraisal techniques)

Research (Kydd, 1989; Bocij *et al.*, 1999; Renkema, 2000) shows that there are IT/IS Evaluation challenges, which in turn infer barriers to the application of IAT. Essentially, these barriers force the decision maker to choose some IAT over others. Barriers may exist due to the organisational context, characteristics of IAT and type of IT/IS system (Farbey *at al.*, 1993). The next seven sub-sections discuss IT/IS evaluation challenges as reported by the normative literature.

2.6.1 Nature of Direct/Indirect Costs, Tangible and Intangible Benefits

As noted in section 1.1, the evaluation of IT will not be the same as the evaluation of IS, as the evaluation of IS should reflect the human and organisational components of IT. Failure to recognise that difference between IT and IS can place decision makers at a disadvantage as they may invest IT whilst wanting to invest in IS. As such, the evaluation process will be challenged in assessing the IS if decision makers only see the IT. Other evaluation challenges may come by way of cost identification. Research by Remenyi (1995) shows that costs associated with IT/IS investments come from a variety of direct and indirect sources and in different stages of the IT/IS life-cycle. Whilst direct costs, such as the price of hardware and software, are visible and quantifiable, indirect costs, such as system downtime and unpredicted user training, may not be obvious to the decision maker. As such the evaluation process may inadvertently ignore indirect costs, causing rapid increases in the IT/IS budget (Willcocks and Graeser 2001).

24

In a similar manner, evaluation may recognise tangible benefits, such as among others reduced processing time and higher data storage capacity, whilst failing to acknowledge non-financial benefits, such as user satisfaction and improved corporate image (Ballantine et al. 1998). It is important to note that research by Primrose (1990) has argued against challenges to IT/IS evaluation from the identification of intangible benefits and costs. Indeed, according to Primrose (1990) the notion of intangibles does not exist, and all cost and benefits can be described in tangible terms. Some IAT, such as among others Value Analysis (Rivard and Kuff, 1989) and X-Gap (Kaplan, 1986). For example, Value Analysis is concerned with the evaluation of benefits not costs. It recognises that the value of intangibles can come from management's ability to make a better decision, and the value added to the organisation as a result of that decision. Value Analysis has the ability of establishing values for outcomes (also intangibles). X-Gap uses Net Present Value (NPV). In the case of negative NPV (X-Gap), management can decide to look at intangibles and decide to integrate them into the evaluation equation or not. This method gives decision maker the ability to control the justification project by allowing (or not allowing) intangibles to alter the outcome.

The quantification of costs, and identification of benefits, is dependent on the type of IT/IS project (Appendix A2), as different types IT/IS projects will include a different set of costs and benefits. For example, whilst projects that automate processes usually have tangible costs and visible benefits, strategic IT/IS investments often have indirect costs and will take time before the benefits surface. As such, decision makers need to recognise that different IT/IS projects will have different cost and benefits, requiring different treatment and approach to evaluation (Cronk & Fitzgerald, 1997). Furthermore, the portfolio of cost and benefits will change in response to the ever-evolving technology. This will reflect on evaluation as Kydd (1989) points out that the ability to predict the future benefits of the system will dictate, in the present, the IAT used to evaluate that system. As such, the decision maker must always be mindful of new technology developments and how it reflects on the evaluation process.

When combined, the issues of IT vs. IS, costs/benefits, project types and new technology will almost certainly require the decision maker to have extensive knowledge about the organisation, its context and its needs just to identify the IAT that would be suitable for the evaluation process.

This type of knowledge seldom exists in one person. As such, the issues presented above will present challenges to the evaluation process and may impede the application of IAT.

2.6.2 Characteristics of IAT

Decision makers must be aware that different investment appraisal techniques (IAT) will have different characteristics (Renkema, 2000) and therefore should be used in accordance with their characteristics. For example, NPV may be a suitable IAT for automated projects where costs and benefits are more on the direct and visible side. However, NPV will not represent the value of a strategic investment where costs are on the intangible side because benefits surface in the long term. Renkema (2000) suggested that IAT have the following characteristics:

- The *objective of the method* will limit it to specific types of IT/IS evaluation projects, based on the system being evaluated. The IT/IS system that will be deployed on a departmental level will only require IAT that can cope with the requirements of a single department. However, the same IAT used in the last example may not be suitable if the system was going to be implemented in all departments in the organisation. Therefore, IAT may only be suitable if they are used with projects that fit their limitations. Furthermore, the IAT may only be suitable for evaluating certain applications. In this case, the IAT may not be used because it cannot produce a meaningful evaluation due to the nature of the system.

- *Evaluation criteria of the method* are the limitations imposed on the IAT because it includes the decision maker's list of criteria to accept an investment proposal and to compare it with other investment proposals. In this case, the IAT may not be used because it will not have the ability to represent the criteria(s) needed to evaluate the system.

- *Support of the decision making process* indicates the limit to which an IAT can be used in evaluation. The IAT may only be able to represent intangible benefits to a certain degree, which may not satisfy the decision maker's criteria. In this case, an IAT may not be used because its criteria fits the requirements needed for the evaluation, but not to the extent where it could produce a meaningful representation.

- *Measurement scale of the method* may force the decision maker to select one IAT over another because it fits the outcome of the evaluation format.

IAT may use a nominal scale, using labels such as investment, value improvement, or numerical labels 1, 2 and 3 investments.

- The IAT may use an *ordinal scale*, showing whether an investment is better or worse than another investment, but not how much better or worse. Also, an IAT can use an Interval scale, which can represent how much better or worse an investment is. Finally, a Ratio scale may be used by an IAT, which gives a number with absolute zero, such as $10,000. In this case, the scale is simply not suitable for representing the data needed from the evaluation.

IT/IS evaluation must take into consideration the data needs of the evaluation recipient alongside the characteristics of the IAT, as data produced by the IAT will reflect its characteristics. For example, IRR is based on numerical inputs and cannot produce non-numerical outputs. Essentially, data produced by the IAT will only be useful if it meets the requirements of the decision maker. Failing to do so can cause a knock-on effect leading to a lack of definition in IT/IS requirements (Waterlow & Monniot, 1986) and ultimately, the misinterpretation of users' needs (Hill & Jons, 1992; Kotter and Heskett, 1992). Therefore, matching the IAT to data requirements is a continuously challenging task for decision makers. It is also important to note that lack of awareness by decision makers towards the available selection of IAT can further complicate the evaluation process (Clemons, 1991).

2.6.3 Evaluation Practices of the Organisation

The IT/IS evaluation process may be complicated by deliberate or unintentional organisational practices. For example, the corporation may deliberately wish to ensure control over new IT/IS investments in its subsidiaries. To achieve that wish, the corporation may decide to monitor and prioritise all new IT/IS investment proposals, or even compare them to other (non IT/IS) proposals. To do this type of benchmarking, the corporate policy will need to include criteria for the evaluation of IT/IS investments. The criteria can indicate which IAT to use, thus moving decision makers away from other IAT. As a result, the corporate policy would deliberately challenge the evaluation process if the specified IAT were not suitable for the evaluation task (Farbey *et al.*, 1993). The presence of this type of corporate policy is usually justified by stating that it serves the greater good of the corporation, or at least is perceived to do so.

Political force may result from having a senior position, financial influence, or control over the stakeholder voice. Political forces can persuade the adaptation or abandonment of IT/IS projects by controlling the evaluation process. For example, political forces inside the organisation may push managers to think of short-term visible results as opposed to long-term strategic benefits (Irani *et al.*, 1999[a]). Here, the evaluation process, if conducted, is deliberately put to use to justify an outcome that has already been decided. Thus, the use of IAT has little or no value if it does not meet the criteria of the political force (Jones and Hughes, 2001).

Inadvertently, budgetary practices in the organisation may present challenges for the IT/IS evaluation process. Research (Banister *et al.*, 2001) shows that organisations often allocate budgets on an annual base, especially in the public sector where income is dependent on government support and external financing (such as tax). In such situations, the planning process is restricted to annual plans since the availability of future financial resources is undetermined. Therefore departments wishing to invest in IT/IS systems will have to estimate the availability of future financial resources. In effect, departments will have added pressure to only pursue projects that pay off in the short-term. This reflects on the IT/IS investment process, as those carrying out the evaluation will be reluctant to justify expenses over the long term, or even to suggest a system that will consume unknown organisational resources.

However, IT/IS investments seldom justify their expense and deliver benefits in the short term (Remenyi, 1995). This forces decision makers to evaluate IT/IS investments in such a way that it appears to payoff in the short term. As such, the evaluation process is transformed from a tool that assesses the impact of technology on the organisation to being a persuasion tool that aligns decision makers into accepting the IT/IS investment proposal. Here, evaluation may only apply IAT that serve to emphasise the short-term visible benefits.

The IT/IS evaluation process may also be unintentionally complicated if departments do not share information about the financial resources available to them. Here, practising the ideology of departmental budgets (rather than organisational budgets) will limit the ability of the evaluation process in taking into account the financial resources available to the project.

Based on inadequate data, the results of the IT/IS evaluation process may produce insufficient data to meaningfully decide on the appropriateness of a proposed IT/IS investment. This leaves decision makers with a choice to invest blindfolded, not to invest, or to redo the evaluation in such a way that it produces different results, which are more relevant at a departmental level. Budgetary practices may also conceal the full costs of IT/IS maintenance (Willcocks, 1992). For example, training and unplanned maintenance are often outside the official budget (Lin and Pervan, 2001). Therefore IT/IS evaluation will not include those hidden costs in its assessment, which might thus affect the final decision.

Finally, the organisation may unintentionally complicate the IT/IS evaluation process by not allocating the needed resource for the task (Irani et al., 1997). This can include making available the labour force to carry out the activity, securing the time of users that need to be involved, or even allocating the funds to finance the evaluation project. The organisation may also impose a time limit (time caps) on decision makers, thus not allowing the process to take a sufficient duration to complete.

Time is one of the more common resources that imposes limitations, often resulting in the deployment of an IT/IS system that requires more pre-launch testing (Griffiths, 1994). Furthermore, research (Remenyi & Sherwood-Smith, 1999) shows that very few post-implementation evaluations actually take place in industry, pointing that the unavailability of organisational resources may be the cause. Lack of resources may push decision makers to compromise on the quantity and/or quality of the evaluation data collection and analysis effort to conserve on available resources.

2.6.4 Forced IT/IS Projects

There are situations where the organisation cannot afford not to invest in IT/IS. For example, government regulations may force software to be updated on a periodic basis, thus forcing upgrades on the organisation regardless of the cost or the added advantage to the customer. Also, organisations may need to replace a system immediately if it crashes beyond salvation. For instance, an organisation may need to ensure the continuity of its service to its clients (hospitals, banks, police) at the expense of the new investment. The organisation may also be forced to invest in an IT/IS project as a response to competitors.

In all these situations, IT/IS evaluation is virtually non-existent, or is at best carried out as a formality to satisfy organisational rules and regulations (Willcocks and Lester, 1999). As such, forced IT/IS projects on the organisation may eliminate the need to evaluate the IT/IS investment, thus potentially acting as a barrier to the application of IAT.

2.6.5 System Development and Operation

During IT/IS system development, decision makers base their assessment on specific variables. For example, the number of users, the data processing capacity and the functionality of software. The decision makers combine the variables, make a number of assumptions, such as future demand for extra data storage, and form the equation (not necessarily numerical) upon which the ultimate verdict will be based. After the system is deployed, the very same variables are put to the test (benchmarking) to assess if the system delivered the desired benefits at the expected costs. As such, alterations to those variables will complicate the evaluation effort. Alterations may occur during the development stage (for example, users adding functions to the software and thus adding development costs).

Alterations may also occur after the system is deployed (for example, the organisation launches a new product line which requires new hardware). In both cases, IT/IS evaluation will have to be undertaken again to account for the new variables, thus questioning assumptions made earlier during the development stage. Furthermore, any alterations to the system will have secondary affects that may, or may not be quantifiable or tangible thus posing further challenges to the IT/IS evaluation effort. As such the degree of control over the scope of the IT/IS investment will affect the IT/IS evaluation process.

2.6.6 Different Platforms, Operating Systems and Languages

Research shows that organisations hardly ever have a single approach for implementing IT/IS systems, depending on different computer platforms, operating systems, a variety of standards and computer languages (Markus and Tanis, 1999; Brown, 2000). Essentially, IT/IS systems were developed to solve specific needs, thus creating incompatible islands of technology (Duke *et al.*, 1999).

It is often necessary for islands of technology to work with coherence for the department to perform its task, which gave new importance to integrating applications (Klasell and Dudgeon, 1998). However, integrating applications is still in its early days, which gives room for islands of technology to challenge IT/IS evaluation in distinguishing between costs and benefits. For example, incompatible IT/IS systems produce redundant databases (Klasell and Dudgeon, 1998), thus requiring cross-allocation of human and financial resources, which can complicate tracing back the costs of those databases to their primary users (Kalakota and Robinson, 1999). As a result, IAT that function by identifying absolute costs and benefits (such as cost benefit analysis) may be excluded from the evaluation process if decision makers are unable to attribute the costs and benefits to their original source.

2.6.7 Evolving IT/IS Systems

Gilb's (1988) Evolutionary Life-cycle model is applied on IT/IS systems that do not have a clear starting point, or a known termination point. Paul (1994) describes such IT/IS systems as living, which can complicate IT/IS evaluation when attempting to verify if the investment actually delivered the predicted benefits at the estimated costs. Here, the IT/IS system has gone through an evolution to a point where its beginnings are lost to the evaluation process. As such, costs and benefits, as perceived by traditional IAT, may represent a moving target.

2.7 Summary and Conclusions

This chapter has presented a review of IT/IS life-cycle models for the purpose of establishing the IT/IS evaluation in them. In doing so, setting a foundation by which the forthcoming chapter can design a conceptual model. The life-cycle models reviewed were:

- The Waterfall Model.
- Spiral Model.
- Prototyping.
- Gilb's Evolutionary Development Model.

31

It can be seen clearly that no generic way of life-cycle can fit all organisational needs. As such, the availability of different life cycle models (traditional and non-traditional) may be useful as it enables decision makers to have some flexibility with when, why and how they evaluate their IT/IS. In turn, when, why and how systems are evaluated will depend on the organisational (and decision makers') perception of value, worth or usefulness of IT/IS. As such, to gain an understanding of that perception, research into IT/IS evaluation could investigate IT/IS justification procedures and evaluation practices within the real life context of the organisation.

The literature review of life-cycle models also demonstrated that IT/IS evaluation may occur in different stages (phases) of the life-cycle to serve a specific IT/IS evaluation role. As such, it can be seen clearly that no single IAT can fit all evaluation roles. IAT taxonomies may be a useful guide for decision makers when choosing the IAT for their evaluation needs, as taxonomies reflect different characteristics and potential uses of IAT. However, the availability of different IAT taxonomies also reflects the inability of researchers to reach some form of consensus as to which IAT should be applied and in what situation. Although differences in taxonomies are generally considered healthy by academics as it encourages debate, decision makers wanting to choose the appropriate IAT can find navigating taxonomies challenging.

It is also apparent from the literature review that advancements in technology have changed the evaluation process as incremental systems extend the life-cycle of systems. Thus, making it difficult for decision makers to see what is the impact of the technology on the organisation. Incremental systems may ultimately make life-cycle models obsolete, as the usefulness of life-cycle models will be judged by the ability of decision makers to apply them. Incremental systems represent just one challenge to IT/IS evaluation, and potentially the application of IAT. As such, identifying barriers to the application of IAT may in part rest with research into challenges to IT/IS evaluation, as the normative literature continues to infer a relationship between them. However, before this relationship can be established, empirical data must be collected, analysed and debated among researchers and practitioners.

Chapter 3

Conceptual Model and Proposition Testing

This chapter presents a novel model that could be used as a frame of reference for practitioners to use as a tool to facilitate a better understanding of the effect of barriers to the application of investment appraisal techniques (IAT) in the public sector. A frame of references may be useful, as IT/IS systems are becoming an integral part of the business operation due to technological developments and global competition. The importance of the frame of references will be displayed through its ability to express the interaction between IAT and barriers to their application. To produce the frame of reference, this research will introduce a conceptual model (an empirically untested version of the frame of reference) and use propositions to establish the validity of barriers to the application of IAT.

3.1 The Need for a Frame of Reference

This dissertation proposes to develop a *frame of reference* that can recognise barriers to the application of IAT. The need for the *frame of reference* stems from the need of decision maker to improve IT/IS evaluation practices, which can potentially act towards reducing IT/IS project failure. The exact percentage of IT/IS project failure is not known, as organisations are more likely to conceal it than make to known to the public. However, Remenyi (1996) reported that IT/IS projects continue to fail, as the success rate of IT/IS projects is equal to the rate of failure. Booty (1998) is of the opinion that one-third of projects that implement systems across the organisation fail to deliver the benefits specified by users. Beynon-Davies and Blyth (2000) stress that IT/IS failure is commonplace and that it occurs if the system does not meet user expectations.

Reports on IT/IS project failure have been coming in for the last three decades, and may in part be due to the exclusion of non-financial IAT (Khalifa *et al.*, 2002). Bocij *et al.* (1999) state that IT/IS failure is still (as attributed by Lyytinen and Hirschheim in 1987) due to the poor designing of system structures, poor management of development processes and poor consideration given to changing environments. Khalifa *et al.* (2000[a]) indicate that failure can be due to the inability of the organisation to assess the information flow of their systems and use it to construct system designs that satisfy IT/IS project needs. Farbey *et al.* (1993) maintains that the cause of failure has roots in the early stages of project development, especially when system developers fail to recognise the wide array of costs and benefits associated with the project, such as those produced by the second order effects of implementing a large IT/IS project. Farbey *et al.* (1993) explains that when the project is large enough, it can have the capability to alter the relationship between the organisation and its customers, suppliers and competitors. Therefore, the new system can bring about a new way of doing things and may change the culture and social structure of the organisation, thus delivering unpredicted benefits (or disadvantages).

On the course of reducing IT/IS project failure, one potential action is to improve IT/IS evaluation practices (Khalifa et al., 2001[b]), as section 1.1 has demonstrated the many positive roles evaluation can perform during the IT/IS life-cycle.

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Improving IT/IS evaluation practices may rest on developing life-cycle models that enable the recognition of barriers to the application of IAT, during IT/IS evaluation. Therefore, there is a necessity to develop a *frame of reference* that would identify a range of barriers restricting the application of IAT. It would facilitate better understanding of the effects of barriers to the application of IAT. The *frame of reference* can be employed by decision makers who may wish to consider such barriers during the justification of IT/IS investments. However, to develop the *frame of reference*, a conceptual model (empirically untested version of the *frame of reference*) is needed to begin the process of moulding the *frame of reference*. Specifically, the conceptual model would:

- Bring together the thoughts and ideas that emerged from the literature review.
- Represent the issue(s) that will be investigated by the empirical inquiry.
- Enable the visualisation of barriers to the application of IAT, during the IT/IS life-cycle.
- Prompt the suggestion of Propositions, which will be used to test aspects of the conceptual model.
- Through the Propositions, Units of Analysis (UOA) will be devised to test the propositions. In doing so, the characteristics of the UOA will dictate (or at least point to) the methodology to be used in the empirical enquiry.

Moving the conceptual model to a working *frame of reference* requires verifying its applicability by subjecting it to empirical findings. Testing the conceptual model is vital for a number of reasons, and they are:

- To verify the validity of the model, testing of its aspects is required, through collecting data relevant to the UOA.
- Trough the empirical enquiry, the collected data can be analysed to indicate the dominant barriers from the case studies.
- Those barriers can then be related back, and integrated into the conceptual model, were it might be viewed as a managerial *frame of reference*.

3.2 Barriers to the Application of Investment Appraisal Techniques:
A Conceptual Model

Section 2.6 detailed how IT/IS evaluation is challenged by a number of issues, including: nature of direct/indirect costs, tangible and intangible benefits; characteristics of IAT; evaluation practices of the organisation; forced IT/IS projects; system development and operation; different platforms, operating systems and languages and; evolving IT/IS systems. Any of those challenging issues may result in a barrier to the application of IAT (Khalifa *et al.*, 1999). Furthermore, section 1.5 argued that much research is needed in the public sector, possibly by analysing IT/IS evaluation practices in it. Therefore to move the dissertation forward it is necessary to develop a research question, one that clearly identifies the area under investigation and directly addresses the overall aim of the dissertation (section 1.6.1). Consequently, the following research question for this dissertation was developed as:

Research Question: *How and why does the public sector justify IT/IS during the adaptation of information systems?*

In response to the research question, a conceptual model is developed to represent the impact of barriers that lead to the exclusion of IAT during the IT/IS life-cycle in the public sector. Chapter 2 reviewed traditional (Waterfall model) and non-traditional life-cycle models (Prototyping, Spiral, and Gelb's models), in doing so, Chapter 2 has enabled the construction of the conceptual model, based upon the foundation of one of the reviewed life-cycle models.

Whilst taking into account the strengths and weaknesses of the reviewed life-cycle models, this dissertation will base the conceptual model on the traditional life-cycle philosophy. As such, the conceptual model presented in this chapter will not redevelop the life-cycle phases, but will utilise features of the Waterfall Model (Royce, 1970) and expand on it to illustrate the occurrence of barriers to the application of IAT during IT/IS evaluation. The conceptual model has, eight phases representing the life-cycle of the IT/IS system (figure 3.1).

The conceptual model advocates that the application of IAT is not necessarily restricted to the official Feasibility Assessment phase (as indicated in the Waterfall model), but can occur during the initial Departmental Investment Proposal (Phase 1 of the conceptual model) for the purpose of gaining approval from immediate departmental management, and during the Organisational Feasibility Assessment (Phase 2 of the conceptual mode), which is similar to the Waterfall model. In doing so, the conceptual model will indicate that barriers to the application of IAT can occur in more than one phase of the life-cycle (i.e. Phases 1 and 2). Evaluation in Phases 1 and 2 of the conceptual model is referred to as Pre-Implementation Evaluation. Descriptions of the eight phases of the conceptual model are as follows:

PHASE 1: *Departmental Investment Proposal*

In this phase, a person or user group recognises that an IT/IS investment can resolve a current need, or exploit an opportunity. To mobilise the project, a short report is produced that defines the need for the investment, as well as its costs and benefits (as perceived by the project department). To produce the proposal document, basic IAT such as Net Present Value (NVP), Payback, or Internal Rate of Return (IRR) may be applied to assess the impact on the proposed technology on the department. In this early stage, a list of benefits can be produced by consulting system users and/or basing the benefits list on that of the old system. However, the list at this phase is not detailed. The benefits list can also be used to gather cost estimations by conducting a preliminary market search.

The old system, which may or may not be IT based, has to be taken into account so that the proposed IT/IS system does not disrupt the old operation, but provides a continuation to the existing operation of the old system. If the proposed system is intended to alter the current operation, then the departmental operation in its entirety, and possibly the organisational operation, should be studied for strategic fit with the proposed IT/IS. The proposal is finally given to the department head for authorisation to prepare a formal feasibility report.

Figure 3. 1: Life-Cycle Segment of the Conceptual Model
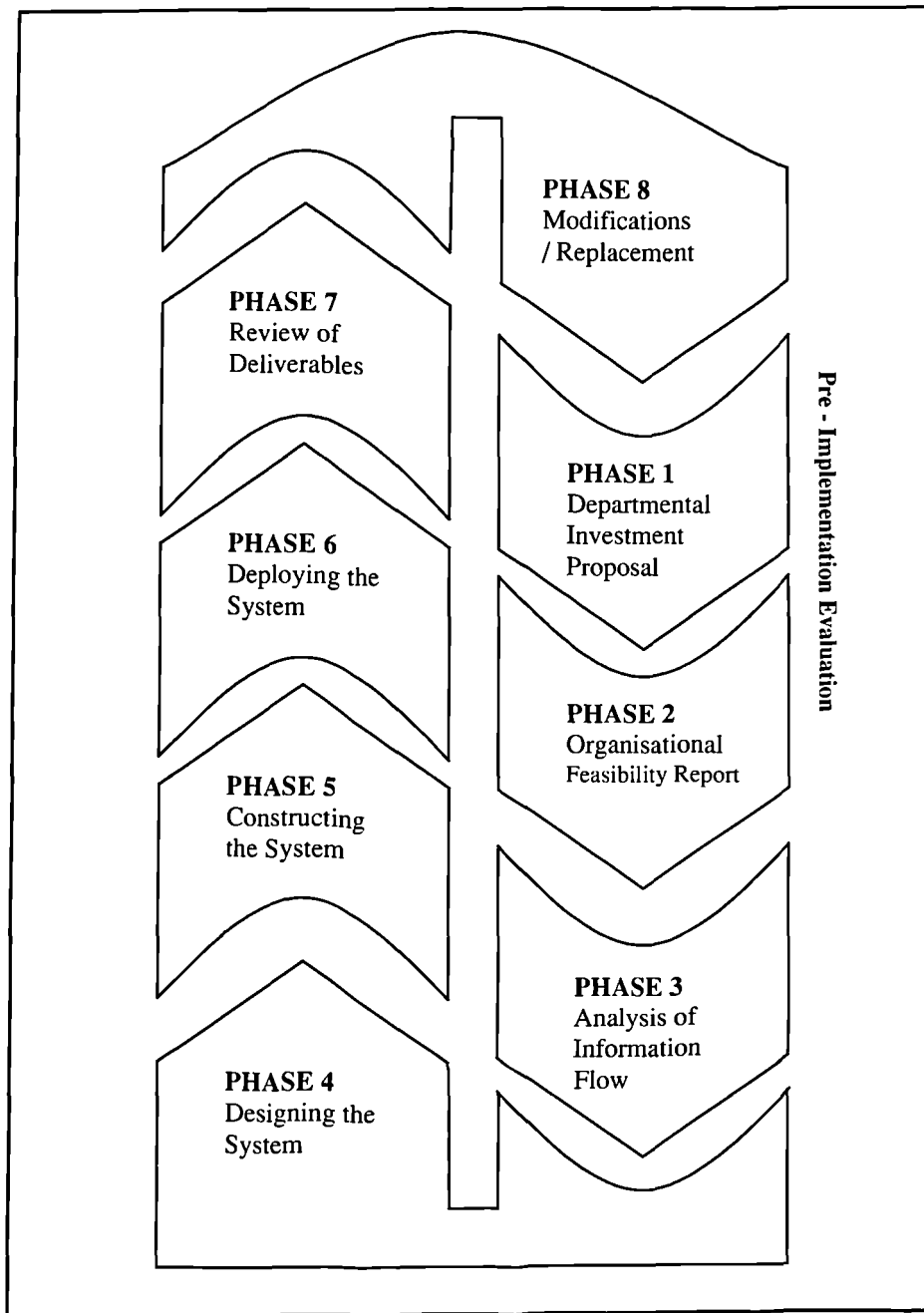
PHASE 2: Organisational Feasibility Report

In this phase, the feasibility report is prepared for the consideration of the prime decision maker and/or a steering committee. Production of the organisational feasibility report will be the responsibility of consultants and/or organisational staff. The report can address the availability of technology to construct the proposed investment, the availability of financial resources to meet the proposed investment and the implications of introducing the proposed investment on an organisational level.

The feasibility report may employ an IAT to assess the impact of the proposed technology on the organisation. Unlike the last phase, the report in this phase has extensive details of cost and benefits to enable formal (by departmental or organisational decision makers) justification of the project. To develop the feasibility report, three main activities should be conducted. Firstly, the preliminary function of the new system must be established. To do so, an inventory of desired benefits at estimated costs is composed by the project department and/or representatives of the Information and Communications Technology department (ICT). Here, an IAT may be employed to evaluate the proposed system.

Secondly, to estimate the cost of the project, the ICT department may search the market for prices to gain an actual estimation of the direct project costs, such as the price of hardware procurement and software development. Alternatively, and if dictated by the rules and regulations of the organisation, vendors are given an abbreviated form of the full tender, where the vendors submit estimations to the project costs. This may be limited to five or less vendors if the project size does not require an open tender. Finally, studying the implications of deploying the system is a prediction of the future. However, employee surveys, consultancy reports and simulation modelling may be employed, which will form part of the final report. The end product of this phase is the production of a feasibility report by which the decision makers can give the go ahead for proceeding to the next phase.

PHASE 3: *Analysis of Information Flow*

The aim in this phase is to study the current flow of information in the project department and its relevance on an organisational level. To do this, initial diagrams are produced by system developers (Information and Communications Technology Department (ICT) or an external organisation) by an analysis of the current information system in place to determine the information flow. Users next verify the accurate representation diagrams in accordance with their needs. The process is then repeated using the list of benefits from the last phase to produce complete diagrams of the new system, which are then used to develop a detailed requirements specification.

PHASE 4: *Designing the System*

This phase uses the diagrams produced in the last phase to design the detailed technical features of the new system. This would be the responsibility of ICT, if the system were to be designed internally. Alternatively, if the system were to be tendered, an invitation to tender (ITT) is given to vendors. In this phase the tender in not abbreviated and will include hardware, software and cable requirements. Also, the speed and capacity of the system must be determined here. The number of vendors who reply to the tender can be narrowed down by the organisation (with a survey for example). The vendor(s) awarded the tender will proceed to design the system according to the given specifications. The design will address the configuration and capacity of the database, hardware, software, as well as the number of system operators. In the case where a vendor is not employed, the responsibility of the design would fall to the ICT department.

PHASE 5: *Constructing the System*

Whilst developing the software, and assembling the hardware, the database is designed according to specifications. An off the shelf package may suit the organisational needs and therefore must be considered when possible. Also, user manuals are developed here for training and maintenance purposes. The technical performance of the system is also tested prior to deployment.

PHASE 6: *Deploying the System*

In this phase, workstations, cables and databases are placed in their pre-assigned locations. The database is populated and/or data is transferred from the old system. The organisation may choose to operate the two systems simultaneously until users are more comfortable with the new system.

PHASE 7: *Review of Deliverables*

After a pre-defined period of time (usually six months), users participate in a post-implementation evaluation activity by which the features of the new system are compared with the original benefits inventory. Technical performance of the system may also be evaluated for compliance with specifications.

PHASE 8: *Modifications/Replacement*

After the system has been in operation in the organisation for some time, users may see an opportunity to improve upon the system, or amend a defect in it. Once the system is modified beyond a maintainable situation, the department may proceed back to Phase 1 where the life-cycle is continued.

3.3 How Does This Model Differ From Its Predecessors

In addition to the eight phases described in the last section, the conceptual model of figure 3.1 is expanded in figure 3.2 to show the complete version of the conceptual model, which demonstrates the relationship between IAT, barriers and Phases 1 and 2. The conceptual model in figure 3.2 is designed to show the existence of barriers to the application of IAT in the public sector. The conceptual model argues that decision makers can, at some point during the IT/IS evaluation process, develop a list of IAT for potential application during IT/IS evaluation process. Consequently (states the model), whilst considering the list of IAT to apply, decision makers will encounter at least three barriers to the application of IAT. Those barriers can permit decision makers to apply some of the IAT in the developed list, whilst preventing them from applying others. It is important to not that is model does not state what should be included in the developed list of IAT, only that the list needs to be developed as decision makers see fit to do so. The model suggests that the organisational IT/IS justification process (Barrier 1), the lack of available time to perform IT/IS evaluation (Barrier 2), and the lack of financial support for evaluation (Barrier 3) can impede the application of IAT. The explanation and justification for those three barriers will be detailed in section 3.4.

Key to this conceptual model is the emphasis that IAT can be applied in not just one (as the Waterfall model suggests), but *two* phases during pre-implementation evaluation (Phases 1 and 2). The conceptual model proposed in this research (figure 3.2) brings the notion of continuous evaluation in the context of the traditional life-cycle philosophy one step closer by suggesting that evaluation may employ IAT during the first two phases and in the seventh phase (Review of Deliverables).

41

Figure 3. 2: Conceptual Model for Barriers to the Application of IAT
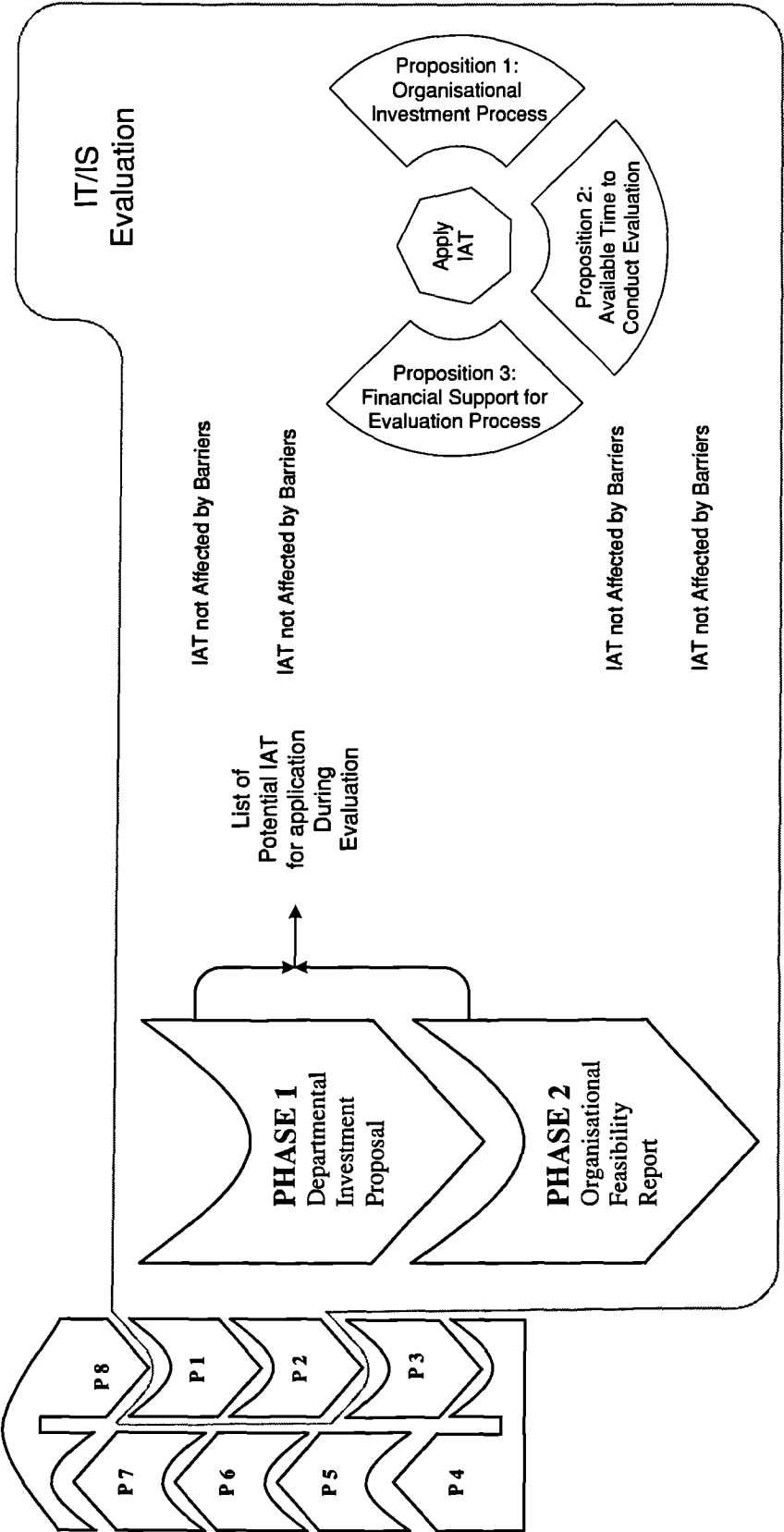
It is also important to note that the barriers might affect different IAT differently and in varying phases. Therefore, whilst preventing the application of (for example) NPV in phase 2, the same barrier might permit its application in phase 1. Specifying if one barrier always occurs before, after, or at the same time, as another IAT is not the focus of this model, as this model seeks to bring awareness to the existence of the barriers and not debate their effects on a specific IAT in a specific phase. The explanation and justification for the three specified barriers of figure 3.2 will follow.

3. 4 Propositions

As noted in section 3.3, propositions will be used in this research to test the validity of barriers within the empirical study. Propositions focus the research on what to study (Yin, 1994), focusing the research to a defined area. As such, the first proposition acts as the main guide for the research direction (figure 3.3) and essentially restates the overall intention of the research (see section 1.6.1). The main guiding Proposition is as follows:

Main Guiding Proposition: *There are barriers that prevent the application of particular Investment appraisal techniques.*

Figure 3.3: Relationship Between Propositions
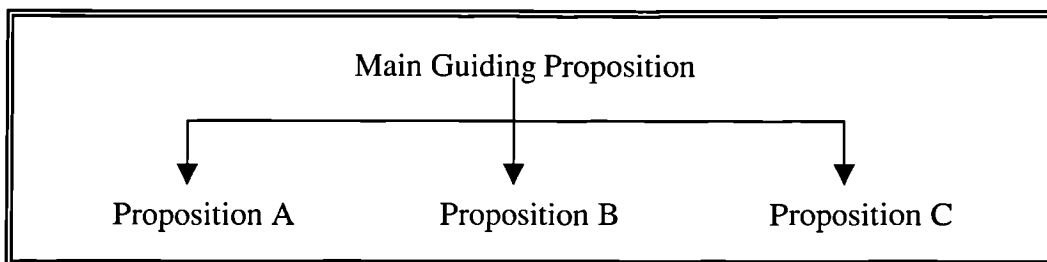
The main guiding proposition asserts that there are obstacles completely restricting decision makers, or at least limiting them, from applying IAT during the evaluation of new IT/IS investments. The source of these obstacles (or barriers) may possibly be a deliberate or accidental component, internal or external to the organisation. Considering the wide area potential sources of barriers, the main guiding proposition will prove difficult to test as the nature and number of these barriers may prove to be extensive, as will as time and case sensitive. Consequently, sub-propositions will be suggested that target specific barriers.

3.4.1 Proposition A

Farbey *et al.* (1993) suggests that a corporate policy, when present, will limit corporate subsidiaries from using any IAT that does not align with the evaluation policy guidelines. Effectively, decision makers will block out any possibility of using a new IAT if it does not correspond with the policy guidelines. The purpose of such a policy is to develop a measuring stick by which the investment practices of all subsidiaries are set against and to insure consistency in evaluation practices. The measuring stick (or benchmarking approach) can force subsidiaries to apply the same IAT in dissimilar conditions (Butler *et al.*, 1993; Khalifa *et al.*, 2000[b]). The intention here is that the good of the corporation will outweigh the good of the corporate subsidiary. In the case of a singular company (not a corporation with many subsidiary organisations), Avison and Fitzgerald (1995) state that in many organisations, the corporate IT/IS strategy group[1] and the IT/IS steering committee[2] dictate the process by which systems are evaluated. Corporations set standards to manage their operations, which will create rules and regulations and over time they become part of the organisational character, thus shaping its internal value system. Organisations evolve in response to internal needs and external pressures, but that does not mean that the *way* they value things will change. It seems that regardless of how much awareness there is about tangible and intangible costs and benefits, decision makers continue to apply financially based techniques because it is part of their standing orders, or unofficial process (unchallenged evaluation habits of decision makers). Therefore, understanding organisational IT/IS evaluation rules and regulations is key to understanding the barriers to the application of IAT. As such, the following proposition is given as the first barrier to be introduced in the conceptual model. It states that:

Proposition A: *Organisational IT/IS evaluation process will prescribe the use of specific investment appraisal techniques.*

This proposition asserts that official (or unofficial) criteria by which the organisation justifies its new IT/IS investments will include rules and regulations, which in turn will limit the evaluator to apply a specific IAT, if any.

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[1] Composed of top managers, division heads, and the ICT director
[2] Composed of middle management in the project department and representatives of ICT

Such rules and regulations may possibly be part of an ICT procurement policy, the preference of a departmental manager, or a directive issued by the corporate headquarters of the organisation. Rules and regulations may also represent the informal practice traditionally applied in organisations for such justifications.

3.4.2 Proposition B

Through capital budgeting and resource planning, organisations are able to take on projects to satisfy a need or exploit an opportunity. However, needs and opportunities are not immune to time, as both of them will lose their value beyond a specific period. As such, capital budgeting and resource planning of IT/IS projects dictates the completion of the system development process within a specific period of time, which in turn can limit the IT/IS evaluation process to a specific completion date. As discussed in section 2.5, IAT have different characteristics to accommodate the diversified IT/IS evaluation roles (section 1.1). Investment appraisal techniques will require different types of data (quantitative and/or qualitative), in different quantities (departmental or organisational level) and from different sources (internal and/or external to the organisation). Some IAT will require more time to complete than others, depending on the size and function of the system under consideration. It also depends on the number of decision makers involved, and the number of participating users in the evaluation process. Accordingly, decision makers may only be able to apply an IAT if the technique can be completed within the period allowed for the evaluation process. Time limitations may also exist due to external pressures such as new government legislation, which forces the organisation to implement a new system within a specific period of time.

Griffiths, (1994) states that time caps (pre-specified completion dates) are one of the more common resources that impose limitations, often resulting in the deployment of a system that requires more pre-launch testing, thus pointing to the limited application of IAT. The relationship between the application of IAT and time allowed for the IT/IS evaluation process is unproven and therefore warrants further research. As such, the following proposition is given as the second barrier to be introduced in the conceptual model. It states that:

45

Proposition B: *The choice of the investment appraisal technique will be restricted by the time available to perform the task.*

This proposition asserts that, when employed, the type of IAT selected will depend on the time available for the decision maker to apply it. This proposition does not target the factors that contribute to time limitations, but states that it can be a barrier to the implementation of IAT. If proven within the confines of the empirical study, this proposition will show the need to make scheduling flexible enough to allow decision makers to choose the IAT.

3.4.3 Proposition C

IAT have different characteristics (Irani *et al.*, 1998) and therefore can vary in implementation costs. For example, if the IAT requires detailed analysis of systems and stakeholders (such as Cost Benefit Analysis), then the organisation may have to employ sufficient staff to carry out the process. Also, the organisation may need to move staff from their current assignments and involve them in the evaluation process. In addition, the systems being evaluated may have to be taken off line, which may disrupt the current production and delivery of products and services, all of which can add to the cost of the evaluation process (Khalifa et al, 2001[a]). Therefore, the organisation might decide to simplify the evaluation process and apply an IAT that does not necessarily need detailed analysis, thus reducing the cost of the evaluation process and adhering to the available budget for evaluation. Based on this, the following proposition is given as the third and final barrier to be introduced in the conceptual model (figure 3.2). It states that:

Proposition C: *Investment appraisal techniques will be excluded from the evaluation process due to lack of financial support.*

This proposition asserts that the cost of conducting IT/IS evaluation will dictate which IAT is applied, according to the availability of organisational funds. The proposition assumes a direct relationship between the act of choosing the IAT and the financial restrictions influencing the decision maker.

Here, IAT are not selected because they would best serve the evaluation process, but rather because they are in line with the allocated budget for the evaluation process. Consequently, the unavailability of financial support for the evaluation process may act as a barrier to the application of IAT, forcing the evaluator to exclude IAT that would need a budget greater than that allocated. If proven within the confines of the empirical study, this proposition will show practitioners the need to allocate the budget that would allow decision makers to apply the appropriate IAT for the evaluation process.

3.5 Summary and Conclusions

This chapter has presented a conceptual mode that is based in part on the traditional life-cycle model. The conceptual mode also represents the effects of barriers to the application of IAT during the IT/IS evaluation process. The conceptual mode is underpinned by three propositions that name the *organisational IT/IS evaluation process*, *time available to perform IT/IS evaluation*, and *financial support for IT/IS evaluation* as barriers. The purpose of the conceptual mode is to develop a *frame of reference* that may be used by decision makers to recognise barriers to the application of IAT as named in the conceptual mode.

The conceptual model is a starting point towards the dissertation contribution to the body of knowledge, not an end product. As such, any assumptions made in the conceptual model will be evaluated after the empirical inquiry. Particularly, basing the conceptual model on the traditional life-cycle may not be appropriate, as not all systems in organisations have a definitive starting and ending point. The review in chapter 2 has demonstrated that diverse organisational needs may push the employment of integrated technologies of different platforms, operating systems and languages. As such, traditional life-cycle models may not be suitable for application on incremental systems that employ islands of technology. A non-traditional life-cycle model, such as the Spiral model, or Gilb's evolutionary development model, my be more representative of systems in industry. Therefore, it is important to reiterate that the conceptual model is a starting point, not an end product.

Chapter 4

Research Methodology

This chapter presents the way in which the aims and objectives of the empirical inquiry will be satisfied. Here, a discussion on the issues affecting the selection of an appropriate research methodology is given. The discussion includes: (i) identification of the characteristics unique to the intended empirical study; (ii) an account of different research approaches (strategies), and; (iii) justification of the research strategy in light of those study characteristics. The discussion will conclude the application of a strategy that employs a multi-case study for the purpose of theory testing. The strategy will also have an interpretive epistemological stance that employs qualitative research methods. Then, the chapter moves into a detailed discussion of the empirical research methodology. That discussion describes three independent parts, as follows: (i) Research Design; (ii) Case Study Data Collection; and (iii) Case Study Data Analysis. Next, the Case Study action plan or Protocol is described and discussed to include: (i) Case Study Overview; (ii) Fieldwork Research Procedures; (iii) Questions Addressed by the Research; and (iv) Research Output Format. Conclusions are the final component of this chapter.

4.1 Introduction

This dissertation endeavour to increase the body of knowledge, in the area of IT/IS evaluation, with focus on the barriers to the application of investment appraisal techniques (IAT). By identifying barriers, and integrating them into a conceptual model, researchers and practitioners will become more alert to their effect(s) on the system development process. Such a conceptual model was suggested in Chapter 3 (figure 3.2), specifying organisational IT/IS justification process, in addition to time and financial limitations as the barriers to IAT. In developing the conceptual model beyond conception, empirical data will need to be generated. The empirical data will test (within the confines of the study) the validity of the propositions suggested in Chapter 3. Also, the empirical data will permit enhancement to the conceptual model presented in figure 3.2. By doing so, specific barriers to the application of IAT will be acknowledged and a *frame of reference* will be available for decision makers to consult.

Galliers (1992) defines research strategy as the means of going about one's research, taking on a particular style and utilizing different research methods with which to collect data. Therefore, to decide on a strategy that would dictate the way in which data is collected and analysed, characteristics of the intended empirical study must be identified, different research approaches (strategies) must be reviewed, and a research strategy must be justified in light of those study characteristics.

4.2 Characteristics of The Intended Empirical Study

The characteristics of the research inquiry will greatly influence the selection of an appropriate research strategy (Yin, 1994). As such, the previous chapters reported on a phenomenon (section 1.4), suggested a research question (section 3.2), formulated a main proposition (or theory) (section 3.4) and developed sub-propositions to support the testing aspects of the conceptual model (figure 3.2) all of which are summarised in table 4.1. To test the validity of each proposition, the relevant data needs to be collected through an empirical study. However, the data characteristics (quantitative and/or qualitative, epistemological stance) must be specified before deciding on a research strategy. To do so, each proposition must be broken down into a series of research units that point to what should (and should not) be studied (Yin, 1994).

49

When combined, each set of units will scientifically prove the validity of the propositions within the confines of the empirical study. The *Units of Analysis* (UOA) for the intended empirical enquiry are summarised in table 4.1 and is followed by a discussion of the issues.

Research Issue	Description
Phenomenon	IT/IS investment decision makers over the last decade have preferred the use of financially based (traditional) IAT, or have ignored IAT and relied on gut feel or act of faith type investments.
Research Question	How and Why do organisations justify IT/IS during the systems development process?
Theory	There are barriers that prevent the application of particular Investment appraisal techniques.
Propositions	(A) Organisational IT/IS evaluation process will prescribe the use of specific investment appraisal techniques (B) The choice of the Investment Appraisal Technique will be restricted by the time available to perform the task, and (C) Investment appraisal techniques will be excluded from the evaluation process due to lack of financial support.
Units of Analysis	(A) Organisational Context (B) IT/IS Investment Process, and (C) IT/IS Evaluation Practices.

Table 4.1: Characteristics of the Research Inquiry

4.2.1 Units of Analysis: Proposition A

Proposition A addresses the effect(s) of the organisational IT/IS justification process on the application of IAT. In addressing this proposition, the empirical study must look at the organisational context as a whole and specifically on the IT/IS justification procedures. Therefore, the investigation must start by collecting data about the function of the organisation, the products and services it provides, departmental structure, clients, employees, general economic status, competitors and external legislation that governs its actions. Here, the focus of the first unit of analysis is to establish a picture of the organisational context, which will set the foundation towards explaining IT/IS justification practices.

As such, those items of data covering the organisational IT/IS justification process will be addressed by the unit of analysis under the heading of *Organisational Context*.

Next, the investigation needs to form a strong understanding about the rules and regulations that govern the official IT/IS justification process. To do so, data is required about the system development process in the organisation, decision making structure, key decision makers, as well as committees and groups responsible for developing and carrying out the decisions. If the case study is part of a corporation, then data will be collected about the IT/IS procurement policies of the corporation, capital budgeting program, as well as any IT/IS justification guidelines that the corporation issues to its subsidiaries. Whilst collecting required data, the unit of analysis will seek to uncover official directives that dictate the specific use of an IAT, if any. As such, those items of data covering the official IT/IS justification process will be addressed by the unit of analysis under the heading of *IT/IS Investment Process*.

To complete the investigation into Proposition A, data must be collected to reflect the *actual* IT/IS justification process. To do so, previously attempted and completed IT/IS projects will be analysed for justification practices. Also, comments by employees into the unofficial justification idiosyncrasies will be analysed. The main focus here for this unit of analysis is to seek to uncover unofficial practices that lead to the specific use of an IAT, if any. As such, those items of data covering the actual IT/IS justification process will be addressed by the unit of analysis under the heading of *IT/IS Evaluation Practices*.

4.2.2 Units of Analysis: Proposition B

Proposition B addresses the effect(s) of capital budgeting and resource planning on system development. It looks to establish a relationship between the time allowed (by planning) to conduct IT/IS evaluation and the IAT applied to it. As such, the empirical inquiry will need to utilise units of analysis similar to that of Proposition A (that is *Organisational Context, Investment Process* and *Evaluation Practices*). However, the emphasis here is not on the actual rules and regulations that result in a time allowed to complete the IT/IS evaluation process, but on the effect of time caps imposed on the application of IAT. Especially in the case of the latter two units of analysis (that is *Investment Process* and *Evaluation Practices*).

51

Therefore, whilst UOA for Proposition A aims to find rules and regulations that specify the use of an IAT (thus excluding all other IAT), UOA for Proposition B aims to detect practices that force time limitations on IT/IS evaluation. Thus, attributing time limitations as a barrier to the application of IAT.

4.2.3 Units of Analysis: Proposition C

Proposition C addresses the effect(s) of budgeting on system development. It looks to establish a relationship between the availability of financial resources (through budgeting) allocated to the IT/IS evaluation process and the IAT applied. The empirical inquiry will need to utilise units of analysis similar to that of proposition A (that is *Organisational Context, Investment Process* and *Evaluation Practices*). However, the emphasis here is also different from that of proposition A. That is to say, the main focus of inquiry here for the units of analysis is to establish that due to restrictions from financial resources, there is not enough support to apply the majority of IAT. Rather, the organisation was forced to apply a specific IAT.

4.3 Selecting A Research Strategy

This section proceeds with reviewing and deciding on research approach alternatives that would ultimately specify the research strategy. The alternatives include the epistemological stance (positivist or interpretivist); the type of data (qualitative and/or quantitative); and features of research strategy. Alternatives are decided in the following sub-sections on the basis of the characteristics of the UOA (table 4.2).

4.3.1 Epistemological Stance and Data Type

In IS research, it is conventional to refer to Epistemology (Hirschheim and Kelin, 1989; Burrell and Morgan, 1979; Archer, 1988). The Merriam-Webster dictionary defines epistemology as *"the study or a theory of the nature and grounds of knowledge especially with reference to its limits and validity"*. According to Burrell and Morgan (1979), the nature of knowledge is either viewed as hard, objective and tangible, or as soft, subjective and intangible.

	Requires Subjective/Intangible data	Requires Linking Case Study Variables	Requires Multiple Sources of Data	Requires Rich Primary Data	*Interpretations from Researchers Point of View*
Proposition A					
Organisational Context	✓	✓	✓	✓	✓
Investment Process	✓	✓	✓	✓	✓
Evaluation Practices	✓	✓	✓	✓	✓
Proposition B					
Organisational Context	✓	✓	✓	✓	✓
Investment Process	✓	✓	✓	✓	✓
Evaluation Practices	✓	✓	✓	✓	✓
Proposition C					
Organisational Context	✓	✓	✓	✓	✓
Investment Process	✓	✓	✓	✓	✓
Evaluation Practices	✓	✓	✓	✓	✓

Table 4.2: Summary of UOA Characteristics

Those who agree with the former view (positivist) believe that knowledge may be learned or communicated and those who agree with the latter view (interpretivist) believe that knowledge can only be gained through observation and personal experience. The two views have an impact on empirical research strategy, as the former (positivist) dictates that the researcher take the role of an observer, whilst the latter view (interpretive) dictates that the researcher gains knowledge by participating in the subject of the empirical study (Irani *et al.*, 1999[b]).

Units of Analysis, discussed in section 4.2, will dictate the *kind* of data needed to test the propositions, thus pointing to the epistemological stance. For instance, the *Organisational Context* seeks to form a picture about the background and setting of the case study. This requires information on the character and nature of the organisation. This type of data seems to be subjective and possible intangible, as it depends on the perspective of the data provider. Furthermore, the second Unit of Analysis (*Investment Practices*) fundamentally addresses the unofficial behaviour of the decision maker that might lead to the exclusion of IAT. Again, the data is subjective and biased to perspectives.

Finally, *Evaluation Practices* is the last Unit of Analysis that aims to uncover a relationship between previous attempted IT/IS projects and the treatment of them by decision makers. The data here is clearly soft and confidential as the record of those events will more than likely vary from one source to another. Therefore, in all three Units of Analysis, the empirical study needs to gain data from human sources, thus requiring face-to-face contact. Also, rich primary data can be gained by reading spoken but unsaid answers from the interviewee, thus reflecting a more accurate record of organisational practices and behaviours. The data required by the Units of Analysis show that an interpretive epistemological stance is needed and would appear to require qualitative data. However, before the decision is made on employing qualitative data, this dissertation will review the strengths and weakness of this kind of information. Denizen and Lincoln (1994) define qualitative research as the "*study things in their natural settings, attempting to make sense of, or interpret, phenomena in terms of the meaning people bring to them*". Research shows (Benbasat and Weber, 1996) that qualitative research can be desirable for the following reasons:

- It allows close involvement of the researcher in the situation, resulting in a considerable insight into the events, actions and users concerned.
- The research method employed allows the barrier between the researcher and the user to be lowered.
- The method allows the researcher considerable flexibility as interviews and observations can be repeated, or allows the chosen method to be changed, thus taking different observation and asking different questions of various users.
- The researcher can study IS in their natural setting and learn about the state of the art.
- The method allows the researcher to understand the nature and complexity of the process taking place.
- Valuable insight can be gained into new topics emerging in the rapidly changing IS field.

However, qualitative research can have potential weaknesses (Lee, 1991; Miles and Huberman, 1994) that include:

- Qualitative data can be rich with detail, which may be lost during summation.

54

- Qualitative data can be unstructured and unbounded as it concerns people's behaviour and attempting to understand their perception in a particular situation.

- Data collection may take weeks or months as interviews can be repeated.

- Qualitative analysis can have a lack of controllability, deductibility, repeatability and generalisation.

- Since it is restricted to a small number of cases, generalisation is difficult.

- Since data is rich and complex, it is open to a wide range of interpretations, such that the researcher bias is a constraint danger.

- Researchers engaged in cases with frequently changing situations will find it difficult to make controlled observations, controlled deductions and predictions, which makes validity and verification very difficult for the researcher.

Furthermore, it seems that a quantitative research method would not be suitable, as Irani (1998) indicates that it would not be able to differentiate between people and objects of natural science, a research feature needed by this study. On the other hand, Remenyi and Williams (1996) advocate the use of qualitative methods in IT/IS research, as this area of science is often concerned with human and organisational idiosyncrasies. However, the suitability of qualitative methods for this research is driven by the criteria discussed in section 4.2. Namely:

- Acknowledgement that the sensitive issues and idiosyncrasies under investigation may not have been previously identified, studied and recorded.

- The study of complex variables, with participants having different perceptions.

- The need to study a phenomenon it its natural setting.

- The ability to observe a phenomenon over time.

- The need to capture 'reality' and detail within an organisational context.

- The scope and sensitivity of data required and the need for 'rich' primary data.

- The extent of behavioural, cultural and organisational control.

Finally, table 4.1 summarised the main ingredients of this research. It included a theory, followed by three propositions to be used for testing aspects of the conceptual model (figure 3.2), thus making the model more than a concept, but a working *frame of reference*. Therefore, propositions are essential in this research if decision makers are to consult the *frame of reference* with a high degree of trust.

As such, the research strategy objective must be to test the theory and propositions within the confines of the empirical study. Having considered the strength and weaknesses of qualitative research, alongside the characteristics of the UOA (table 4.2) this dissertation will employ a research strategy for the purpose of theory testing, with an interpretive epistemological stance, which will collect qualitative data.

4.3.2 Alternative Research Strategies

Cavaye, (1996) states that there are several research strategies that are suitable for collecting qualitative data. They include the following:

- *Field study*, where the researcher develops constructs (hypotheses) before entering the organisation, collects the data with certain techniques, acting as an observer and does not wish to manipulate or control variables (Stone, 1978).

- *Action research*, where the researcher both observes and participates with the organisation, does not have an idea about the phenomenon, and uses collected data to solve the issue of the phenomenon and have control over variables (Mansell, 1991).

- *Application description*, where the researcher accounts for the actual events surrounding the phenomenon for display and learning purposes to the audience (Bonoma, 1985).

- *Ethnographic research*, where the researcher attempts to understand the meaning that practitioners attach to the phenomenon and data is interpreted from the viewpoint of the practitioners (Sanday, 1979).

- *Case Studies,* where the researcher enters the study environment (with or without theoretical constructs) for the purpose of studying a phenomenon in its real life context without intending to interfere with a phenomenon (Yin, 1994).

Table 4.3 demonstrates that Field Study would not be suitable as a research strategy as it does not employ Propositions and does not aim to understand the organisational context, the two of which where justified (in sections 3.4) as necessary elements of this dissertation. Furthermore, Action Research would not be suitable a research strategy because it does not define the research area (which this dissertation does as IT/IS Evaluation), and seeks to alter the phenomenon under investigation, which this dissertation does not.

Also, Application Discretion would not be suitable as a research strategy as it does not relate findings to a predefined theory (as this research does so with Propositions), and does not attempt to contribute to the body of knowledge, which is the fundamental of the dissertation. Finally, Ethnography does not relate findings to a predefined theory (as this research does so with Propositions), and does not allow the researcher to interpret the empirical findings, as needed by this dissertation to contribute to the body of knowledge. From table 4.3, it would seem that case studies offer features that may be capable of deliver that data as required by this dissertation. Therefore, the next section will discuss the appropriateness of case studies as a research strategy.

	Case Study Research	Field Study	Action Research	Application Description	Ethnography
	✓	✓	✓	✓	✓
	✓		✓	✓	✓
	✓		✓	✓	✓
	✓	✓		✓	✓
	✓	✓		✓	✓
	✓	✓	✓		✓
	✓	✓	✓		
	✓	✓	✓	✓	

Table 4.3: Comparing The Characteristics of Case Study Research With Those of Related Strategies (Cavaye, 1996) [Page 231]

4.4 Case Study as a Research Strategy

Research strategies can be used as an exploratory tool, which aims to develop logical hypotheses and propositions to be used for further inquiry (Yin, 1994). They may also be used for a descriptive purpose, which seeks to reflect the image of a specific context, describing a sub-structure that has rarely been the topic of previous research and discovers a phenomenon (William, 1993).

Finally, research strategies may be used for an explanatory purpose, which aims to give a cause and effect relationship to a specific phenomenon. It suggests propositions to explain a path of events (Allison and Zelikow, 1999). Yin (1994) distinguished between the strategies of research to include Experiments, Surveys, Analysis of Archive Information, Histories and case studies and claims that each of them may be used as exploratory, descriptive, or explanatory. However, unlike Cavaye (1996) who specified research strategies as being suitable for qualitative research, Yin (1994) does not make the same claim about Experiments, Surveys, Analysis of Archive Information and Histories. As for case studies, they have been reported to be the most wildly used research strategy in the IS area (Myers, 1997; Cavaye, 1996; Orlikowski and Baroudi, 1991). Furthermore, they can be applied to both quantitative and qualitative research (Stake, 1994) and can be carried out using Positivism or Interpretivism (Cavaye, 1996). As for the other research strategies suggested by Yin (1994), the Merriam-Webster dictionary gives the following definitions of such research strategies:

- *Experiments:* an operation carried out under controlled conditions in order to discover an unknown effect or law, to test or establish a hypothesis, or to illustrate a known law.

- *Surveys:* to query (someone) in order to collect data for the analysis of some aspect of a group or area.

- *Histories:* a chronological record of significant events, often including an explanation of their causes.

- *Analysis of Archival Information:* an examination of records or historical documents, its elements and their relationships.

Whilst considering which research approach (strategy) to adopt, Yin (1994) argues that the way the research question is stated will drive the selection of an appropriate research strategy. Yin claims that who, what, where, how many, and how much type questions may require different research strategies depending on the extent of control a researcher needs to have over behavioural events and the degree of focus a researcher needs to have on a contemporary event (as opposed to an historic event). The summary of these criteria is presented in table 4.4.

Strategy	Form of Research Question	Requires Control Over Behavioural Event?	Focuses on Contemporary Event?
Experiment	How, Why	Yes	Yes
Survey	Who, What[1], Where, How Many, How Much	No	Yes
Archival Analysis	Who, What, Where, How Many, How Much	No	Yes/No
History	How, Why	No	No
Case Study	How, Why	No	Yes

Table 4. 4: Relevant Situations for Different Research Strategies

Further to the criteria above, Irani (1998) recognises the nature of the broader problem domain and adds the following as criteria dictating the choice of a research strategy:

- The need for a research strategy with deductive characteristics.

- The need to empirically test hypotheses or propositions.

- Acknowledgement that the sensitive issues and idiosyncrasies under investigation may not have been previously identified, studied and recorded.

- The study of complex variables with participants having different perceptions.

- The need to study a phenomenon it its natural setting.

- The ability to observe a phenomenon over time.

- The need to capture reality and detail within an organisational context.

- The scope and sensitivity of data required and the need for rich primary data.

- The extent of behavioural, cultural and organisational control.

- Resource constraints such as time and financial budget.

However, four main potential weaknesses have been linked to case studies. According to Yin (1994) and Cavaye (1996):

- Case study research can be allow vague or biased views to control the analysis of data, which can drive false conclusions.

- Case study research can be can be unstructured in its data analysis, which does not give a scientific explanation as to how other researcher can arrive at the same conclusions.

- Case study research may not provide the foundation for scientific generalisation

- Case study research can produce massive amounts of data, susceptible to multiple explanations.

- Case study research may institute a linkage between variables, but is not able to provide a direction for causation.

- Case study research may not have control over the behavioural event, and has no control over independent variables. Consequently, this may restrict the internal validity of conclusions

In selecting a research strategy, it was decided that case studies would be appropriate. Cohen and Manion (1994) state that case studies are able to observe the characteristics on individual units of analysis, such as those used in this research. Also, Yin (1994) advocates the use of a case study when a phenomenon needs to be studied in its real life context and when the borders are not clear between the variables. In the circumstances of this study, the variables exist within the units of analysis (see section 4.2) and therefore Yin's recommendation applies. Also, Cavaye (1996) suggests that a case study is able to gather rich primary data and permits the description of a complex structure. This also seems to be necessary in this research as the study focuses on the practices of an organisation.

Also, Irani et al. (1999[b]) argues that a case study would be able to collect data on group or individual behaviour in its social context, is able to identify, rationalise and explain variables and their comparative effect on the organisation. Cavaye (1996) supports this view by suggesting that the case study can be formulated to analyse more than one unit of analysis. Selecting a case study would be appropriate as the other research strategies discussed above can be dismissed. For example, using Experiments requires controlling the environment, which translates to controlling the decision making of senior staff in the organisation, a task certainly beyond the ability of the research. Histories as a research strategy can intuitively be dismissed as the empirical inquiry is dealing with a current problem, not a historic one. A Survey only asks standard questions of a large sample and therefore would not enable the researcher to alter the inquiry as needed during the data collection phase, thus limiting its ability to investigate the context. Finally, Analysis of Archival Information will not produce rich primary data that reflects the idiosyncrasies of the organisation. Furthermore, the characteristics of the UOA in Table 4.2 dictated that a case study be selected as a research strategy for the following reasons:

1. The empirical inquiry would need to study a contemporary problem, as those decision making practices are still occurring. The empirical inquiry would not however need to control the behavioural events, as it is investigating the occurrence of a phenomenon (that is decision making practices). As such, the research question asks how and why, which would be consistent with Yin's justification for a case study approach in table 4.3.

2. The propositions inquire about the effects of organisational rules and regulations on the selection of IAT. To do this, the empirical study needs to examine those effects in real life context, over a period of time to show a pattern of events. It would also require the gathering of rich primary data, from multiple sources, all of which are features of the case study strategy. In addition, face-to-face contact is needed to uncover idiosyncrasies of the unofficial practices of the organisation. Face-to-face contact will also enable the interviewer to pick-up patterns in the answers. This would be consistent with the criteria of Irani (1998).

3. The units of analysis represent a complex set of variables (section 4.2), with participants having different perceptions. Case studies have flexible deductive capabilities, able to shift the line of questioning (during the semi-structured interview) if required.

   Case studies will allow for face-to-face contact, as well as the use of field notes, written documents and archives to support the understanding of the context, all of which are vital in order to study the units of analysis.

4. Markus (1983) suggests that theory testing is indeed one function that case studies can perform (objective or research strategy). One of the main features of case studies is their ability to detect patterns of practice (Benbasat et al., 1987; Remenyi, 1991). As such, this case study would enable the researcher to collect data, as required by the units of analysis, relate them back to the propositions and test the theory within the confines of the case study.

Having considered alternative research strategies, alongside the characteristics of the UOA (table 4.2) this dissertation will employ case study as a research strategy with an interpretive epistemological stance, which will collect qualitative data.

4.5 Single vs. Multiple Case Studies

Testing propositions, and developing a *frame of reference*, is the primary objective of this thesis. As such, the number of cases conducted must enable the researcher to test the validity of the propositions within the confines of the study. A single case study would indeed provide rich primary data of the organisational context. It would enable the researcher to develop a full picture of the organisational idiosyncrasies, whilst testing the theory and propositions given in table 4.2 (Wheeler *et al.* 1993). However, a single case may not provide sufficient data that would justify conclusions about the propositions. Therefore, in the light of the characteristics of this research, a single case study will not be appropriate. Having said that, a single case will be important in testing the research methods for gathering data. This can be accomplished through conducting a pilot study were the researcher can refine the research methods and interview skills needed to collect data. This approach is advised when dealing with a complex study of human and organisational idiosyncrasies by Irani *et al.* (1999[b]).

Rather than a single case study approach, multiple cases are more appropriate for the research proposed in this dissertation. Conducting multiple cases enable the researcher to test and cross-check findings. Also, the analysis of data across organisations is possible with this strategy. Admittedly, multiple cases do not provide the richness of data that a single case study can. However, this is not necessary as the proposed line of research indicates specific data as required by the units of analysis to test the propositions. Multiple cases will provide a more robust investigation of the cause and effect relationship of the units of analysis (Herriot and Firestone, 1983), as it will be able to move the investigation from one organisational context to another thus isolating idiosyncrasies that contribute to explaining the phenomenon. Accordingly, the degree of generality would increase from the application of multiple cases studies.

The number of case studies conducted depend on how much is known about the phenomenon and how much information can be uncovered for conducting additional cases (Dyer *et al.*, 1991). However, Eisenhardt (1989) suggests that a research strategy that employs multiple case studies should not have more than ten or less than four cases. The research in this dissertation will employ the use of multiple case studies within the limits suggested by Eisenhardt.

4.6 Empirical Research Methodology

The empirical research methodology takes into account the case study variants that have been identified and justified in section 4.3 and 4.4. The methodology is presented in figure 4.1 and represents the way in which the empirical inquiry will go about accomplishing its aims and objectives (see section 1.5). The empirical research methodology is composed of three independent parts, as follows: (i) Research Design, (ii) Case Study Data Collection and (iii) Case Study Data Analysis.

4.6.1 Research Design

The research design is the first independent part of the empirical research methodology. The starting point is to review the literature, thus developing a firm understanding of the investigation domain (that is IT/IS evaluation). From that review, several sub-topics will be identified for a more focused literature review leading to a specific research area and ultimately identifying a research need. Developing a conceptual model is then conducted to represent the intended empirical research, aspects of the model will be tested through the employment of propositions. Based on the data required to test the validity of the propositions, the type of data is determined (that is quantitative and/or qualitative), the epistemological stance is determined, and a research strategy is identified.

Based on the needs of the empirical study, it was decided that the research design would utilise a multi-case study strategy for the purpose of theory testing, through the employment of qualitative research methods. The research design is now transformed into a plan of action or protocol (Friedman, 1987). Research protocols are a necessary investigation tool for a number of reasons, including;

1. To put the task of data gathering into a manageable format.
2. To insure that targeted data is collected.
3. To insure that the research follows a specific schedule.
4. To track the path at which knowledge was developed.
5. To act as a map so that others may follow to arrive at similar conclusions. This is especially needed where the issue under investigation is subjective and where the research depends on quantitative methods.

Figure 4. 1: Empirical Research Methodology
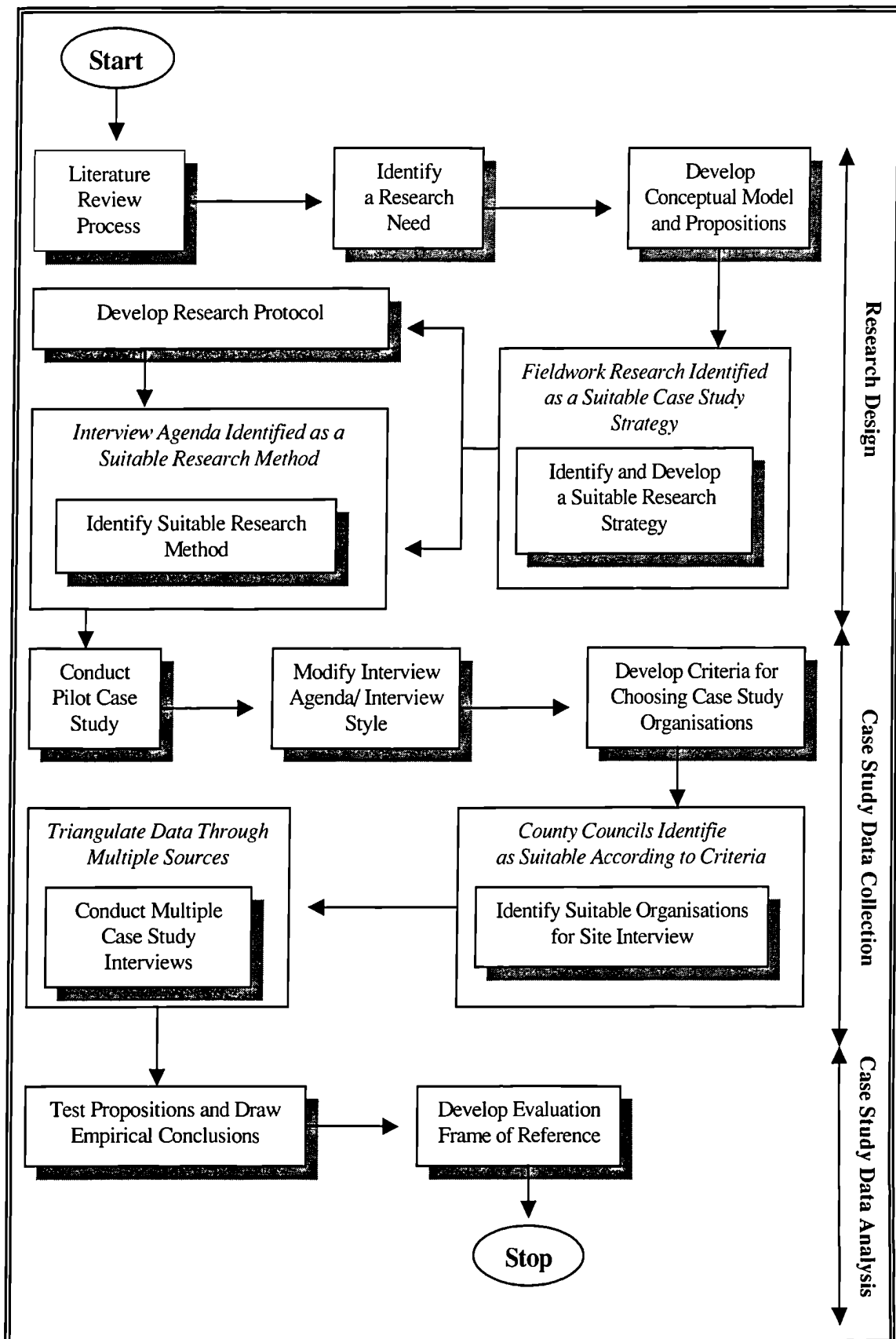
Within the protocol, a quantitative research method was developed to gather data as required by the units of analysis. The method was in the form of an interview agenda, which is a series of questions relating to the units of analysis and designed to guide the researcher during the semi-structured interviews. In addition to the interviews, data was collected through archival documents, minutes for meetings, consultancy reports and the website of the organisation.

4.6.2 Case Study Data Collection

This is the second part of the research methodology, where the first task was to establish the effectiveness of the research method. To do this, a pilot case study was performed, during which three semi-structured interviews were conducted with the use of the agenda. That pilot study allowed the refinement of the way in which questions were put to interviewees, the identification and elimination of questions, improvement of interview skills, but most importantly, the pilot study showed that the interview agenda did indeed lead to the collection of data that directly fed into the empirical inquiry. The pilot study also showed that at least 22 other organisations passed through exactly the same event that was directly related to the empirical inquiry. In addition, using cases studies from the public sector seemed convenient as the ICT director arranged the introduction by contacting peer ICT directors in other counties.

Therefore, the pilot case study indirectly contributed to the identification of further potential case study organisations. One last result from the pilot case study was that it enabled the researcher to access other organisations within that corporation, as the ICT director of the pilot case study made the introduction to other organisations. Furthermore, each of the case studies visited had resulted from an introduction by the director of the ICT department from the last case study.

The case study organisations were selected due to common similarities in their internal, and external, organisational context. For example, they were operating within the same business sector, and providing the same set of services, to similar client demographics, under the same governing legislation and economic climate. Similarities were perceived by the researcher to be of importance for the purpose of conducting cross-organisational analysis. Chapter 5 will show that all case studies were of County Councils who went

through a reorganisation effort at the same time. The number of case studies was subject to time and resource limitations, but more importantly, it depended on the stage at which the researcher had achieved sufficient depth and richness in data collection (Bassey, 1981). However it is important to specify the type of data-triangulation employed in this research. According to Patton (1987) and Flick (1992) triangulation is a tool by which data can be validated, and triangulation can be one of four types:

1. Data triangulation, where a verity of data types are used in the study.

2. Investigator triangulation, where several researcher collect the same data type from a single source.

3. Theory triangulation, where multiple perspectives are used to interpret the same set of data

4. Methodological triangulation, where multiple research strategies are used to study a single problem.

As such, to improve the quality of the data collected, data-triangulation (Bell, 1996) was employed to cross-cheek the collected information.

4.6.3 Case Study Data Analysis

This is the third and final part of the research methodology. In this section, the testing of the propositions is described by the production of the framework in figure 4.2. That framework details the role of elements within the units of analysis (section 4.2) and how they contribute to testing the theoretical propositions presented in section 3.4. Here, the main guiding proposition, which also doubles as the main theory for the thesis, represents the apex, which is underpinned by three sub-propositions. Combined, propositions A to C will contribute to testing the validity of main guiding proposition within the confines of the empirical study. Each proposition (that is A to C) has three units of analysis, although addressing the same topic area, aiming to gather data from different perspectives, and for different purposes, thus forming the basis for the empirical enquiry, which will be given in Chapter 5.

Figure 4. 2: Framework for the Testing of Propositions
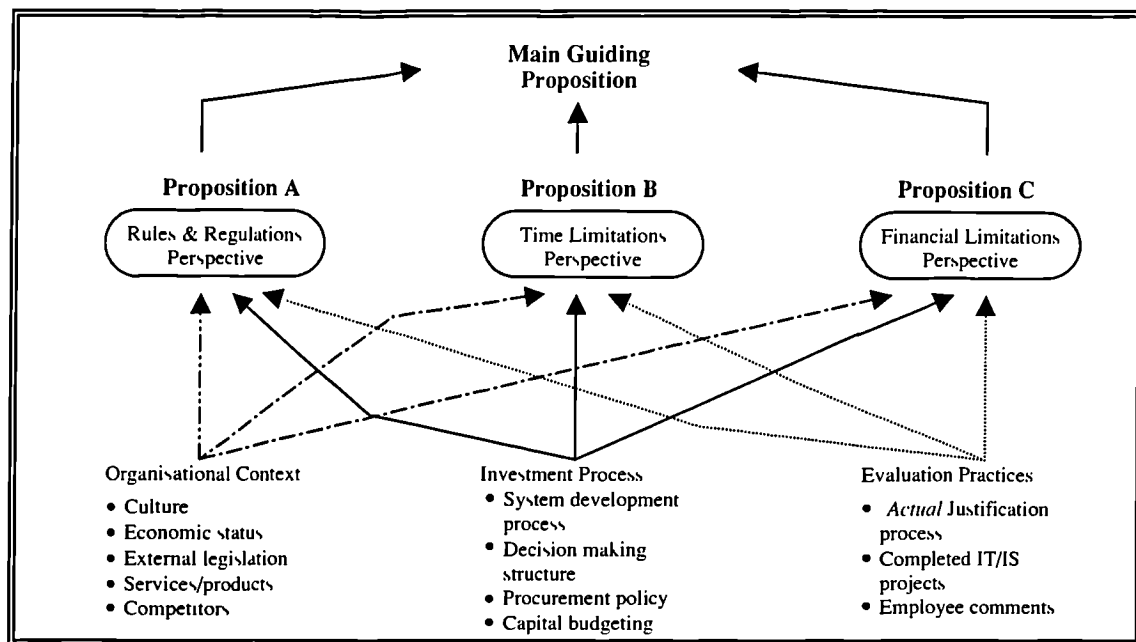
4.7 Case Study Protocol: An Operational Action Plan

A case study protocol was described by Yin (1994) as a tool that would organise the research, acting as an action plan, and setting rules and regulations by which data would be gathered. Remenyi (1991) adds that such a protocol is necessary to increase the consistency and focus of the data gathering process. The necessity of having a case study protocol was discussed by several researchers, including Friedman (1987), Remenyi (1991) and Irani et al. (1999[b]). The argument was that in situations where the empirical inquiry was subjective, and seemed to depend on irregular data gathering tools, then a scientific map of the research must be developed so that other researchers can trace the path of data collected and ultimately the knowledge created. As such, the case study protocol represents an official document that an investigator uses to schedule data gathering dates, to specify the means by which it will be gathered and to detail the objectives and procedures of the analysis. Yin (1994) suggests that case studies may have questions on five levels, as presented in table 4.5. He added that a case study protocol will outline (i) the case study overview; (ii) fieldwork research procedures; (iii) questions addressed by the research; and (iv) the research output format. As such this thesis will adopt the outline suggested by Yin and this chapter will address Level 1 and 2 questions, with other parts of the dissertation addressing the remaining Levels.

Question Level	Research Question	Section Reference
Level 1	Questions asked of specific interviewees	4.7.2
Level 2	Questions asked of an individual case study	4.7.1 / 4.7.2 / 4.7.3
Level 3	Questions asked across multiple case enquires	4.7.3
Level 4	Questions asked of entire study	1.6 / 7.1
Level 5	Questions about the recommendations and conclusions beyond the scope of the study	7.4

Table 4. 5: Questioning Levels in a Multiple Case Enquiry. Source: Yin (1994)

4.7.1 Case Study Overview

In this section of the case study protocol, the issues under investigation are detailed here, to assist the researcher in focusing on the main questions that need to be studied. These objectives reflect the needs of the research in general and on the data required by the units of analysis in specific. They are as follows:

- To identify official IT/IS investment processes in the case study organisation and its application of investment appraisal techniques (IAT) that is do they use traditional/non-traditional appraisal techniques for their justification of new investments, or do they invest in an act of faith fashion.

- To establish the actual process by which IT/IS investments are justified, through examination of previously completed IT/IS projects.

- To detect organisational barriers to the application of IAT. Targeting rules and regulations that dictate (or prohibit) the use of a type of IAT. Also, barriers as the result of limitations on the time available to perform the IT/IS evaluation process. Finally, barriers as the result of lack of financial support to the application of IAT.

4.7.2 Fieldwork Research Procedures

Performing a case study research requires the investigator to have plans and contingency plans for gathering data. Obviously appointments with interviewees will be scheduled, and documents can be requested ahead of time, but they will never be guaranteed. Furthermore, interruptions during the interview are expected, and documents may not be available, but that should not stop the investigator from completing the collection of the required data.

68

Therefore, a fieldwork procedure must be designed to cope with such events. This section of the protocol presents those procedures that will be employed during the multi-case study investigation. They are as follows:

- Specify who needs to be interviewed: ICT director in all cases needs to be interviewed, as well as senior ICT staff and senior representative of the finance department.

- Identify appropriate data gathering research methods and establish line of inquiry: interview agenda (Appendix B.1) developed and geared towards collecting rich primary data through semi-structured interviews. The agenda enabled the steering of the interview process. All interviews were taped and transcribed at a later date. Additional data to support findings was obtained from archived documents, meeting minutes, consulting reports and the website of the organisation.

- Develop data collection agenda that takes into account contingencies: in the case of failure by the interviewee to keep the appointment, predefined employees should be on stand-by. Such a measure was not required as all appointments were conducted according to schedule.

- Develop an interview timetable: dates and times were set to accommodate the interviewee needs. All employees interviewed were asked to set aside at least one hour for the meeting.

- Identify and discuss supplementary framework procedures: to insure full disclosure of information, each interviewee was given a confidentiality agreement. The agreement also applied to the organisation as a whole. Essentially, the organisation agreed that the information could be published provided its specific identity was not disclosed. Disclosing its function, number of staff and figures relating to its operation was permitted.

Conducting interviews requires the skill of being able to distinguish between what is relevant and what is added by the interviewee. It also requires the ability to make interviewees discuss issues that may be controversial and confidential. Therefore, the first step is to gain the confidence of the interviewee by establishing the presence of the confidentially agreement, in which all information disclosed will be represented without indication to the identity of the provider. Interviewees were asked to start by describing their function in the organisation. This was done to put the interviewee at ease and in the mood for the interview.

Permission was given by each employee for the taping of their interview. Once the interviewee was comfortable with the process and the presence of the tape recorder, the interview agenda was used to guide the semi-structured meeting. Upon discussing a certain point, the interviewee was not interrupted because the pilot case study showed that it would often lead to the disclosure of relevant data. Obviously, if the discussion strayed beyond the scope of the empirical inquiry, then steering was applied. To test the accuracy of the data, at least three staff members were interviewed with the same line of questioning. In addition, when applicable, organisational documents were produced to support the claims of the interviewee. Thus achieving what researchers label as data triangulation (Yin, 1994; Irani et al., 1999[B]).

4.7.3 Questions Addressed by the Researcher

In maintaining focus on the task of data collection, a set of questions was developed for the eyes of the researcher only (table 4.6). They act as a reminder of the main issues that need to be addressed and answered during each individual case study. This data is essential for the purpose of testing the propositions within the confines of the case study. Interviewees are not shown these questions, but they are used for consultation before and during the interviews to maintain some form of structure to the interview.

No.	Question
1	What is the formal IT/IS system development process for new projects?
2	What is the informal evaluation process for new IT/IS proposals?
3	What are the barriers to the application of IAT during the evaluation process?

Table 4. 6: Questions Addressed by the Empirical Inquiry

4.7.4 Research Output Format

Chapter 5 presents the empirical data analysis and the format which the output of the empirical inquiry will take. In anticipation that large amounts of data would be gathered, a case study skeleton was developed to (a) direct data to their designated location within the cases study; (b) point out missing data to the investigator; and (c) facilitate the cross-analysis of case studies. Furthermore, Appendix B.2 to B.4 presents three tables (one for each proposition) that line up questions in the interview agenda.

The interview agenda are relevant to the respective proposition, with a description of the data it aims to generate. Thus, setting guidelines to the degree of data relevance and ensuring that each question contributes to the testing of at least one proposition.

4.8 Summary and Conclusions

Qualitative data and case study research has long been accused of being unstructured, unreliable and unverifiable, which makes justifying the path by which data is collected and analysed a continuous challenge to researchers. The weaknesses and strengths of the case study approach are just a matter of perspective. That is to say, weaknesses and strengths of the case study can be the strengths and weaknesses of another research strategy. The decision to adopt or exclude a research strategy should be based on its qualities.

Although this chapter has presented the reasoning behind selecting case studies as a research strategy, that reasoning might have arrived at a different conclusion (that is not to use case studies). For example, instead of case studies, surveys could have been issued to the entire population (22 County Councils) on what they consider the barriers to be against the application of IAT. Alternatively, action research could have investigated barriers and that data could have been used to guide IT/IS justification for a current project, which might have produced a more practical *frame of reference*. Therefore, it is safe to say that other approaches should not be completely dismissed when investigating barriers to the application of IAT in the public sector.

Chapter 5

Empirical Data Analysis and Propositions Testing

This chapter commences the empirical data collection and analysis phase of the dissertation by investigating barriers to the application of investment appraisal techniques (IAT) in four public sector organisations, which serves the overall aim of the dissertation. The investigation will collect empirical data, as this will be necessary to test the propositions presented in Chapter 3. This chapter begins with a discussion of the reorganisation effort undertaken by the case study organisations in 1996 as part of a directive by the regional government to reformulate the geographical and functionality of all District and County Councils, thus forming 22 new Unitary Councils. Next, a detailed presentation of the four case studies is given, to include information relevant to IT/IS on the organisational context, investment process, evaluation practices and barriers to IAT.

The chapter then moves to establish common threads between the case studies by suggesting and discussing ten key barriers. The purpose of which is to establish grounds to draw parallels between the case studies and analyse them for occurrence patterns, which will go towards testing the propositions identified in Chapter 4. Conclusions will be presented in the final segment of this chapter.

5.1 Introduction

Increasing the body of knowledge requires exploring new frontiers of data which may be in the form of reanalysis of old data, or the creation of new data. This desertation is concerned with the latter, as new data is sought from conducting multiple case studies. Previous chapters have discussed issues regarding the use of IT/IS Investment appraisal techniques (IAT) in industry and developed a conceptual model (figure 3.3) that identifies barriers to the application of IAT. However, moving the model from a conceptual point to a functional decision-aiding *frame of reference* requires testing aspects of the conceptual model for irregularities. Those aspects were presented and discussed in the last chapter, centring around three propositions relating to the effect(s) of organisational rules and regulations, as well as time and financial limitations on the application of IAT. To test the propositions, units of analysis were developed to represent the characteristics of the intended empirical inquiry (section 4.2) and a research strategy was aligned in accordance with those characteristics. The units of analysis are as follows:

(i)   Organisational Context.

(ii)   Investment Process.

(iii)   Evaluation Practices.

Although each proposition requires the units of analysis to produce data from a different perspective (for example, UOA for proposition A required data to test the effect of organisational rules and regulations on the application of IAT, whilst UOA for proposition B required data to test the effect of time caps on the application of IAT) each case study will present one set of the three units of analysis and will include data for each of the three propositions. This is necessary due to close proximity of the data required by the propositions (that is each proposition requires data on the Organisational Context, Investment Process and Evaluation Practices). As such, reporting the case study investigation will follow the sequence of the units of analysis presented above, with a fourth section that reports on barriers to the application of IAT (table 5.1). The next section of this desertation will discuss the IT/IS reorganisation to describe a common context between the case studies.

Case Study A (Section/ U●A)	Case Study B (Section/ U●A)
5.3.1 Organisational Context	5.4.1 Organisational Context
5.3.2 Investment Process	5.4.2 Investment Process
5.3.3 Evaluation Practices	5.4.3 Evaluation Practices
5.3.4 Barriers	5.4.4 Barriers
Case Study C (Section/ U●A)	**Case Study D (Section/ U●A)**
5.5.1 Organisational Context	5.6.1 Organisational Context
5.5.2 Investment Process	5.6.2 Investment Process
5.5.3 Evaluation Practices	5.6.3 Evaluation Practices
5.5.4 Barriers	5.6.4 Barriers

Table 5. 1: Structure of Case Study Analysis

5.2 IT/IS Reorganisation

In one historically and culturally distinct region of the UK, 13 counties shared all major local government functions, including local planning, fire fighting, schools, libraries, social services, public health and sanitation, recreation, the environment and voter registration. However, in 1974 and again in the 1990s, Parliamentary reforms redrew the administrative boundaries.

In 1996, a directive was issued by the regional government to merge the functionality of all 10 Borough and 12 County Councils, forming 22 new Unitary County Councils. The reorganisation effort officially started on the 1st of April 1996 and continued for a maximum of two years (varies from one case to another). During that transition period, the task for the merging Councils was to combine the services offered by the Borough (figure 5.1) and the services offered by the County (figure 5.2), to produce a new Council able to offer the services described in figure 5.3. In most cases, mergers occurred between one Borough and one County Council. The IT/IS reorganisation team had to evaluate systems for applicability in the new operating environments, eliminate redundancies and investigate new proposals, as these activities formed the basis of the IT/IS reorganisation effort.

As such, IT/IS evaluations occurred at the same time, during the same period and under similar financial and time constraints for all County and Borough Councils. This gives researchers a valuable opportunity to study evaluation on a massive scale and gain a stronger understanding of barriers that might prohibit the application of IAT.

Figure 5. 1: Summary of Services Offered by Borough Councils
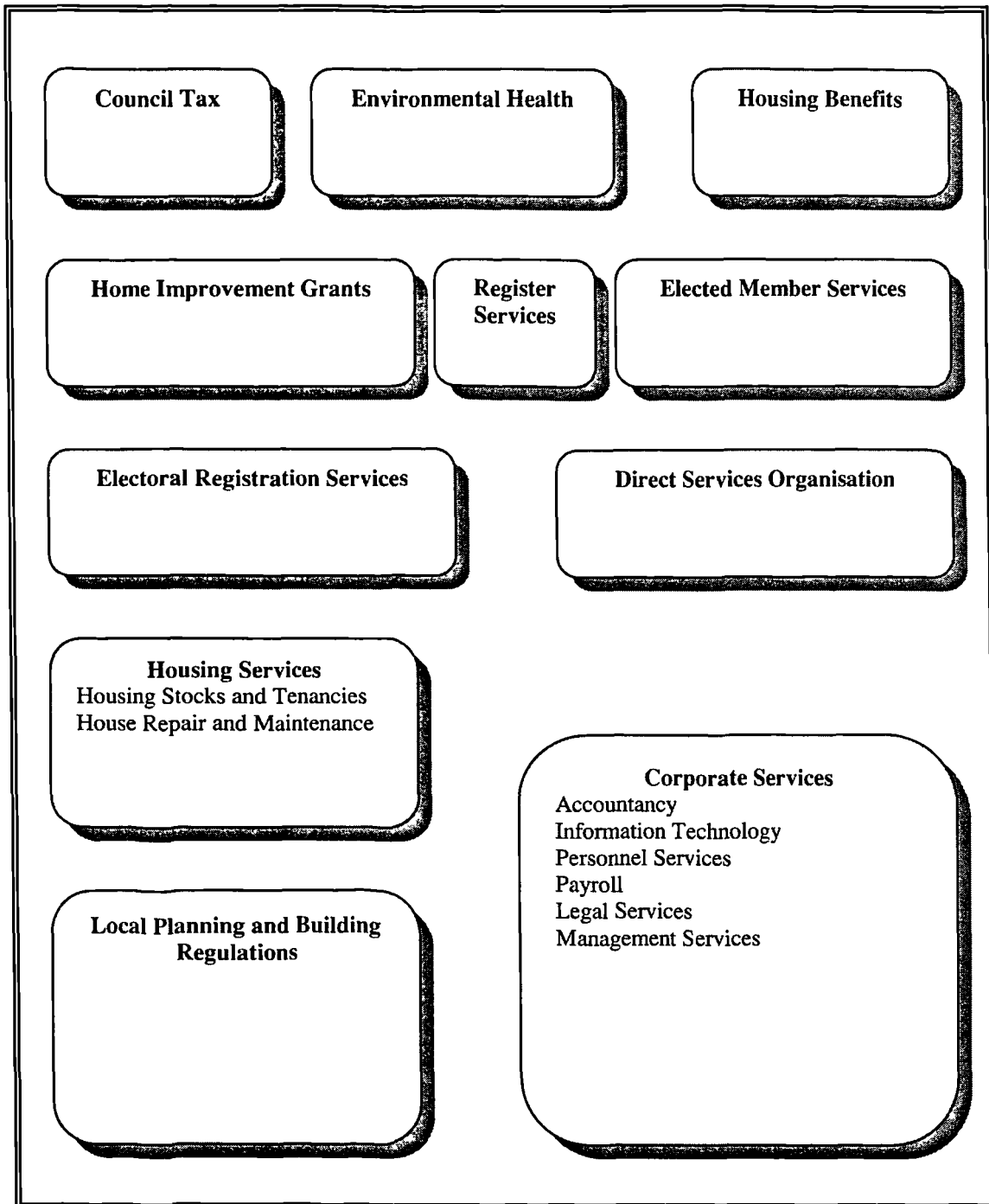
Figure 5. 2: Summary of Services Offered by County Councils

Departmental Services
Highways, Street Lighting, Road Safety
Planning
Trading Standards

Education Services

Direct Services Organisation

Emergency Planning

County Records

Register Services

Elected Member Services

Property Services

Social Services

Borough Services
Police
Fire Services

Library Services

Leisure Centers

Central Supplies Reprographics

Countryside and Forestry

Public Relations and Information

Corporate Services
Accountancy
Information Technology
Personnel Services
Payroll
Legal Services
Management Services

Economic Development

Figure 5. 3: Summary of Services Offered by Unitary County Councils

Council Tax	Education Services	Housing benefits

Environmental Health and Trading Standards services

Electoral Registration Services	Direct Services Organisation

Emergency Planning	County Records	Register Services

Elected Member Services	Property Services	Social Services

Home Improvement Grants	Library Services	Leisure Centres

Public Relations and Information	Housing Services	Countryside and Forestry

Departmental Services
Local and Authority Wide
Planning Services

Economic Development

Corporate Services
Accountancy
Information Technology
Personnel Services
Payroll
Legal Services
Management Services

5.3 Case Study A

5.3.1 Organisational Context

The first organisation (Case Study A) was established in 1996 as the result of the merger of two districts and two counties. In 1995, the Chief Information Systems Officer (CISO) was appointed to set in motion the IT/IS reorganisation effort across the Council. Prior to reorganisation, plans needed to be developed to facilitate the smooth transition of IT/IS systems from the old Councils to the new one.

77

Since the merger included two Borough Councils and two County Councils, the reorganisation plans needed to include criteria that would assist in eliminating redundant systems. To do this, the CISO developed an evaluation criterion (table 5.2) and formed a project team to perform the assessment of approximately 240 IT/IS systems (both vendor and legacy systems). The team consisted of IT/IS staff from the Information, Communication and Technology Department (ICT) and key IT/IS system users. Redundancy was inevitable since the two Borough Councils performed the same function. The same situation applied for the two County Councils. Therefore, the project team selected IT/IS systems for the now council and eliminated IT/IS systems from the old councils on the basis of the criteria in table 5.2. The criteria were not the only driving force in forming the IT/IS structure of the new Council. According to interviews, less than six months were allowed for developing reorganisation plans, gearing the departments towards the reorganisation effort and auditing all IT/IS. Therefore, the project team concluded that time limitations would not allow them to replace all systems that should be replaced. Instead non-functioning redundant systems, with high upkeep costs (as determined by ICT) were to be removed first.

Criteria	Description
Functional	IT/IS systems must accommodate the job requirements of current and future organisational needs.
Technological	Specifications of hardware and software must fit with the organisational technology strategy.
Cost	Initial and ongoing costs of the IT/IS system need to be within allocated budget. Contractual lease agreements on hardware and software must also be taken into account.
Data Capacity	Storage capacity of new system must to be large enough to accommodate data from all four merged organisations.
Data Protection	Data migrating from old systems to new ones need to be protected from loss as the result of the transfer.
User Opinion	The majority of users trained to use a particular system will have a stronger say on which system to finally implement.
User Training	Systems with large number of users will cost less in terms of training.

Table 5.1: Criteria For Implementing New Systems

During reorganisation, Councils were required to maintain the delivery of services to their local population, which restricted the IT/IS project team from disrupting (stopping) the operation of IT/IS systems that directly supported the delivery of services to the local population. As such, systems were not evaluated for their value, worth or usefulness as the evaluation process may have resulted in disrupting the service to the local population.

As such, the need to maintain the delivery of IT/IS services forced the reorganisation team to choose IT/IS systems that could not be replaced without causing major disruption. Case Study A showed that the ICT department decided to use several platforms, putting first the functionality and cost requirements over the need to completely harmonise systems, which was more desirable for training and maintenance reasons. Different platforms were also chosen due to the unique characteristics of individual departmental systems, requiring different programs to support the business process, which ultimately meant different platforms. Users participated in choosing the technology, as the IT/IS department was keen on giving proper consideration to social aspects of the system, for example, user resistance to new technology, user technology preference, the effect of the IT/IS on current job description and user training. The position of the ICT department during the reorganisation process can be summed up in the following statement:

"We felt that we would be unable to successfully implement the system without the full support of the users, who would ultimately use the system". (CISO)

Many of the inherited systems were difficult to replace, as they were cross-interfaced with other systems to allow them to transmit data back and forth. To remove them meant the rewriting of codes, a process that CISO and the working group decided was not feasible at that point in the reorganisation effort. The process of selecting the systems that would be used, and those that would be disregarded ultimately resulted in three brand new systems (Forward Planning Department, Finance and Resource Department and Housing Department) and approximately 57 inherited systems. The current ICT department has 34 IT/IS specialists whose roles are to service, support and manage approximately 1500 organisational PC users in 22 departments across 59 locations. The Case Study A provides for approximately 120,000 customers and employs approximately 5,500 staff members.

5.3.2 Investment Process

Case Study A showed that departmental (rather than corporate) decision making prohibited the ICT department from creating and enforcing an IT/IS investment decision-making process that would be used consistently throughout the organisation.

Developing an IT/IS investment decision making process was perceived by the ICT as being an integral part of the IT/IS strategy, which was in part ignored due to lack of involvement from departmental directors in its formulation, leaving the task to the assistant director level, or even lower decision making levels. In effect, IT/IS investment decision-making strategy was redeveloped in each department, rendering the organisational IT/IS strategy to some extent ineffective.

When the procurement of a new system is required, the CISO forms a team consisting of IT/IS specialists from the ICT department and potential users from the project department. In this team, technology and the alignment with strategy is the responsibility of the IT/IS specialists, whilst functionality and alignment with the business process is the responsibility of the users. The concept of the IT/IS project either initiates from within a department, or by way of suggestion from a member of the ICT department, which indicates that the organisation may be more reactive than proactive in implementing IT/IS.

Once the proposed IT/IS project gains preliminary approval by the project department a meeting is arranged between key members of the project department (typically middle management) and staff from ICT department. The ICT department staff then attempt to establish the proposed IT/IS investment requirements in terms of functionality and development cost limitations as imposed by the project department. The ICT department would then send vendors an invitation to tender, which details technical specifications and projected costs of the new IT/IS system. Next, the ICT department makes a choice from the vendors' offers on the basis of the criteria in table 1 (functionality, technology, cost, etcetera.) and prepares a feasibility report for the project department based on the offer from the vendor. Finally, the report is submitted for the approval of the CISO and the senior project department members. The tendering process only takes place for acquisitions greater than £15,000. Any projects costing between £1,000 and £15,000 are organised by the project department in coordination with the ICT. The ICT does not get involved in projects costing less than £1,000.

Case Study A has a Client Group (representatives from different departments), which meets with the ICT department on a quarterly basis to discuss the IT/IS strategy and new procurements.

For projects not included in the annual budget, and costing more than £15,000, the ICT department and the project department can bring a bid for capital request at the council member level for their approval. These 60 elected members then have the ability to allocate the required funds from the organisational capital fund (or central pot) reserved for such capital investments. The other option available for departments wishing to make capital investments is to submit a bid for revenue to the council members, which solicit for an increase in the dissolved budget in the next budget cycle.

Systems are typically replaced, modified, or purchased for one of two reasons. Firstly, if the current system is no longer appropriate as the result of functional defects, difficulty in maintenance, government regulations, or if the business processes have changed. Secondly, if the department has no IT/IS system and intends to invest in technology to improve the efficiency and effectiveness of the department. The organisation looks at cost, functionality, alignment with business process, opinion of users and compatibility with current technology as criteria for all new procurements. Three examples of recent IT/IS projects are presented below:

- *Planning System:* In 1997 the paper-based system in the Forward Planning department was not delivering (from senior user perspective) in terms of management, time, process, documentation and efficiency. The director of the planning department requested the ICT department to recommend a system that would improve the department's business process. The ICT department decided not to develop the system in-house due to shortage in labour force and time constraints imposed by the planning department. For such a request, the ICT department has a standing criteria to make certain that the recommended system would fit cost requirements, technical specifications, corporate strategy and would get positive response from users. The planning system is used to provide housing/housing extensions with permits.

- *Education System:* In 1998, there was recognition within the Education department that the paper-based system was not efficient, causing staff to waste time on retrieving documents and on managing them. As with the *Planning System*, the ICT department was contacted by the Education department to recommend a system that would improve its business process.

The ICT department followed the same criteria as those for the Planning system (fit cost requirements, technical specifications, corporate strategy and would get positive response from users). The Education system was implemented to support the capture and management of data concerning student grants, student loans, student records and teacher records.

- *Document Imaging Processing System (DIP):* In 1999, new office accommodation was in heavy demand, pushing the organisation to consider alternative solutions to solve this problem. One of the solutions was to implement a document imaging system. It would be used to convert rooms of paper-based archives to a digital form, which would free these rooms for other use. In response to this idea generated by employees, the ICT department presented a feasibility report that looked at the cost of implementing the DIP versus the potential savings from the extra office space, improved document management, elimination of paper-based archive maintenance costs, and savings on staff not retrieving paper documents. The compatibility with existing systems, user opinion and organisational strategy were given consideration when developing the system.

The last three examples clearly demonstrate that Case Study A is primarily concerned with saving costs and is reactive in nature due to resource restrictions, a subject which can affect the IT/IS evaluation practices of Case Study A as discussed in the next section.

5.3.3 Evaluation Practices

The ICT department performs technical evaluation of how the system functions, via IT/IS Key Performance Indicators (KPI). In 1996, the CISO started using KPI to respond to users complaining about system downtime. IT/IS indicators would be used by the ICT department to defend the quality of its service. This technical evaluation is concerned more with the technical performance of the system than the ability of the system to deliver benefits at the desired costs. KPI include the following:

- To measure the extent to which users are satisfied with the ICT services they receive.
- Percentage of calls resolved within agreed times.

82

- To measure the efficiency of the ICT unit in restoring the service within an agreed time-scale after an operational problem has been reported by the users.
- Percentage of successful projects.
- To measure the degree of success of ICT projects in terms of delivering business benefits without delays or cost over-run.
- Acquisition costs of workstations.
- To measure the total procurement costs of a workstation.
- Total cost of connection to voice network.
- To measure the total life cycle costs of a connection to the voice network.
- Cost of connecting to data network.
- To measure the cost efficiency of providing a connection of a device to a data network
- Support costs per workstation
- To measure the cost efficiency of providing support for users of workstations
- Workstation support per support specialist.
- To measure the efficiency of technical infrastructure and the productivity of support specialists.
- Ratio of workstations to employee.
- To measure the percentage of ICT throughout the local Council.
- Number of training hours received per employee.
- To measure the training provided to those who use the ICT service.
- Availability of ICT service.
- To measure the amount of time in the week that services (or part of the services) are available electronically.
- Accessibility of information to the general public.
- To measure the percentage of information and services that is directly available to the public through ICT.
- Customer satisfaction.

In 1998, the ICT department started participating in a benchmarking club that compares organisational IT/IS indicators with IT/IS indicators of 12 other UK Councils. This benchmarking club is the result of the Best Value (BV) initiative, aiming to achieve the right service at efficient cost. Best Value was introduces by the regional government and has many activities including evaluating, benchmarking and service delivery performance.

This gives IT/IS evaluation a new importance in all UK local Councils. The 12 Councils in the benchmarking club were selected by Case Study A due to similarities of functionality and customer base. Case Study A used the practice of benchmarking to measure the performance and efficiency of the ICT department. The ICT department also performs a number of activities that are considered partially driven for the purpose of IT/IS evaluation. For example, the ICT department annually sends out a survey to its users to assess the performance of the ICT department. The survey asks:

- Whether the ICT department meets the client expectations on problem resolution.
- Whether the system provided meets the functionality needs of the department.
- Whether the network response time is adequate.
- Whether the support provided by the company from which the system was originally purchased is appropriate.

User input is also sought by the ICT department during quarterly meetings with the Client Group, on the successful deployment of the IT/IS system in terms of its ability to support the business process. A Service Level Agreement (SLA) was also introduced in 1997 into all departments of the organisation by the ICT department. They are formal documents that detail standards and targets that the client can expect form the ICT department. However, the SLA does not specify penalties for the ICT department if it fails to meet the standards and targets. For example, SLA specifies the response time for an inquiry (5 minutes) but does not specify resolution time. Furthermore, the SLA does not have a signing-off procedure once the service is completed. SLA is negotiated annually (by the Client Group with ICT) and SLA meetings occur on a quarterly basis with senior department members. SLA is significant to IT/IS evaluation because it acts as a measuring instrument. However, none of these evaluation practices aim to assess the value, worth or usefulness of IT/IS systems.

5.3.4 Barriers to the Application of IAT

The case study provided insight into the organisational practice of selecting IT/IS Investment appraisal techniques, and the barriers during this adaptation. By looking at the history of the ICT department, it was clear that due to time restrictions, IT/IS evaluation was not a priority during the reorganisation period (Barrier 1), as the staff involved with the reorganisation effort were overwhelmed with other takes.

Tasks included the harmonisation of IT/IS systems, allocating staff, patching up technical defaults and setting systems up to support departments' business processes. As such, little or no effort was spent on assessing the impact of technology on the organisation. In describing the reorganisation effort, the CISO stated that:

"We were operating more in the sense of fire fighting, rather than problem prevention".

Beyond reorganisation, Case Study A demonstrates the characteristics of a reactive organisation (Barrier 2) by only implementing systems that are deemed necessary for cost saving motives, or to replace a system at the end of its life cycle. Reactive organisations may render the application of IAT impossible for exploring new IT/IS avenues, as the organisation is continuously fire fighting. This may in part be due to the traditional bureaucratic system employed in the public sector (Murray, 1990), which as discussed in section 1.5 may force Case Study A to put the interest of taxpayers over the interest of its departments to explore new IT/IS avenues through IT/IS investment. Interviewees commented about the reactive nature of the organisation, stating that the benchmarking club (for example) was forced on the organisation and consequently may not be considered as a proactive move by the organisation to evaluative its IT/IS system. That is to say, this organisation would not have participated in such an activity if it did not have to. Therefore, evidence from Case Study A demonstrates that such a reactive organisation has little or no interest in performing IT/IS evaluation, or using any Investment appraisal techniques, unless a higher government Council demands or enforces it.

During the investigation of Case Study A, interviewees commented that departments procured add-on systems (higher performance hardware, newer software versions and additional network) aimed at improving the efficiency and effectiveness of specific departments. These add-on systems were not formally evaluated (from the IT/IS perspective) but were justified by departmental managers as rational investment, since they signified improvement to the organisation. As such, departmental managers may have bypassed (by using their managerial authority or political influence) the evaluation process by justifying add-on systems to themselves (Barrier 3).

The investigation of Case Study A showed that it was common practice by departmental managers to invest in IT/IS systems, or add to current systems, if the department had extra funds at the end of the budget cycle. Departments would typically do this to avoid returning the extra funds from the allocated annual departmental budget to the main organisational fund, which would have risked reducing their budget during the next cycle. Accordingly, the IT/IS evaluation process was not employed (nor any IAT) for such last minute IT/IS investments because the decision to invest was not based on value worth or usefulness of the investment (which is the purpose of evaluation), but on protecting the budget for the upcoming year (Barrier 4). This meant that such IT/IS investments were not initiated to improve business performance, or for winning competitive advantage, but to protect the budget from reduction. Consequently, IAT have no role here but to justify a decision that has already been taken. Such last minute IT/IS projects are content to choose hardware, software, or networks that best fit user functionality requirements within the budget available for the department.

The investigation of Case Study A also demonstrated that evaluation of the impact of IT/IS on the department was not conducted, as project departments were content with current justifying practices of new IT/IS projects. This included the employment of an accounting type feasibility report that targets initial procurement costs, which justifies the expenditure over a period of time (payback). Feasibility reports may include technology specifications and projected benefits to the department (as perceived by users). In Case Study A, a feasibility report resembles an IT/IS cost benefit analysis (Farbey et al., 1993), but lacks its detail and purpose (to actually explore whether the system is suitable as perceived by the users). Current justifying practices of new IT/IS projects also include the selection of vendors on the basis of their reliability to maintain the system and train/support employees during the life cycle of the system. Coupled with the feasibility report, the project department (supported by ICT) were confident that sufficient evaluation was conducted, reducing the opportunity for an IT/IS evaluation project to occur (Barrier 5).

During the investigation of Case Study A, interviewees also commented that the Year 2000 problem (Y2K bug) was used in the organisation to push for IT/IS modifications and procurements of new systems, above what was actually required to comply with Y2K needs (that is install/upgrade systems resistant to the Y2K bug).

Interviewees commented that during 1996 to 1999, the ICT department calibrated with other departments to secure the agreement of the central Council administration (and the elected Councillors) on funding for new IT/IS projects. As such, IT/IS evaluation, if employed, was merely a formality to justify a decision that was already taken. In effect, Y2K projects were not justified due to the lack of knowledge by the central Council administration and the elected Councillors about the availability of technology to cope with the Y2K problem. If that knowledge was not in question, the ICT department (and other departments) might have needed to present a real justification for the proposed IT/IS investments and may have employed IAT to do so. Consequently, lack of knowledge with regards to technology may have indirectly prevented the application of IAT (Barrier 6)

The interviewees noted that lack of organisational funding was (and still is) a primary barrier for not conducting IT/IS evaluation when investing in new projects (Barrier 7). The reasoning here is that lack of funds (as a result of project budgeting) prohibited the employment of qualified IT/IS personnel to conduct the evaluation process. The Case Study A showed that the annual budget had not allocated funds specifically for IT/IS evaluation projects. The budget of the ICT department (£2.5m in 1999) had decreased over the last three years due to an initiative by top management to lower the budget by 10% annually in all departments.

The investigation of Case Study A also demonstrated that one of the main barriers for not applying IT/IS evaluation was (and still is) the unavailability of organisational rules and regulations that support the use of any IAT (Barrier 8). The CISO stated that his job involved IT/IS investment decision making, which was carried out using logical reasoning, or at best used a financial feasibility report. In Case Study A, organisational decision making practices may have impeded the use of IAT by not advocating the employment of any during the IT/IS evaluation process. As a result, leaving decision makers to justify the proposal on the basis of the feasibility report. Interviewees stated that organisational rules and regulations could not be developed because every new project had a different set of variables and that it would not be plausible to adopt an IT/IS Investment Appraisal Technique that would fit all situations. The unavailability of organisational rules and regulations also adds to the political inability of the ICT department to commit users to the evaluation process (Barrier 9).

In other words, the ICT department does not have organisational rules and regulations to make available/secure the participation of key users in the IT/IS evaluation project. It is also apparent from Case Study A that political barriers between departments complicated IT/IS evaluation, preventing the application of an IAT on an organisational level. Political barriers are a sub-product of departmental, rather than corporate decision making (Barrier 10). The final, and perhaps most obvious, reason given by the interviewees for not conducting an IT/IS evaluation is that it was not required from the ICT department (Barrier 11). In summary, the barriers identified in Case Study A are as follows:

Case Study A - Barrier 1:	IT/IS evaluation was not considered a priority during reorganisation due to other overwhelming tasks and time limitations.
Case Study A - Barrier 2:	IAT that explore new IT/IS avenues are not a necessity for such a reactive organisation.
Case Study A - Barrier 3:	Managers used their authority or political influence to justify the procurement of add-on systems.
Case Study A - Barrier 4:	Departments spend extra funds available from their allocated budget at the end of the fiscal year to prevent reduction of the departmental budget in the upcoming fiscal year.
Case Study A - Barrier 5:	Current justifying practices of the organisation including feasibility reports and vendor evaluations, which were viewed as sufficient to go ahead with decisions to invest in a new IT/IS project.
Case Study A - Barrier 6:	Y2K projects were used in the organisation to push for IT/IS modifications and procurements of new systems, whilst taking advantage of the lack of knowledge of primary decision makers about the actual need for the projects.
Case Study A - Barrier 7:	Lack of organisational funds to finance an IT/IS evaluation project.
Case Study A - Barrier 8:	Unavailability of organisational rules and regulations that support the use of any IAT.

Case Study A - Barrier 9: Political inability of the ICT department to commit users to the evaluation process.

Case Study A - Barrier 10: Departmental, rather than corporate decision making.

Case Study A - Barrier 11: IT/IS evaluation was not required from the ICT department by the organisation.

5.4 Case Study B

5.4.1 Organisational Context

This case study Council (Case Study B) was established on April 1st 1996. Case Study B is the result of a merger between one District Council and part (one-fourth) of a County Council. During the merger all databases of the old County Council were split into four parts (among four District Councils) and transferred to the relevant location in the new Unitary Council. To manage the reorganisation effort, a shadow team was established one year prior to reorganisation, consisting of directors of senior positions in the planned new Council. The IT/IS related shadow team worked on plans to facilitate the IT/IS reorganisation effort and designed the IT/IS departmental structure in the new Council. The IT/IS team was also responsible for allocating staff to new positions; a task that resulted in employees not knowing to which Council they would be relocated (or systems they would be working on) until a date close to reorganisation (approximately one month). Therefore, the IT/IS shadow team decided it would be more appropriate to wait (if possible) before initiating new IT/IS investments until users were involved in its specification design.

However, this was not the only motivation to keep their current IT/IS systems functioning. The prime directive during reorganisation was to maintain the delivery of Council services to the local population. As a result, all staff working on the reorganisation effort were to do so whilst continuing to perform their original jobs. Consequently, this prime reorganisation directive was a strong force that motivated the IT/IS shadow team towards keeping operable IT/IS systems. In addition, keeping old systems was a necessity, as the time allowed to plan for reorganisation (approximately 6 months) was insufficient (as viewed by the reorganisation team) to study the removal and replacement of old working systems.

89

Replacing unnecessary IT/IS systems would have required two resources not available to Councils during reorganisation: funds to finance the new IT/IS investments and time to purchase new systems and train staff on them. Ultimately, the responsibility of deciding on which IT/IS systems to deploy in the new Unitary Council was that of the newly appointed director of the ICT department.

The ICT director finalised the structural design of the ICT department on the basis of the resources available to his organisation (reorganisation budget and people skills) from the old dissolved Councils. The only IT/IS systems replaced were those not operable, or those that were duplicate systems common to both the District and County Councils (figures 5.1 and 5.2 respectively). Therefore, an evaluation was done to assess which IT/IS system was to be kept and which was going to be replaced. The evaluation looked at:

- The data capacity of both systems to insure that the one chosen would be able to withstand the storage requirements of the new authority.
- The technology used to run the systems to check the compatibility.
- The cost of maintaining such technologies, as the new authority was performing the reorganisation task under limited budgets.
- People skills available to operate the systems, as the organisation did not have the financial capability to employ new staff to operate new technology.

The finance system of the District Council was the only system to fit the two replacement criteria (operability, duplication) and was therefore replaced in 1996. However, the old District system used an ICL mainframe, which could not accommodate the increase in data size due to the raise in staff numbers across the organisation. The ICT department was aware that an IBM mainframe was used in the County Council to run the finance system. Therefore, the ICT department and the Finance department decided to use the IBM mainframe because it was *newer* technology and had much greater data capacity than that of the ICL mainframe. Furthermore, the reorganisation team elected not to join the databases of both mainframes because of the sensitivity of the data and the fear that data would be lost or corrupted during joining.

Consequently, data was pulled out of the ICL mainframe, and imported into the IBM mainframe, which consumed the majority of the 6 months available for reorganisation. The current ICT department has 20 IT/IS specialists, whose role is to service, support and manage approximately 1200 organisational PC users in 22 departments across 59 locations. Case Study B Council provides approximately 120,000 local residences and employs 6,500 staff members.

5.4.2 Investment Process

European Community (EC) regulations dictate that an open tender will be announced for any IT/IS project over £50,000. Such investments typically initiate within the department wanting the new IT/IS system (project department). Departments interested in investing in IT/IS would approach the ICT department with a preliminary feasibility report, listing the benefits desired from the investment and estimated costs. The report would be developed by departmental staff from market research. The research would arrive at the cost estimate by looking at the current IT/IS system in the department and mimicking its functions, thus forming the first half of the benefits list. The second half of the benefits list would result from user suggestions. In some instances, neighbouring Councils using similar IT/IS systems would be solicited for recommendations. A key point here is that the project department usually makes an internal decision to go-ahead with an IT/IS investment before the full specifications of the system are developed and before the actual cost of the project is determined. In doing this, there is little or no room to do an IT/IS evaluation to determine the business value of the IT/IS investment.

With the preliminary feasibility report, the ICT department would form a project team, consisting of a systems manager, an IT/IS representative in the project department, a finance member in the project department and a repair and maintenance staff member. The team would work on the IT/IS specifications that would be used to form part of the tender. The partial tender would be published in an EC journal to attract as many vendors as possible. Once vendors reply with interest to the project, the ICT department sends the vendors a questionnaire to determine their suitability for completing the project. The questionnaire is case specific (is redeveloped for each new project), but typically looks at the vendor's track record, financial status and compliance with EC regulations.

Once the choice has been narrowed down to approximately five vendors, the ICT department issues a full tender of the IT/IS project and waits one month for a response from the vendors; to include detailed systems specifications and actual costs. In some instances, a demonstration is required from the vendor and a site visit to a similar IT/IS system in operation, where representatives of the Council can test the system and ask current users for their feedback. At that point, both the ICT department and the project department make the final selection. This detailed process only occurs for IT/IS projects greater than £50,000. IT/IS projects ranging from £20,000 to £50,000 only need to do a limited tender to three vendors. Finding a vendor for projects under £20,000 is left to the discretion of the department's director. The ICT department will not invest in unproven technology, and technology that does not have a substantial user base in the market. This is the position of the ICT department because it views the number of its IT/IS staff as insufficient to handle major software problems. Consequently, if the result of an IT/IS evaluation process recommends the use of unproven technologies, that recommendation would not be followed.

The IT/IS investment protocol (tendering process) is viewed by top management and staff as a sufficient process with which to invest in new IT/IS systems. Therefore, the management of the Council never requires departments to use IAT to demonstrate the value, worth, and/or usefulness of the IT/IS systems, beyond the requirements of the tendering document. Consequently, Case Study B did not seek to improve its IT/IS investment decision-making procedures, which were inherited from the old Councils. The only effort made in this issue was when the ICT developed a procurement procedure in June 1997, to further formalise investment procedures across the Council. It is also important to note that, in addition to requiring proven technology and a wide user base, the ICT is very price sensitive about the cost (procurement and ongoing) of IT/IS investments. Case Study B does not have a central pot for capital bids, leaving departments to pay their own IT/IS investments, possibly by borrowing money form external sources (banks). Since reorganisation, investments in new IT/IS projects include the following:

- *Housing System:* was implemented in 1997 to replace an existing system. The process involved an open tender in a European Journal and the initial estimates of the project cost exceeded £50,000.

The feasibility report (developed by the Housing department) insisted that the old in-house system used outdated technology and that such technology would be difficult to upgrade. Consequently, the old system was deemed too expensive to keep and was not able to meet current organisational needs. The open tender attracted 14 vendors, 9 of which were eliminated after the use of the questionnaire. Whilst evaluating the technology solutions and project costs estimated by different vendors, Case Study B found that the costs where quite similar, but only one vendor proposed using proven technology. Therefore Case Study B made the final selection by choosing the vendor that would implement proven technology.

- *Highway Costing System:* was also implemented in 1997 to replace an existing system. The old system was also outdated and therefore could not meet the functionality desired by users. A project team from both the ICT department and the Highway department developed the specifications of the new IT/IS system. The specifications were based on the functionality of the old system, in addition to new functions suggested by users. Also, the project team visited a number of companies and attended presentations before finalising the specifications list. Since initial estimates of the project fell just under £50,000, a limited tender to three vendors was conducted. Case Study B made the final selection after choosing the vendor that would implement proven technology.

- *Y2K Project:* was initiated in 1997/98 across the Council to detect IT/IS systems that were not Y2K compliant. The audit produced a list of PCs that needed to be upgraded or replaced. The tendering process was not employed since the PC replacement/upgrade project fell under the £20,000 mark. Y2K was also used to expedite upgrading IT/IS systems that were not current with organisational needs, moving systems from a character base to a Windows front-end, for example the Leisure system needed updating. The audit also showed that the software for running the Planning system was not Y2K compliant. In addition, the company providing support for the Planning software declined to guarantee its resistance to Y2K. Consequently, Case Study B had no alternative but to replace the old software with a newer version that was Y2K compliant. Therefore, no evaluation process was performed and no IAT were employed. The functionality of the new application mimicked the old one and added features as requested by system users. Replacement of the Planning system was concluded in 1998.

5.4.3 Evaluation Practices

As noted in the last section, Case Study B does not employ IT/IS evaluation to assess the value, worth, or usefulness of new investments in IT/IS, as it views its investment process (that is screening vendors, only investing in proven technology with a wide customer base and using procurement policy) as a sufficient mechanism to pass judgment on IT/IS proposals. In the procurement policy (developed in July 1997 by ICT), the project evaluation and approval section (for projects costing £10,000 and above) requires feasibility reports to address the following:

1. Provide justification for the project e.g. legal requirement, improvement in service, increased efficiency, cost savings, better management information etcetera.

2. Consider alternative solutions together with costs and benefits of each option having first taken advice form the ICT Department.

3. Make a recommendation for preferred option to IS Liaison Group, which must be approved by the Chief Officer.

The procurement policy was designed to be flexible in nature so that they can encompass all new IT/IS projects without difficulty. However, whilst being flexible, the ICT department left the interpretation of improvement in service, cost savings and alternative solutions (among other things in the procurement policy) to the discretion of the project department. Consequently, there is no standard by which these terms can be measured (that is does not specify the application of IAT) leaving the ICT to perform its own assessment on a case-by-case basis. For example, the procurement policy requires the feasibility report to include an analysis of the function that is to be performed by the new IT/IS system and questions its value and contribution towards the overall organisational function. However, the policy does not specify how a department can justify the necessity of the desired benefits, nor does it suggest how to develop alternative IT/IS solutions.

In Case Study B, feasibility reports are essentially used by departments to gain management's commitment to the project. Typically, such reports list the benefits desired from the new IT/IS investment, which are based on the old functionality of the system, and additional features as requested by users.

The report also includes a preliminary cost analysis based on market research of

employees in the department. Interviewees commented that IT/IS evaluation might not be the primary objective of this report, as it is used in the main to channel departments in the Council to centralise their IT/IS procurement through the ICT department. In 1998, the ICT department started participating in a benchmarking club that compares organisational IT/IS indicators with IT/IS indicators of 12 other UK Councils. This benchmarking club is the result of the Best Value (BV) initiative, aiming to achieve the right service at efficient cost. Best Value was introduced by the regional government and has many activities including evaluating, benchmarking and service delivery performance. Benchmarking employs the use of Key Performance Indicators (KPI) (same as section 5.3.3).

5.4.4 Barriers to the Application of IAT

Case Study B provided insight into the organisational practice of selecting IT/IS Investment appraisal techniques (IAT) and the barriers during this adaptation. Since April 1995, the shadow team was working on plans for the reorganisation effort, whilst performing their original job function. The plans needed to be ready by reorganisation date (April 1996). Consequently, time to plan for reorganisation was cut short by previous obligations, resulting in an actual 3 to 4 months (as noted by interviewees) to plan for the reorganisation effort. The IT/IS shadow team could not evaluate all IT/IS systems, study alternatives and plan for their replacement in that short duration. Therefore, the shadow team decided not to evaluate all IT/IS systems for value, worth or usefulness, focusing instead on developing plans to facilitate the transfer of operable IT/IS systems into the new Council. As a result, the time allowed for the reorganisation effort prohibited the exploration of alternative IT/IS solution in the new Council and the employment of IAT (Barrier 1)

During the investigation of Case Study B, the IT/IS shadow team (now reorganisation team) viewed IT/IS operating costs, functionality, data capacity and user training as sufficient criteria to assess the keeping or elimination of systems inherited from the merging authority. Whilst depending on those criteria, the reorganisation team did not place any value on the assessment of the impact of IT/IS on the organisation (IT/IS evaluation).

95

Thus, the employment of operating costs, functionality, data capacity and user training as evaluation criteria prohibited the employment of IAT (Barrier 2). It is also important to note that the administration of the Council did not require the reorganisation team to justify the systems beyond those criteria. As such, the ICT department, pressured for time, ignored the role of IT/IS evaluation and the employment of IAT (section 1.1) since it was not required to do so by the Council administration (Barrier 3).

Case Study B was most determined, during reorganisation, to maintain the delivery of services to its clients. In effect, keeping IT/IS systems operable was more important than replacing them with better systems. Therefore, the organisational need to maintain the delivery of services to the local population would have bypassed any system replacement recommendations by the IT/IS evaluation process, making IT/IS evaluation (and IAT) practically worthless (Barrier 4).

The investigation of Case Study B also showed that some of the inherited IT/IS systems (from the old Councils) needed upgrades to their hardware and software. These upgrades were quickly approved by administration as necessary IT/IS investments to the continuity of the system. No assessment of value, worth or usefulness of such IT/IS upgrades were made because it was perceived by ICT to be necessary. The ICT did not employ IT/IS evaluation (nor IAT), as the need for upgrades was not in question (Barrier 5).

It is also apparent from Case Study B that financial limitations forced the ICT department not to employ additional full time staff, or employ the services of external consultants to perform IT/IS evaluation. During reorganisation, the entire Council was operating under strict budgets, leaving little or no finances to spend on evaluation. As such, the absence of financial support to perform evaluation may have acted as a barrier to the employment of IAT (Barrier 6). With a shortage in labour to perform evaluation, the ICT department could only allow departments to invest in proven technologies. Consequently, the organisation has no need to use IT/IS evaluation for developing innovative IT/IS solutions. As such, instructions by ICT to other departments to invest only in proven technology restricted the ability of decision makers to explore IAT that may recommend unproven technology (Barrier 7).

Case Study B demonstrated that in practice, IT/IS specifications of new investments were usually based on the specifications of the old system, suggestions by system users and/or consultation with near-by Councils. The development of specifications in this manner is viewed as a safe process by the Council and therefore an IT/IS evaluation is not required. As such, IT/IS investment practices of the Council may have acted as a barrier to the application of IAT (Barrier 8). Finally, the tendering process is perceived by decision makers as delivering the IT/IS project at the lowest possible cost, further reducing the need to assess the value, worth or usefulness of the project through the application of IAT. Accordingly, they did not require an IT/IS evaluation (Barrier 9). The summaries of the barriers are as follows:

Case Study B - Barrier 1:	The time allowed for the reorganisation effort prohibited the exploration of alternative IT/IS solutions in the new Council and the employment of IAT.
Case Study B - Barrier 2:	The reorganisation team viewed IT/IS operating costs, functionality, data capacity and user training as sufficient IT/IS evaluation criteria.
Case Study B - Barrier 3:	The ICT department did not employ IAT as it was not required to do so by the Council administration.
Case Study B - Barrier 4:	The Focus was on maintaining the delivery of Council services to the local population.
Case Study B - Barrier 5:	IT/IS upgrades were justified as necessary investments to maintain the continuity of systems, leaving little or no room for IT/IS evaluation of value, worth or usefulness.
Case Study B - Barrier 6:	The absence of financial support to perform evaluation impeded the employment of IAT.
Case Study B - Barrier 7:	Instruction by ICT to invest only in proven technology restricted the ability of decision makers to explore IAT that may recommend unproven technology.
Case Study B - Barrier 8:	The manner in which the benefits list is developed for IT/IS projects may have acted as a barrier to the application of IAT.
Case Study B - Barrier 9:	The tendering process is perceived by decision makers to deliver the IT/IS project at the lowest possible cost.

5.5 Case Study C

5.5.1 Organisational Context

This case study Council (Case Study C) resulted from the merger of two District and one County Council. The preparation for the reorganisation started in April 1995, when the new management team was appointed to plan for the reorganisation and ultimately manage the new Unitary Council from April 1st 1996. The management team was composed of the CEO and departmental directors.

The reorganisation team of Case Study C anticipated that they would have approximately 8 months to complete planning for reorganisation. The director of the Information, Communication and Technology Department (ICT) was concerned that this duration was not sufficient to investigate the need to replace all old systems and then redesign new IT/IS systems to match that need. Instead, the merging Councils would have to make do with whatever systems were operable, unless there was a solid reason not to (that is the system stopped functioning).

Time limitations were not the only barrier for not evaluating and implementing new systems across the new Council. Case Study C inherited a debt resulting in an organisation wide budget cut of 4% annually over the first five years (1996 to 2001). Therefore, the ICT department had to endure a budget cut whilst maintaining the level at which its service was being delivered. Effectively, budget cuts forced the Council into implementing only IT/IS projects that were viewed by managing directors (MD) as critical. Forced IT/IS projects had little or no use for evaluation, as the MD has already taken the decision to implement the new systems.

When possible, the MD inherited systems from the merging Councils to reduce the cost of investing in unnecessary IT/IS projects. Selecting systems that would be inherited by the new Council continued well after the reorganisation date (1st April 1996) and included all departments (and systems) in the old 3 Councils. Typically directors of the new Council would make their selection based on reports developed by 2 representatives of each system from each old Council. The reports would include a description of the following:

98

- How much data would be needed to run the system?
- How much would it cost to run the system?
- How many employees would it take to run the system?

Users were also consulted on their preferred systems, but were not giving a say on the final decision. During the planning stage, it was not uncommon for employees from the merging Councils to go on informal inspections of each other's systems. This was done to reach consensus between the employees on which system would ultimately be adapted. The interviewees commented that this practice in part facilitated the merging process.

The ICT department was also consulted on the evaluation and selection of departmental IT/IS systems, as they would ultimately be responsible for servicing the systems. During reorganisation, departments needed to merge the databases of systems and allocate and train staff for IT/IS related jobs in the new Council. Therefore, during that period (1996-1998), some staff moved to the new Council facilities whilst others remained to run the old systems (in the old facilities). Although the management team recognised that training was important, it was not viewed as a priority. This was mostly due to the similarities between systems, budget cuts and because in most cases the chosen system would be accompanied by the staff that was previously running it. Consequently management felt that a maximum of 50% of staff would need training on systems. Hence, management elected to leave training until after the reorganisation had been completed. The complete reorganisation effort took approximately 18 months to finalise after the reorganisation date.

The investigation into Case Study C also showed that as a result of budget cuts (20% over 5 years) the ICT department could not service mainframe systems. However, the Credits and Payment system, the General Ledger system and the Council Tax system were all running on mainframes and they were not replaceable due to the cost involved. As such, the ICT department had to use inherited systems operating on a mainframe platform (IBM based) whilst immediately planning for their replacement with Unix based platforms. As a result, projects concerning the replacement of mainframe systems were evaluated as a formality, where in reality the decision to replace them was taken out of financial necessity.

Another result of the budget cuts was that organisational departments used IT/IS to improve efficiency and reduce operating costs, by implementing work flow systems (Lotus Notes) and implementing internet to improve communication. Also, uniform office systems were deployed to ease communications between departments and to improve data transfer and sharing. The investigation into Case Study C also demonstrated that the conditions under which systems were evaluated and selected (that is time and fund limitations) contributed to the current operation of departmental systems, with the exception of a number of financial systems (that is Credits and Payment system, the General Ledger system and the Council Tax system). All systems operated independently from each other's applications and databases, as merging Councils continued to operate their departmental systems in the same way as they had prior to reorganisation, due to time and fund limitations.

The reorganisation of IT/IS systems occurred on a departmental level, rather than an organisational approach, giving MDs the ability to choose whatever software they, and their departmental staff were comfortable with. The merging of applications and databases across different departments was not considered during the reorganisation of the IT/IS systems and as a result, (say interviewees) departments that could have benefited from shared databases and software did not. Interviewees also commented that software application and database integration across departments is presently on management agenda, in order to facilitate the new directive of the regional government. By 2005 Councils are to provide their clients with access to payment and appointment booking services through the Internet (E-Gov).

Between 1996 and 2000, the size of the cumulative organisational IT/IS system had approximately quadrupled. Interviewees commented that the growth was also linked to budget restrictions. In this case, user departments exploited the IT/IS function to fill the void left by the cuts. Alongside this, the increased sophistication and complexity of software applications run by users demanded faster processors, more servers and larger networks. The current ICT department has 32 IT/IS specialists, whose role is to service, support and manage approximately 1300 organisational PC users, in 22 departments, across 40 locations. The ICT department is responsible for the overall IT/IS strategy and technical direction of the Council. The Council provides for approximately 99,000 customers, maintains the computer labs for 69 local schools and employs approximately 4,800 staff members.

5.5.2 Investment Process

IT/IS projects, within departments, usually start taking form after an employee recommends that a departmental need can be resolved with an IT/IS investment. Management investigating this proposal would ask:

- What is the function of the hardware desired and does it fit with the functionality of the user.

- What are the specifications and features of the software and how will it be used by the employee.

Departmental management would then research the market for different systems that would meet the requirements and seek input from ICT with regards to technical specifications and development options. A project team consisting of the project department and representatives of the ICT would be formed at this point. The project team would prepare a two-page justification report to include a preliminary IT/IS benefits list and development options. The department would submit the report to the Council, seeking authorisation to pursue the matter further. If the Council approves of the project, the next step would be to locate a vendor(s) capable of supplying the system and ask them to give a presentation to the Council.

Usually the vendor is required to provide the Council with a site visit of a similar system, running live, so that users can work with the system before a commitment is made to purchase. Vendor assessment is considered by the ICT as a valuable measure to insure that the investing department procures the system desired at the lowest possible cost. Representatives of the department would also ask people working on the system for their feedback and recommendations. If the department decides on a system and a vendor that meets their requirements, then one of two options are pursued to finance the project. Namely a supplementary bid from the central pot (annual reserve for capital expenditure , or a bid for increased departmental capital in the next budget cycle However, the decision to pursue is not left entirely to the project department. Since 1996, all IT/IS procurements have to be approved by the ICT department, to gu de IT/IS investment into complying with:

- *Corporate objectives*: to insure that the organisation has a unified strategic direction with which it can deliver the *best* services to its clients.

- *Service plan*: to insure that resources (human and financial) are available to maintain IT/IS systems and to allocate them appropriately across departments.

- *Technical specifications* (as set by ICT): to allow for the testing and standardization of all IT/IS hardware entering the Council, which can reduce maintenance costs.

Technical specifications (recommendations as to which equipment to buy) are proposed by the ICT to the Information Systems Steering Group (ISSG) and become policy with their approval. Consequently, departments investing in IT/IS projects would approach the ICT early for recommendation on specifications and development options. The ICT would then open a new project record and arrange a meeting with the client (project department) to identify an outline of the project (that is new procurement, internal work, or hardware). In the case of a vendor supplying the system, the ICT would attend the vendor presentation and site visit to review the live system. It is the policy of the ICT department not to search for vendors for departmental projects, as these systems have a specific functionality, which (according to ICT) should be the responsibility of the client. The evaluation of departmental systems is viewed by ICT as the responsibility of that department.

5.5.3 Evaluation Practices

In 1998, Case Study C started participating in an annual Benchmarking club. It was established by the regional government as part of the best value directive, which specifically attempts to push the participating Councils into delivering the optimum service at the lowest possible cost. One activity in the Benchmarking club is to compare KPI (Key Performance Indicators) between the 22 participating Councils. Key Performance Indicators (as with section 5.3.3) are used to measure the delivery of service by the Council to the clients. The Benchmarking club includes all departments in the Council by registering approximately 1000 KPI, 12 of which are specific to the ICT. An external consulting firm administers the Benchmarking club and produces reports to the participating Councils for learning purposes. The consulting firm also holds a workshop upon completion of the activity. This Benchmarking club has IT/IS evaluation components, but was not conducted for the purposes of IT/IS evaluation.

102

That is to say, the Council did not choose benchmarking as an Investment Appraisal Technique, it was chosen for the Council by the directive of the regional government. Interviewees commented that such an activity would not have been undertaken if it were not a directive. In Case Study C, KPI were not used before the Benchmarking club. Instead, Service Level Agreements (SLA) were (and still are) used to establish the amount and timing at which the ICT department will deliver services to other departments. SLA could be considered as an evaluation of the delivery of service of the ICT, but it does little to indicate the current status of the business value of IT/IS systems (that is IT/IS evaluation). Furthermore, SLA do not have any penalties if the service is not delivered as agreed in the contract. The ICT department holds the IT/IS budget and primarily controls the output of its service to the Council. Therefore, SLA has IT/IS evaluation qualities but were not established for that purpose.

According to ICT, IT/IS evaluation remains the responsibility of users, because they understand the benefits of the system and only they can assign a measurement value to those benefits. ICT interviewees commented that all the ICT department can do is make sure that the maintenance is within the cost and that the technology fits within the technology in the Council. To do that, the ICT developed an IT/IS procurement policy in 2000, with a list of Investment Appraisal Questions to be answered. They include the following:

- Have the objectives been identified?
- Does the project fit with business and ICT strategies?
- Have different options been analysed?
- Are the benefits realistic?
- Will the benefits be delivered?
- Have costs been properly calculated?
- Are the financing arrangements clear and reliable?
- Have the inherent risks been analysed?
- Have the resources and time scales been planned?
- Are the project management arrangements satisfactory?
- Which is the best option? (One option is not to go ahead at all).

Interviewees commented that this procedure formalises the unofficial IT/IS procurement policies of the Council, which were known to the MD but not formally documented. The main feature of this policy is that it asks the department wanting the IT/IS investment to justify it in terms of quantitative as well as qualitative answers. As such the procurement policy allows for the employment of non-financially based IAT. When this case study was conducted, the IT/IS procurement procedure was still under construction, as such, the case study investigation can not report on projects that employed the ICT procurement policy.

5.5.4 Barriers to the Application of IAT

Case Study C provided insight to the organisational practice of selecting IT/IS Investment appraisal techniques (IAT) and the barriers during this adaptation. During reorganisation, two barriers above all contributed to the lack of IAT application. Firstly, by the time the management team was appointed (April 1995), they effectively had only 8 months to develop the reorganisation plan. Interviewees commented that there was not enough time to study the workflow of all departmental systems, develop alternative information system solutions and decide upon an appropriate solution. Consequently, the IT/IS reorganisation team was concerned that time limitations would not allow them to evaluate all IT/IS systems for value, worth, or usefulness and plan for their replacement if necessary (Barrier 1). As a result, the IT/IS reorganisation team was forced into eliminating options that would have taken longer to assess and develop, which effectively translated that the functionality of systems were not challenged by an evaluation process, leaving the council exposed to undetected costs and defects from the inherited systems. As a result, the operation style of departmental systems continued from the old Councils through to the new Unitary Council. Also as a result of time limitations, the management team decided not to invest in new IT/IS projects, unless it was absolutely necessary (that is the current system was no longer functioning).

The other overriding barrier for not applying an IAT was that the Council inherited a debt that would significantly reduce its budget by 20% over five years. This financial restriction on spending had several consequences. For example, mainframe operations were deemed unsustainable because their cost of upkeep would have been beyond the capability of ICT.

Consequently, no evaluation was conducted on their historic usefulness, appropriateness in the current organisational structure, or strategic value, it was considered on operating cost and nothing else. Also, as a result of financial limitations, departments decided to use IT/IS to reduce operating costs, by implementing office systems, such as Lotus Notes. This resulted in an increase in the size of the cumulative IT/IS system in the organisation by up to five times since 1996, moving organisational departments more towards cutting costs at any price and away from thinking as a corporation that needs to cumulatively cut its operating costs. Noticeably, the organisation could not afford to bring in outside consultation to perform IT/IS evaluation because of the financial limitations. Therefore, budget cuts during the first five years left little or no room to conduct IT/IS evaluation (Barrier 2).

The next two barriers to the application of IAT are a sub-product of time and financial limitations (Barriers 1 and 2). Directors of departments were instructed by top management to adopt one of the old systems from the merging Councils, basing their decision only on information regarding the number of employees required to run the system, the amount of data needed to operate the system and the cost of running the system. Therefore, the three criteria (cost, data and employees) were forced on departmental directors to pass judgment on the appropriateness of keeping or eliminating systems. Hence, managing directors (MD) where not allowed to employ IAT during reorganisation, but were told to use maintenance costs, data capacity and availability of employees as assessment criteria (Barrier 3). It is also worth considering that the lack of MD knowledge about the role of IT/IS evaluation made the three criteria (cost, data and employees) a sufficient tool to decide on IT/IS systems (Barrier 4).

The investigation into Case Study C also illustrated that it is the viewpoint of ICT that IT/IS evaluation of departmental systems remains primarily the responsibility of departments, as only departmental staff can understand the benefits required from their system and assign value, worth, or usefulness to it. The ICT is content to allow departments to invest in IT/IS systems if they fulfil the requirements of the ICT procurement policy (section 5.5.3). As such, IT/IS evaluation of departmental systems is not conducted by ICT staff, as they view that to be the responsibility of the departmental staff in which the system resides. Therefore, it falls on the department wanting the system to develop a justification report that can be approved by the Council.

105

That is to say, even though there is a procurement policy that supports the notion of IT/IS evaluation, the policy is flexible to the extent where departments still have to investigate and decide what, if any, IT/IS Investment Appraisal Technique to use. As such, there are no organisational rules and regulations that support the application of IAT for new IT/IS projects (Barrier 5). The investigation into Case Study C also demonstrated that IT/IS evaluation is not considered necessary by the MD as long as the system is running within allowed operating costs and as long as the organisation is satisfied with its functionality. Interviewees commented that the nature of government Councils was (and still is) to:

- Use IT/IS systems for as long as possible, as opposed to private sector organisations that typically replace systems 3 to 5 years after deployment. Therefore, most IT/IS systems in Councils are replaced out of necessity after they stop functioning, leaving little or no room to evaluate their role in the organisation.

- Depend on proven technology, refusing to explore (evaluate) alternatives that might give strategic advantages.

- Allocate departmental budgets on a year-by-year basis, eliminating the effectiveness of planning over durations beyond a year, such as those conducted for strategic planning.

Whilst commenting about the reactive nature of the organisation, interviewees noted that the use of KPI for benchmarking would not have been conducted if it was not ordered by the regional government. Also, planning for joining the functionality of systems and databases would not have occurred if the E-Gov project did not require it to do so. As such, the passive nature (rather than active) of government Councils reduces the need to perform IT/IS evaluations or apply any IAT as most systems are replaced out of necessity (Barrier 6). The summaries of barriers discussed in this section are as follows:

Case Study C - Barrier 1:   The IT/IS reorganisation team was concerned that time limitations (eight months) would not allow them to evaluate all IT/IS systems for value, worth, or usefulness and plan for their replacement if necessary.

Case Study C - Barrier 2:   Budget cuts during the first five years left little or no room to conduct IT/IS evaluation.

Case Study C - Barrier 3: MDs were not allowed to employ IAT during reorganisation, but were told to use maintenance costs, data capacity and availability of employees as assessment criteria.

Case Study C - Barrier 4: Lack of MD knowledge about the role of IT/IS evaluation made the three criteria (cost, data, employees) a sufficient tool to decide on IT/IS systems.

Case Study C - Barrier 5: There are no organisational rules and regulations that support the application of IAT for new IT/IS projects.

Case Study C - Barrier 6: The passive nature (rather than active) of government Councils reduces the need to perform IT/IS evaluation or apply any IAT as most systems are replaced out of necessity.

5.6 Case Study D

5.6.1 Organisational Context

This case study Council (Case Study D) was also established on April 1st 1996, as the result of the dissolution of one County Council among five District Councils. Therefore, Case Study D is made up of one District Council and one-fifth County Council. This had a direct implication on the formulation of the IT/IS system in the new Council. Unlike other case studies (A, B and C), where the merging County and District departments had to choose among alternative IT/IS systems, departments in Case Study D needed most of the existing IT/IS systems from the merging Councils to form the IT/IS infrastructure in the new Council. Consequently, the main tasks with IT/IS during reorganisation were to insure continuity in the delivery of IT/IS service to all departments, coordinate the training of new IT/IS users and improve the structure of IT/IS systems to accommodate current organisational needs. However, IT/IS reorganisation extended beyond the three tasks, as a number of duplicate systems needed to be evaluated for use by the new Council including the Credits and Payment, Payroll, Council Tax, Income Collection, Debtors and General Ledger systems. They were evaluated for:

107

1. *Functionality*: Whether or not the system had the ability to cope with current and future departmental needs. For example, the County Debtor system could not accurately differentiate data relevance to each of the five directorates.

2. *Data Capacity*: Whether or not the system had sufficient storage space. For example, storage space was added to the Credits and Payment system of the District Council to accommodate the proportional increase in data generated by the rise in organisational staff (450 to 4500).

3. *Data Migration*: How difficult it would be to transfer the data from the old system to the new one. For example, the County Debtor system did not have the capacity to verify if the migrated data was accurate. Therefore, data input was manually conducted, further occupying staff resources.

4. *Software License*: Whether or not current license quantities were sufficient to meet current and future departmental needs. For example, to accommodate the increase in departmental users, additional software licenses were procured for the Credits and Payment system.

5. *Training*: How much time would be needed to coach new system users. For example, the Credits and Payment system of the District Council incorporated an ordering system to synchronize the budget available with the orders placed by the organisation and allow managers to coordinate any mismatches. For the ordering system to work, all purchase orders had to be entered by electronic means to the system. As most new users (inherited from the County Council) were not accustomed to such ordering practices, the ordering system was suspended from the Credits and Payment system until users had been trained.

6. *Maintenance*: Could the system be maintained by the organisation and how much would it cost. For example, all mainframe-based platforms were going to be phased-out because the cost of running a mainframe operation was not compatible with departmental IT/IS budgets. Furthermore, most duplicate County Council systems were developed in-house, with no manuals on their functionality, no notes on how they were written and no records of any modifications. Therefore, their maintenance was perceived to be very difficult by the ICT department of the new Council.

Time caps was another element that had a direct implication on the formulation of IT/IS systems in the new Council. The time barrier was created as a result of the government directive in April 1995 to start reorganisation in April 1996, leaving a short duration to study systems and formulate a reorganisation plan.

Added to that, time available to plan for the reorganisation of the IT/IS systems was cut short by a deliberate separation of County and District staff, due to political and job placement issues. Political complications occurred as a result of resistance to the District/County Council merger by a number of Council members, in conjunction with a number of County Council senior staff. Job placement complications occurred as a result of the failure of the reorganisation committee to accommodate the transfer needs of staff to the desired new Council location. Therefore, to minimize the effect of these two elements, District and County staff were kept from communicatting with each other. As a result, the two sets of staff did not have sufficient information on each other's skill level, system operation, needs and wants. The problem was finally resolved 4 months before the planned reorganisation date, leaving little or no time to finalise a reorganisation plan of the IT/IS systems. By then, a decision was taken by the director of finance to stay with all operable District Council systems and not investigate the removal of systems unless it was absolutely necessary (that is the system stopped functioning). The decision was his because the ICT department is part of the Finance department.

The investigation into Case Study D demonstrated that as a result of time limitation, the new Council was made up of two IT/IS staff divisions. The first consisted of those who belonged to the old District Council, who had high IT/IS knowledge and were trained to use adopted systems, but could not handle the increase in work load. The second consisted of those who belonged to the old County Council, who were not qualified to use most IT/IS systems and needed immediate training to enter and process data. Since the first priority of the new Council was to insure the continuity of service delivery to clients, training County Council staff on District Council IT/IS systems was going to take time and financing, two resources not available during reorganisation. Therefore, the decision was taken to allow them to enter the data manually until sufficient resources were available to train them. The new Unitary Council was also in receipt of data from the old County Council, who had one year to transmit the data to their relevant locations in the new Councils. The transition period took approximately two years until normal operation of the merging Councils was resumed. The current ICT department has 23 IT/IS specialists, whose role is to service, support and manage approximately 1000 organisational PC users in 22 departments across 88 locations. The IT/IS department is also responsible for maintaining IT/IS systems in 48 schools.

5.6.2 Investment Process

The ICT department is currently developing an IT/IS procurement policy that will be applied across the Council. The policy is needed to rectify variations in IT/IS investment approaches and to coordinate the IT/IS effort in the Council, as in the past this represented complications to the ICT department. The hardware and software investment policy is specifically designed to:

- Insure that the Council capitalizes on its IT/IS investment by justifying the need for the project and placing check-points for project milestones.
- Minimize the number of technical issues by standardizing hardware and software brand names where possible.
- Assign responsibility where it's due.

Interviewees commented that the policy would formalise the unofficial (but common) practice of the Council. For example, departments in the Council always consulted the ICT department for recommendations on their IT/IS investment. The policy would insure that the timing of the consultation would allow the ICT department time to do research before giving recommendations. This is especially necessary to avoid incidents (as with the Ledger system) where the ICT department is not notified about the project until Council members approve the IT/IS investment. In the case of the Ledger system, the ICT department could not give an informed recommendation on the appropriateness on the project, review alternatives, or coordinate the project with other IT/IS investments in the organisation. One senior interviewee noted that 40% of IT/IS investments are initiated and pursued within departments and without the notification of the ICT department. The timing of the new policy coincides with the restructuring of the organisation currently being undertaken by the Council. The ICT is confidant that the time is now suitable to secure an approval from Council members on the application of such a policy across the organisation. In addition, the ICT department now has IT/IS representatives in each directorate, operating as business analysts with IT/IS expertise. These representatives will be able to better inform the ICT department about IT/IS developments in their respective departments and operate as enforcement agents of the procurement policy. Since inception in 1996, the ICT department has not developed guidelines for technical specifications of hardware and software, to be applied on new IT/IS investment. The new procurement policy will include such guidelines.

Recent IT/IS investments include:

1. *Inter-Organisational E-mail:* was started in 1997 to improve communications between departments and to facilitate document transfer. The system accommodates approximately 900 users. The project was approved after the ICT department produced a report for Council members that justified the project.

2. *Thin Client:* was initiated as a result of the need to replace hardware that is not Y2K compliant. The project represents the current IT/IS technical direction of the Council. It connects network terminals to a central server, which distributes the application to users. The change to this strategy was adopted after the approvals of the ICT and Revenues Directors. The project was implemented across the organisation, replacing PCs identified from the Y2K audit.

3. *Digital Image Processing (DIP):* was added as a feature to the Council Tax and Benefits system to reduce space for paper storage. The project was started in 1999 and was completed in March 2001. The Revenue department owns the system. The assistant director of revenue decided on the technical specifications of the system and the project followed a tendering process. Currently, the Extract department will be co-using the system with the Revenue department to bring in the invoices.

5.6.3 Evaluation Practices

Since reorganisation, the Council has not been able to develop a process that can facilitate IT/IS investment evaluation. Interviewees commented that during the transition period (1996 to 1998) the workload on IT/IS staff gave them no time to develop such a process. Their primary objective was to facilitate the transition of IT/IS systems under the administration of the new Council, whilst maintaining the delivery of IT/IS service to the organisation. However in July 2001 the ICT department began developing the ICT Procurement Policy. The Procurement Policy requires all IT/IS proposals to submit a business case, evaluate vendors against specific criteria and use GCAT[1] to estimate project costs. Those are the three requirements of the procurement policy (which are discussed in detail next) that make the ICT confident of its ability to justify IT/IS investments. Firstly, the procedure requires the project department to prepare a business case for the proposed investment to include:

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[1] GCAT is a government backed IT/IS catalogue, issued by the Centrail Computer and Telecommunications Agency (CCTA) since April 1996

- *Current Situation:* which describes what is the current IT/IS process and problem area that requires a solution.

- *System Requirements:* including the objectives and project deliverables from the proposed IT/IS investment.

- *System Outline:* specifications, resources required, potential package solutions and provisional implementation timetable for the IT/IS project.

- *Costs:* which estimates the procurement and maintenance costs associated with hardware, software, cabling and interface, data capacity and conversion, training, consultancy and man-hours.

- *Benefits:* which forecasts the financial/staff savings, service improvements, information availability, management control and information quality as a result of implementing the proposed IT/IS system.

Secondly, the procedure has a set of criteria designed to assess the response by vendors to the IT/IS investment tender. Essentially, the criterion looks at the experience of the vendor with the proposed technology for the project and classifies the vendor's ability to devolve the project as desired by the Council. Implementing vendor evaluation assures the Council that it is in good hands. The criteria includes:

- The clarity of the response to the invitation to tender (ITT).

- The compliance of the proposal with hardware and software platforms as specified by the ITT.

- Simplicity of the technical solution from the support viewpoint.

- The extent to which the response meets the business and operational requirements as specified by the ITT.

- A proven track record of successful implementation of 'XXX system' in a similar size organisation using products and services proposed for the Council.

- The ability of the supplier to provide a total solution. Including specifications of hardware and software, system integration and interface, training, project management, consultancy and system implementation services.

- The perceived ease of use of the proposed solution particularly with the logging and maintenance of key transactions and seamless integration with configuration and change management functions.

112

- The flexibility of the proposed system to adapt to and accommodate future growth requirements e.g. the implementation of other business processes.

- Impact on the Council's current working practices.

- Implementation effort for technical and customer staff.

- A track record for product growth/enhancements and product development planning for the future.

- Product maintenance and on-going support provision.

- Company stability and financial standing.

- Project management, implementation and other professional services proposed.

- Total initial and recurring costs.

- Performance at a comparative reference site.

Thirdly, the ICT procurement policy compares (as much as possible) the cost of proposed IT/IS projects against the list of IT/IS commodity items and services issued by GCAT. The three elements (that is business case, criteria to assess vendor and GCAT) are currently viewed by the ICT as a complete IT/IS evaluation activity against risky, unnecessary, and expensive IT/IS projects. The ICT procurement policy has not been tested as of now on new IT/IS investment proposals (since it is still in development). Interviewees commented that most of the elements in this case study merely formalise historic IT/IS investment proposal protocol in the Council. Case Study D has also been participating in the benchmarking exercise as with the previous case studies (A, B and C).

5.6.4 Barriers to the Application of IAT

Case Study D provided insight into the organisational practice of selecting IT/IS Investment appraisal techniques (IAT) and the barriers during this adaptation. Case Study D showed that the reorganisation schedule was extremely time constrained (4 months), which effectively prioritised the reorganisation task of merging systems and staff. Therefore, as a direct result of time limitations and the reorganisation work volume, any assessment of value, worth or usefulness of IT/IS systems was viewed by ICT as a luxury, rather than a necessity (Barrier 1). Time limitations also forced the Council not to implement systems that required user training. The Credits and Payment system was such an example, needing extra PCs to accommodate an increase in staff.

No evaluation was performed, and no PCs were procured because of user training issues. During reorganisation, interviewees commented that maintaining the delivery of IT/IS services was required by all departments, which made IT/IS evaluation relatively useless. The reason being that any IT/IS evaluation recommendations for system removal were not going to be implemented, as departments could not stop the service delivery to their clients. For example, the Credits and Payment system required extra PC terminals to accommodate an increase in staff from 450 to 4500. Without the extra PCs, manual data entry would be necessary, which disrupts the current operation. Therefore, departments had little or no use for an evaluation process that would produce unusable recommendations, as they were instructed not to replace existing systems unless they stopped functioning (Barrier 2). With Case Study D, budget restrictions during reorganisation forced the Council not to consider IT/IS solutions that required further investment of IT/IS systems. As such, evaluating the value, worth or usefulness of new IT/IS systems was not conducted due to fund shortage (Barrier 3).

During reorganisation of Case Study D, the functionality of the IT/IS systems and upgrade costs were the main categories for keeping or eliminating systems. Consequently, management did not need to assess the value, worth or usefulness of systems beyond the two categories (Barrier 4), further limiting the application of IT/IS IAT. However, some systems were changed (without evaluation) due to a need beyond the categories listed above. For example, the old Ledger system did not fit new government legislation. Consequently there was an immediate need to replace it (Barrier 5). This forced the Council to invest in a new IT/IS system, leaving little or no room to justify the value, worth or usefulness of such a system. Another example is in the case of the Payroll system, where the support for the software was going to expire as the supplier of the software was no longer able to maintain it. Therfore, the ICT decided to be proactive and changed the system to a windows based interface. Yet another example would be the E-gov project, which is forcing the Council to integrate its IT/IS systems by 2005. This is necessary to allow the Council to increase communications between databases and provide clients with its services via Internet. Consequently, all new IT/IS investments must be geared in that direction, limiting the scope of the IT/IS evaluation to systems of a specific type.

The investigation of Case Study D showed that it was common practice in the Council to choose the technical specifications of new IT/IS investments to be compatible with the old system and ask users for extra requirements. Listing specifications in such a way may give little or no room to identify (with IT/IS Investment appraisal techniques) actual benefits needed to fit the requirements and design the functionality accordingly (Barrier 6). The summaries of the barriers discussed in this section are as follows:

Case Study D - Barrier 1: As a direct result of time limitations, the reorganisation work volume prohibited any assessment of value, worth or usefulness of IT/IS systems as it was viewed by ICT as a luxury, rather than a necessity.

Case Study D - Barrier 2: Maintaining the delivery of IT/IS services to the local population was the primary objective during reorganisation, forcing departments to have little or no use for an evaluation process that would produce unusable recommendations.

Case Study D - Barrier 3: Shortage of funds prohibited IT/IS investments and consequently evaluation.

Case Study D - Barrier 4: IT/IS systems and upgrade costs were the main categories for keeping or eliminating systems.

Case Study D - Barrier 5: Systems were changed because of circumstances beyond the control of the Council, leaving little or no room for IT/IS evaluation.

Case Study D - Barrier 6: IT/IS specification selection practice in the Council does not require IT/IS evaluation.

5.7 Common Thirds Between Case Studies: Grounds for Drawing Case Study Parallels

Whilst conducting the empirical inquiry, evidence of similar key issues surfaced from the case studies (A, B, C, and D). These issues are presented and discussed in this section, as follows:

- All case studies are located in one historically and culturally distinct region in the UK. As such, they are susceptible to the same economic and political conditions that form an integral part of their context.

- All case studies are subject to the legislation from the same local government, such as that issued for reorganisation in 1996 (as described by section 5.2).

- All case studies are non-profit making organisations.

- All case studies provide the same array of services (figure 5.3) to clients with the same demographics, offering Council services in the areas of local planning, fire fighting, schools, libraries, social services, public health and sanitation, recreation, the environment and voter registration. figure 5.3 summarises all services offered by the case study organisations.

- All case studies have elected members (Councillors) that function as board of directors would in a profit-making organisation. As such, any IT/IS justification document must ultimately be geared to gain the approval of the Councillors.

- All case studies have the same source of income. Namely: 80% in the form of government aid and 20% collected form the local community as tax.

- All case studies participated in the reorganisation effort of 1996, as described in section 5.2.

- All case studies have a central Information and Communications Technology departments (ICT). In all cases, ICT is responsible for the overall IT/IS strategy and technical direction. In addition, ICT approval is required for all new IT/IS procurements in the organisation.

- All case studies have both isolated systems that support the particular departmental business process, as well as corporate systems that are used across the organisation.

- All case studies participate in a benchmarking activity, initiated by the local government.

5.8 Recurring Barriers Across Cases

This section of the dissertation places the findings of the empirical research into perspective by aligning all barriers identified in the four case studies and analysing them for occurrence patterns. This is possible due to the issues raised in section 5.7, where common thirds between case studies gives sufficient grounds to draw parallels.

116

However, this research does not claim that through drawing parallels the results may be lifted to a state of generalisation. Only the recognition that within the confines of the case studies, parallels between barriers exist. Indeed, this thesis agrees with authors such as Yin (1994) and Irani (1999ᶜ) that generalisation may not be achieved through case studies because findings are very often case specific (that is time, location, context). Having said that, drawing parallels between barriers will enable the author of this dissertation to modify the conceptual model (figure 3.2) into a *frame of reference* that decision makers may consult whilst evaluating their systems. To that end, table 5.2 containing all the barriers identified in the case studies is given below. Based on the discussion presented in the case studies, the barriers have been grouped under ten barriers. The tables also show the frequency of sub-barriers occurring within each barrier and during each case study. For example, barrier 2 has surfaced in some shape or form three times during Case Study A and once during Case Study C, but not during Case Study B and Case Study D.

It is important to note that identifying potential barriers is a subjective issue and open to interpretation. Therefore, the discussion to follow represents the authors best interpretation whilst acknowledging that other interpretations exist. It is equally important to note that identifying specific barriers is a difficult task because in practise they do not exist in isolation from each other. That is to say, the barriers, as presented in this research, have a specific shape and form. For example: *'Feasibility reports and vendor evaluations, were viewed as sufficient to go ahead with decisions'* (Case study A, barrier number 5). However, barriers will exist within the realm of other barriers. Drawing specific lines between them may not be realistic as the cause and effect relationship between them is not established. Nevertheless, this research gives barriers a specific shape and form to enable the study of them in detail. It is therefore the position of this dissertation that barriers will often cluster to prevent the application of IAT. The benefit of separating them is to allow the presentation of evidence of their existence and to give direction for future research into their relationship with each other. A closer examination of table 5.3 shows a specific pattern of barrier occurrence. Notably, barriers 1, 6 and 7 have surfaced in some shape or form during all of the case studies. Indicating their potential candidacy for infusion in the conceptual model (if they do not already exist).

Barrier	Sub-Barriers	CS A	CS B	CS C	CS D
1. Standing Organisational Investment Process	*Barrier 1 occurred three times in some shape or form during Case Study B, and ones during Case Studies A, C, and D* Feasibility reports and vendor evaluations, were viewed as sufficient to go ahead with decisions (A5); IT/IS operating costs, functionality, data capacity, and user training are viewed as sufficient information to assess keeping system (B2); The manner in which the benefits list is developed for IT/IS projects may have acted as a barrier to the application of IAT (B8); Tendering process is perceived by decision makers to deliver the IT/IS project at the lowest possible cost (B9); Information on system cost, data, and employees was deemed as sufficient tool to decide on IT/IS systems (C4); IT/IS systems and upgrade costs were the main categories for keeping or eliminating systems (D4).	✓	✓ ✓ ✓	✓	✓
2. Unavailability of an IT/IS Investment Process	*Barrier 2 occurred three times in some shape or form during Case Study A, ones during Case Study C, but not in Case Studies B and D* Unavailability of organisational rules and regulations that support the use of any IT/IS Investment appraisal techniques (A8); Political inability of the ICT department to commit users to the evaluation process (A9); Departmental, rather than corporate decision making (A10); no organisational rules and regulations that support the application of IAT for new IT/IS projects (C5).	✓ ✓ ✓		✓	
3. The Application of IAT Was Not Required	*Barrier 3 occurred once in some shape or form during Case Studies A, B, and D. But not in Case Study C* IT/IS evaluation was not required from the ICT department by the organisation (A11), Administration did not require the assessment of IT/IS business value (B3), common IT/IS specification selection practice in the Council does not require IT/IS evaluation (D6).	✓	✓		✓
4. Add-on Systems Justified as Necessary	*Barrier 4 occurred once in some shape or form during Case Studies A and B. But not in Case Studies C and D* Managers used their authority or political influence to justify the procurement of add-on systems (A3); IT/IS upgrades were justified as necessary investments (B5)	✓	✓		
5. Instructions by Management to Evaluate in a Specific Way	*Barrier 5 occurred once in some shape or form during all Case Studies, but not in Case Study D* Spend extra funds to prevent the reduction of departmental budget (A4); Instruction by ICT to invest only in 'proven' technology limits the ability of evaluators to explore IAT that may recommend 'unproven' technology (B7); Administration instructed departments not to evaluate IT/IS (C3).	✓	✓	✓	
6. Insufficient Time to Conduct Evaluation	*Barrier 6 occurred once in some shape or form during all Case Studies* IT/IS evaluation was not considered a priority during reorganisation due to other overwhelming tasks and time limitations (A1); The time allowed for the reorganisation effort prohibited the employment of IAT (B1); Eight months to develop the reorganisation plan (C1); the reorganisation work volume prohibited any assessment of value, worth or usefulness of IT/IS systems (D1)	✓	✓	✓	✓
7. Unavailability of Financial Resources	*Barrier 7 occurred once in some shape or form during all Case Studies* Lack of organisational funds to finance an IT/IS evaluation project (A7); The absence of financial support to perform evaluation impeded the employment of IAT (B6); Budget cuts during the first five years left little or no room to conduct IT/IS evaluation (C2); Shortage of funds prohibited IT/IS investments and consequently evaluation (D3)	✓	✓	✓	✓
8. Forced Change Prohibiting Evaluation	*Barrier 8 occurred once in some shape or form during Case Studies A and D. But not in Case Studies B and C* Y2K was used in the organisation to push for IT/IS modifications and procurements of new systems (A6); Systems were forced to change because of circumstances beyond the control of the Council (D5)	✓			✓
9. Reactive Management style	*Barrier 9 occurred once in some shape or form during Case Studies A and C. But not in Case Studies B and D* IAT that explore new IT/IS avenues were not a necessity for such a reactive organisation (A2); Passive nature of government Councils (C6)	✓		✓	
10. Maintaining Delivery of Service	*Barrier 10 occurred once in some shape or form during Case Studies B and D. But not in Case Studies A and C* Focus on maintaining the delivery of Council services to local population (B4); Maintaining the delivery of IT/IS services was the primary objective during reorganisation (D2)		✓		✓

Table 5. 2: Parallels Between Barriers Identified in the Case Studies

5.8.1 Organisational Investment Process

The 1st barrier in table 5.3 (labelled as: *Standing Organisational Investment Process*) encompasses all sub-barriers identified during the case studies that directly cause the exclusion of IAT as the result of organisational investment decision-making practices. This barrier shows that in-house criterion, used to evaluate IT/IS proposals, will move decision makers away from applying most IAT. For example, in Case Study A, decision makers were content with using a feasibility report, in addition to assessing contractor support capability, as the standing criteria for accepting or rejecting IT/IS proposals. In Case Study B and Case Study C, decision makers gathered information on the cost of the project, technical specifications, as well as employee needs, and used that information as criteria to justify the project. In Case Study D, decision makers decided which systems to keep during reorganisation on the basis of IT/IS functionality and upgrade costs. In all the last three examples, there was no need to apply IAT, as the process traditionally used in the organisation was deemed sufficient to pass judgment. The motto here is that 'if it is not broken, don't fix it'; leaving little or no room for decision makers to explore the advantages of using IAT that are not part of the traditional investment process.

Supporting the argument that organisational investment process does affect the application of IAT, the 2nd barrier (table 5.3) indicates that in 2 out of the 4 cases, the administrators of the evaluation process could not apply IAT because there was not an investment process infrastructure that supported it. In Case Study A, the investigation showed that the organisational IT/IS development process did not specify evaluation (or the use of IAT) as a phase during system development. The investigation attributed the overall departmental (as opposed to corporate) decision making style of the organisation as the main element for not having such a process. As such, Case Study A could not bring together the organisation under the umbrella of a unified investment process, leaving each department to evaluate in their own way. The side affect of this is that the ICT department did not have the authority to commit departments to participate in an evaluation process. Case Study C has similar attributes for not applying IAT. Here, the ICT department does not see evaluation as its responsibility and the organisation does not have rules and regulations to say otherwise. As a result, departments are left to evaluate as they please, which often boils down to traditional IAT.

As an extension to that last argument, the organisation as a whole, and the ICT department in particular, may not attempt to apply an IAT because it was not required from them by the organisational process. Here, the 3rd barrier (table 5.3) shows that evaluators may not object to the application of IAT. However, as rules and regulations do not insist on it, evaluation does not employ IAT. Interviewees made these comments in 3 out of the 4 cases, stating that other job requirements took priority over evaluation (and the application of IAT) which was in any case not required. Furthermore, the 4th barrier in table 5.3 indicates that in 2 out of 4 cases, add-on systems did not go through any form of official justification as they signified a logical improvement to the system. Again, IAT were not applied, as the process for investing in add-on systems did not require it.

The 5th barrier (table 5.3) shows that the opposite situation will also affect the application of IAT. That is to say, when the organisation has a specific process that indicates how to evaluate IT/IS proposals, it will limit the evaluations to particular IAT, if any are used at all. This barrier occurred, in some shape or form, in 3 out of the 4 case studies. Typically, this situation would occur when authority is given, by the organisational rules and regulations, to decision-makers, thus allowing them to dictate the way in which IT/IS proposals are justified. For example, there is a reoccurring practice in Case Study A where department directors ordered the procurement of IT/IS for the purpose of protecting the department budget from cuts in the next budget cycle. By doing this, those directors dictated the evaluation process to proceed in a specific fashion, thus negating the application of IAT. In Case Study B, the ICT department issued specific orders to all departments not to procure *unproven* (widely used) technology, thus limiting the ability of evaluators from applying IAT that may recommend otherwise. In Case Study C, the effect of rules and regulations was specific to IAT, as departments were ordered by the administration to abandon systems that did not fit pre-specified criteria. The key point here is that they were ordered to do this. Notably, the re-emergence of the effect of traditional investment process on IAT during the entire empirical inquiry makes it a potential candidate for infusion in the conceptual model (figure 3.2).

5.8.2 Duration Allowed for Evaluation

The 6th barrier (table 5.3) indicates that in all of the case studies, employees were overwhelmed with work during reorganisation, to the extent that evaluation became a luxury rather than a necessity. Here, organisations could not allow sufficient time for the evaluation process to explore the application of IAT, depending instead on pre-specified criteria, or nothing at all. During the reorganisation period (1st April 1995 to 1st April 1996) all case studies indicated that the reorganisation team had to develop plans for the transition from the old Council configuration to the new Unitary Council configuration; accounting for the new line of services, budget restrictions, as well as employee and client needs. Interviewees commented that it was time consuming and was required from them whilst they continued to perform their original function. As such, they viewed that the duration allowed to develop reorganisation plans was insufficient to evaluate all systems, study information workflow, develop alternative solutions and plan for their replacement if necessary. As such, evaluation of the business value of IT/IS systems was bypassed in favour of looking at current systems from operability and upkeep cost point of view. Those systems that did not fit specified functions within the budget allowed were removed and replaced with new systems. In effect, time limitations prohibited decision makers in all cases studied from applying IAT. Notably, the re-emergence of this barrier during the entire empirical inquiry makes it a potential candidate for infusion in the conceptual model (figure 3.2).

5.8.3 Unavailability of Financial Support for Evaluation

The 7th barrier (table 5.3) indicates that in all of the case studies, the unavailability of financial resources prohibited, in one form or another, the application of IAT. In Case Study A, the ICT department commented that it did not have staff to perform IT/IS evaluation and that it was not able to hire new staff because their budget had been decreasing for the previous three years. Financial restrictions also prohibited Case Study B from employing new staff to conduct IT/IS evaluation, or even to hire outside consultation to do the job. Case Study C had similar budget restrictions on a larger scale, as they had to endure a 20% cut over the previous five years whilst maintaining the level at which their service is provided. As such, Case Study C did not have funds to conduct IT/IS evaluation and employ IAT. Case Study D was also unable to conduct evaluation as a result of financial restrictions.

However, this situation is different as the problem was not getting staff to evaluate the system, but finding the funds to carry out the recommendations of the evaluation. In Case Study D, even if evaluation recommended the removal of a system, the reorganisation team would not have had the financial capability to undertake the project. As such, IT/IS evaluation was abandoned in favour of simple functionality and upkeep cost criteria. Notably, the re-emergence of this barrier during the entire empirical inquiry makes it a potential candidate for infusion in the conceptual model (figure 3.2).

5.8.4 Other Recurring Barriers

The remaining barriers in table 5.3 (that is 8th, 9th and 10th) occurred in 2 out of 4 case studies. As such, it is difficult to draw parallels across the case studies to a position where the barriers can be infused in the conceptual model. However it is important to note that IAT were not applied during IT/IS evaluation because it was viewed as unnecessary in barrier 8, was viewed as in opposition to the organisational management style in barrier 9 and was not conducted in barrier 10 as priority was given to keeping the system running, rather then taking them off-line to evaluate them.

5.9 Summary and Conclusions

This chapter has presented the findings of the empirical data collection and analysis of four case studies in the public sector, through which the testing of the proposition in Chapter 3 was possible. In total, 34 distinct barriers to the application of IAT have been identified from the case studies, which are presented in table 5.3 under the categories of ten barriers. Although generalising from case studies would not be appropriate, this dissertation has drawn parallels from the case studies to demonstrate recurring barriers. In doing so, the barriers that resurfaced during all case studies can be used as a beacon to guide future research into the application of IAT in the public sector, without claiming generality. This chapter has demonstrated that case study as a research strategy can be effective in collecting data as required by the UOA. After four Case Studies, no new information was being discovered and the barriers, as named in propositions A, B, C and D, were confirmed as present within the confines of the empirical inquiry. As such, future research into barriers to the application of IAT in the public sector might adopt a similar approach to that undertaken in this dissertation.

Although 34 barriers have been identified, there is still the possibility that other barriers may exist within different locations in the public sector throughout the UK. Some, or all, identified barriers may exist in the private sector.

Organisational rules and regulations, as well as time and fund limitations proved to be the most visible barriers during the case studies investigated. Those barriers stem from the bureaucratic operating conditions of the Councils, forcing decision makers to implement systems under pre-specified conditions (time, fund). This results in in-house criteria that may oppose IT/IS evaluation and the application of IAT. Until that bureaucratic system is reviewed, the identified barriers will most likely remain an obstructing force to the application of IAT. Furthermore, the case study investigation showed that the elected Councillors represented the ultimate decision makers in the bureaucratic system of the public sector. New expenditure (including IT/IS projects) has to be justified by meeting their official criteria as well as their unspoken criteria (which can be based on their skills and experiences). As such, the employment (or exclusion) of IAT is linked to the internal value system of the Councillors, as only they can place any *value* on the application of IAT.

The case study investigation demonstrated that the majority of new IT/IS investments usually targeted cost savings and higher employee efficiency (to save more costs) and aimed to replace systems that stopped functioning. This description on new IT/IS investments seems to agree with the reactive and bureaucratic nature of the public sector. As such, until Councils stop using systems as long as possible and replacing them out of necessity, IT/IS evaluation will continue to be a formality that justifies a decision that has already been taken. Consequently, the application of IAT will not be required in these reactive, cost saving and bureaucratic operating conditions. Further more, IT/IS systems that cut costs and improved efficiency, as argued in the literature review (section 1.5), may not be in the best interest of the populace. As the public sector is a service-oriented industry, customer satisfaction may be the ultimate measuring stick by which the bureaucratic public organisations will be judged. Therefore, decision makers in Councils should find a way to integrate customer satisfaction into their IT/IS evaluation criteria.

The case study investigation showed that applying the traditional life-cycle model would not have been practical for the Councils as most systems were inherited, which made determining their position (phase) within the life-cycle impossible. During reorganisation, decision makers disregarded whether systems were in the beginning or at the end of their life-cycle and assessed them on the basis of appropriateness (according to the in-house criteria) within the new organisational context. This seems to agree with the notion that incremental systems (without a clear starting point) may be the most dominant type of system in organisations. As such, the empirical inquiry demonstrated that non-traditional life-cycle models might be more practical for adaptation on inherited systems, as the alternatives (traditional life-cycle models) were not.

Chapter 6

Frame of Reference

This chapter presents the novel contribution claimed in this dissertation. It starts by distinguishing between statistical generalisation and analytic generalisation. Thus, establishing the basis in which the conceptual model will be transformed into a frame of reference. Next, the chapter revisits the necessity for the conceptual model and discusses why testing is important. In doing so, it re-establishes the need for the propositions first presented in Chapter 3, and consequently the methodology that followed in Chapter 4. After that, a presentation of core barriers to the application of IAT is given from the conceptual proposition point of view, as well as from the empirical findings point of view. This leads on to performing amendments to the propositions and the conceptual model of Chapter 3, based on the findings of the empirical enquiry. The result is the frame of reference, which is the dissertation's novel contribution to the body of knowledge. Finally, and as the result of the suggestion of the frame of reference, implications are given for the benefit of researchers and practitioners.

6.1 Introduction

This dissertation aims to produce a *frame of reference* that can be consulted by decision makers so they might recognise barriers to the application of IAT in the public sector. By using case studies to identify barriers to the application of IAT in Unitary Councils, empirically testing theoretical propositions, and demonstrating a pattern in the occurrence of barriers as named by the propositions, it is possible to *transform* the conceptual model (figure 3.2) to a *frame of reference*. The transformation would require that which Yin (1994) labels as analytic generalisation, in which:

"A previously developed theory is used as a template with which to compare the empirical results of the case studies". (Yin, 1994; Page 30)

In this dissertation, the propositions of section 3.4 are used as a template for the purposes of analytic generalisation, which should not be mistaken for statistical generalisation, where inference given about a population (or universe) depends on empirical data showing the percentage of occurrence within a sample. As such, the *frame of reference* would not claim to be applicable for all decision making situations, but presents itself as a useful tool for organisations passing through similar conditions (reorganisation). Decision makers can consult the *frame of reference* during the IT/IS development process. It may also be employed by evaluators who wish to consider barriers (as named by the *frame of reference*) during the justification of new IT/IS investments. As such, this chapter will now re-examine the conceptual model (figure 3.2) and modify it to accommodate the findings of the empirical research. Therefore finalising the *frame of reference* and satisfying the aim of this dissertation. In fulfilling the aim of this dissertation, the chapter will have presented the dissertation's contribution to the body of knowledge.

6.2 Amendments to the Conceptual Model and Propositions

This section brings together the findings of the case study investigation with that of the literature review for the purpose of administering amendments to the conceptual model (figure 3.2), transforming it into a *frame of reference* (figure 6.1).

Figure 6.1: Frame of Reference for Recognising Barriers to the Application of IAT
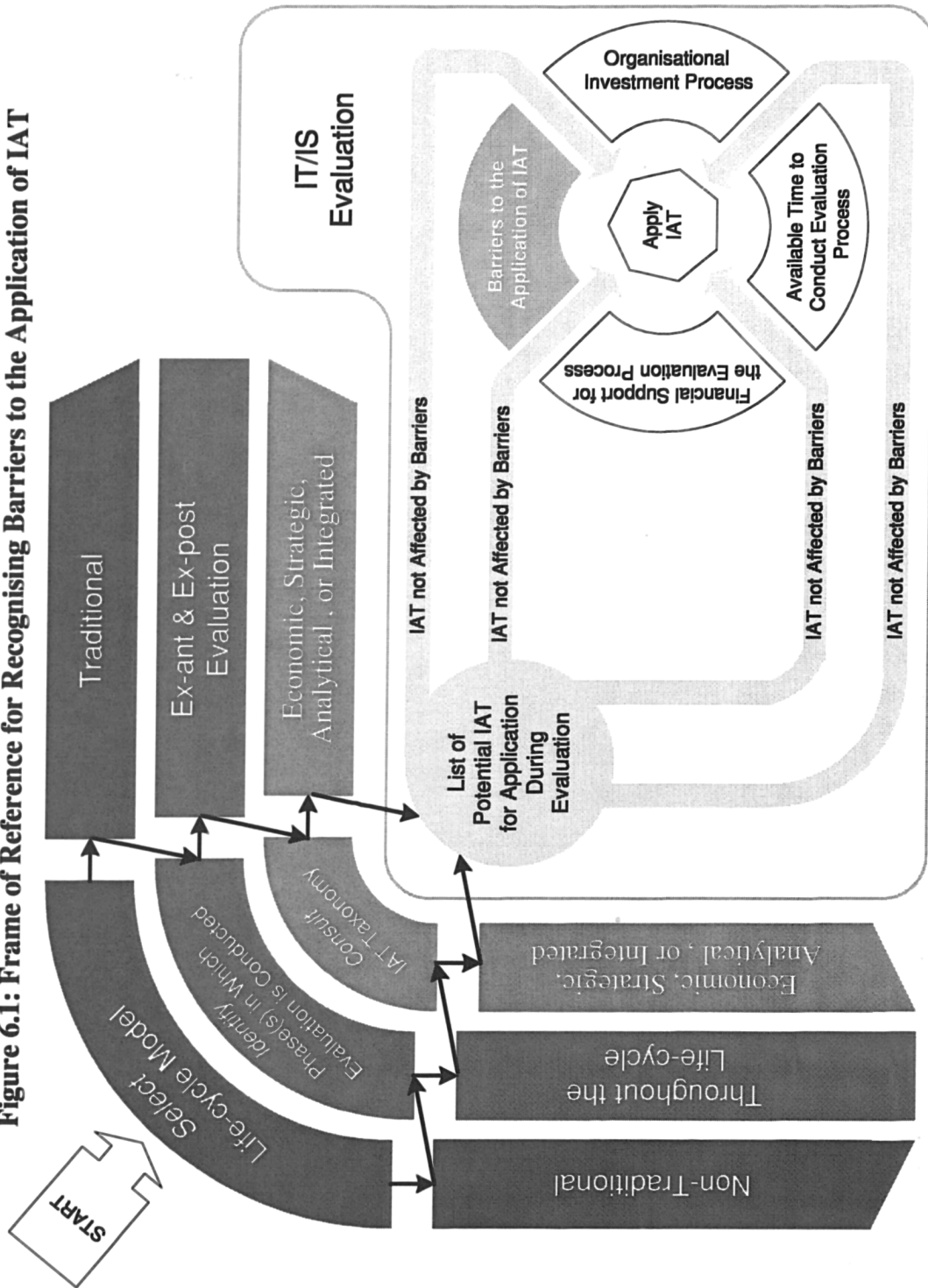
The *frame of reference* has two objectives:

1. *To guide the decision maker through a series of tasks to a point where a list of IAT is developed for potential application during IT/IS evaluation.* This can be achieved by allowing the decision maker to first *select* a life cycle approach (that is traditional or non-traditional) at the starting point of the *frame of reference*. This allows the *frame of reference* to take into account both incremental systems as well as stat-ups. Next, the *frame of reference* encourages decision makers to identify phase(s) in which evaluation can be conducted. In doing do, the role of the evaluation process may be established (see section 1.1), and to allow the decision maker to consider the characteristics of the IAT for the evaluation process (that is quantitative and/or qualitative). Finally, decision makers are encouraged to consult IAT taxonomies [such as that of Farbey *et al.* (1992), Irani[1] *et al.* (1997) or Renkema (2000)] for the purpose of identifying IAT for potential application in their evaluation process.

2. *To guide the decision makers to the application of IAT by recognising barriers to them.* This part of the *frame of reference* is structurally identical to that of the conceptual model (figure 3.2), which was described in section 3.3. However, whereas the barriers presented in the conceptual model are based on propositions derived from the literature review, those barriers given in the *frame of reference* are based on empirical findings from the case study investigations, which will be discussed in the next three sub-sections.

6.2.1 Life Cycle Model

The investigation of case studies A, B, C and D showed that the conceptual model, as presented in figure 3.2, was in part not representative of IT/IS system life cycle models as employed by the Councils. All case studies demonstrated that during reorganisation, traditional life cycle models were not applicable where systems were inherited from the old Councils during the merger process. For example, 57 of the 60 implemented systems in Case Study A were inherited and in Case Study B only one system was replaced just after the reorganisation date in 1996 (District System) whilst all other systems were inherited.

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[1] IAT classifications in the taxonomy of Irani *et al.* (1997) are used in the frame of reference (i.e. Economic, Strategic, Analytical or Integrated). However, the frame of reference may employ alternative taxonomies as desired by the decision maker.

The case study investigation showed that the reorganisation team could not practically determine the phase (during the life cycle) where the inherited system might be, as most inherited systems were not accompanied by documentation about their development and had passed through several upgrades. Development documents show when the system was inherited/deployed and upgrades can disrupt (and hide) the natural life cycle of systems by prolonging them. Consequently, inherited systems were very difficult to place within the traditional life cycle model. As such:

- Traditional life-cycle models were not used to guide the reorganisation of the inherited systems.

- Inherited systems were evaluated on their individual merits against criteria (developed by ICT).

- Inherited systems were allowed to continue functioning until they stopped doing so.

In compliance with findings from the case studies investigation, the conceptual model will need to be modified to accommodate situations where the organisation does not invest in new systems, but may also inherit currently operating systems. The modification to the conceptual model, with regards to the life cycle, is presented in figure 6.1 as part of the *frame of reference*. Figure 6.1 advocates modifying the conceptual model in figure 3.2 so that it is not dependent upon the traditional life cycle model.

6.2.2 Proposition A and the First Barrier to the Application of IAT

Whilst developing Proposition A (*Organisational IT/IS evaluation process will recommend the use of specific Investment appraisal techniques*), the literature review (section 2.6.3) suggested that the organisational IT/IS investment process can include rules and regulations, which in turn can influence (if not control) the IT/IS evaluation process and dictate the use of explicit IAT. In all the case studies, departments followed strict assessment criteria of IT/IS systems during the reorganisation period (table 6.1), which prohibited the reorganisation teams from employing IAT not specified by the criteria. After reorganisation, the empirical inquiry demonstrated that ICT procurement polices, and EC tendering regulations, governed the decision makers' IT/IS justification process.

129

The case studies also demonstrated that the elected Councillors represented the ultimate decision makers in the Councils. This forced decision makers to justify IT/IS projects in terms that the Councillors could understand and accept, thus yielding to the Councillors' unspoken justification criteria. Therefore, the case study investigation showed that departments were indeed influenced by an organisational IT/IS investment process, including official and unspoken rules and regulations, which in turn acted as a barrier to the application of IAT. Therefore, the barrier to the application of IAT in Proposition A (organisational investment process) will be included in the *frame of reference* as presented in figure 6.1.

	Case Study A (Section 5.3.1)	Case Study B (Section 5.4.1)	Case Study C (Section 5.5.1)	Case Study D (Section 5.6.1)
Criterion 1	Data Capacity	Data Capacity	Data	Data Capacity
Criterion 2	Cost	Cost	Cost	Maintenance
Criterion 3	Technology	Technology	Staff Needed	Data Migration
Criterion 4	Functionality	People Skills		Functionality
Criterion 5	Data Protection			Functionality
Criterion 6	User Opinion			People Training
Criterion 7	User Training			

Table 6.1: IT/IS Assessment Criteria Employed by Case Studies During Reorganisation

6.2.3 Proposition B and the Second Barrier to the Application of IAT

During the empirical investigation, all case studies reported that the duration allowed for the reorganisation task (table 6.2) compelled decision makers to consider the assessment of value, worth or usefulness of IT/IS systems a luxury rather than a necessity. Time caps enforced (by the regional government) on the reorganisation effort obstructed the application of IAT by overwhelming decision makers with other (non-evaluation) tasks including: developing reorganisation plans, gearing departments towards the reorganisation effort and auditing all IT/IS systems.

	Case Study A (Section 5.3.1)	Case Study B (Section 5.4.1)	Case Study C (Section 5.5.1)	Case Study D (Section 5.6.1)
Duration	6 months	6 months	8 months	4 months

Table 6. 2: Duration Allowed for the Formulation of Reorganisation Plans

Whilst developing Proposition B (*The choice of the Investment Appraisal Technique will be restricted by the time available to perform the task*), the literature review reported that IAT have different characteristics, requiring different types of data, from different sources, and in different quantities, which all depends on the size and function of the system under evaluation. As such, the reorganisation teams in the case studies may not have been able to employ IAT that did not fit with their reorganisation schedules. Therefore, the barrier to the application of IAT in Proposition B (the time available to employ IAT) will be included in the *frame of reference* as presented in figure 6.1.

6.2.4 Proposition C and the Third Barrier to the Application of IAT

Whilst developing Proposition C (*Investment appraisal techniques will be excluded from the evaluation process due to lack of financial support*), the literature review reported that the employment of IAT might be dependant on the type, source and amount of data required (section 2.6.2). Collecting the data depends on the number of employees available, which ultimately depends on the funds available for the IT/IS evaluation task. During the case study investigations, interviewees commented that the budget available for the reorganisation task only permitted them to assess systems on the basis of the in-house criteria in table 6.1, thus prohibiting decision makers from employing more staff to evaluate the actual value, worth or usefulness of systems through IAT. Case studies A, B, C and D all reported that since reorganisation, their IT/IS budget had been decreasing, further reducing their ability to employ new staff to conduct evaluation.

Table 6.3 demonstrates their limited availability of funds for evaluation. It shows that since reorganisation, the ICT budgets for Case studies A and C have been decreasing (10% over the previous three years and 20% over five years respectively). table 6.3 also shows that case studies B and D did not have sufficient funds to invest in new systems, let alone evaluate potential IT/IS proposals. Therefore, findings of the empirical case study inquiry agree with the literature review on the impeding effect of financial resources on the evaluation process and the application of IAT. As such, the barrier to the application of IAT in Proposition C (funds available to employ IAT) will be included in the *frame of reference* as presented in figure 6.1.

	Case Study A (Section 5.3.4)	Case Study B (Section 5.4.4)	Case Study C (Section 5.5.1)	Case Study D (Section 5.6.4)
Budget available for evaluation	£2.5m in 1999 and decreasing 10% over the last three years	No budget for IT/IS evaluation	Decrease of 20% over five years	No budget for IT/IS evaluation

Table 6.3: Financial Support for the IT/IS Evaluation Process

6.3 Implications of the Frame of Reference

The value of the *frame of reference* in figure 6.1 might not be understood by those decision makers attempting to consult it if they do not recognise its implications. Therefore, the implications of the *frame of reference* are as follows:

- The *frame of reference* takes into account that IT/IS systems may not have a definitive start/stop point (deployment/termination), implying that IT/IS systems may continue to evolve from one form (organisational function and/or technical specifications) to another. Therefore, IT/IS evaluation may not be useful if it depends on a start/stop point to perform the assessment of IT/IS. As such, to cope with evolving IT/IS systems, decision makers may need to consider non-traditional life cycle models (as opposed to traditional life cycle) and the role of IT/IS evaluation within them.

- By suggesting that decision makers should consult IAT taxonomies before forming the list of IAT, the *frame of reference* implies that decision makers can lack the knowledge to recognise the potential benefits and drawbacks from employing IAT. As such, the *frame of reference* advocates that decision makers should (at least) educate themselves before ruling out any IAT by capitalising on published IAT taxonomies.

- The *frame of reference* proposes that the pre-existing organisational IT/IS investment process may impede the application of IAT. Organisational investment processes fundamentally represent rules and regulations that where initially placed for the benefit of the organisation. Therefore, the *frame of reference* encourages decision makers to take another look at those rules and regulations and question their impact on IT/IS evaluation.

- The *frame of reference* indicates that if IT/IS evaluation is employed as a singular task (rather than a continues activity) to assess the impact of technology on the organisation during a specific phase in the system's life cycle, it may require a minimum duration to complete. As such, decision makers may need to calculate the duration allowed for the evaluation process and investigate how it obstructs the application of IAT. Effectively, decision makers may have to balance the benefits desired from the evaluation process against the time resources they can allocate for it. Only then can decision makers make an informed choice on the inclusion (or exclusion) of IAT from the evaluation process.

- Due to the existence of barriers to IAT, decision makers will have to eliminate potential IAT for application. Accordingly, the more barriers to IAT, the less choice the decision maker will have to apply IAT. As such, understanding and acknowledging the existence of as many barriers as possible will increase the chance of applying a variety of IAT during IT/IS evaluation. As such, the *frame of reference* encourages decision makers to investigate, and if possible, uncover as many barriers to the application of IAT as possible.

6.4 Summary and Conclusions

This dissertation has named three barriers to the application of IAT in the public sector (organisational investment process, time available for evaluation, funds available for evaluation). The inclusion of the identified barriers from the case studies in the *frame of reference* (figure 6.1) can give decision makers advanced warning about some of the problems they may face whilst applying IAT. Advanced warning can be essential in the decision making environment, useful to bring attention where there is none, and even to educate decision makers for the purpose of improving IT/IS justification practices. The *frame of reference* also specifies with the advanced warning the nature of the potential problem, letting decision makers know that they need to look at the organisational rules and regulations for potential barriers to the application of IAT by way of time limitations, fund limitations and/or pre-existing IT/IS justification processes. As such, the *frame of reference* may be a valuable tool for guiding IT/IS evaluation in the public sector.

Frames of reference are general in nature to accommodate the vast array of decision making conditions that may occur across organisations. As such, frames of reference may be criticised for not aiding the decision makers enough as they require adaptation to the specific organisational context before use. Frames of reference are guiding tools, not procedures to resolve a problem. Therefore they need to be general in nature, but not to the extent where their essence escapes the comprehension of the decision maker. It is important to note that the essence of the *frame of reference* presented in this dissertation is to recognise that barriers can impede the application of IAT in the public sector. As such, the ability of the *frame of reference* to adapt is what makes it useful, as decision makers are able to modify their features whilst taking into account the organisational context, the decision maker's skills and experiences, as well as the essence of the *frame of reference* to produce the desired result.

Although the frame of reference was designed to guide decision makers in the public sector, it may also be suitable for guiding decision makers in the private sector, whilst taking into account that the nature and source of barriers (as named by the *frame of reference*) may not be the same as that in the public sector. For example, time caps may not be due to government legislation (as in the public sector) but due to orders by decision makers to complete IT/IS evaluation within a specific period duration. Fund limitations in the private sector may be due to slow-down in sales, rather than a reduction in financing from the regional government (as in the public sector), and so on.

Chapter 7

Conclusions and Recommendations

This chapter presents the final element of the dissertation by highlighting common ground between the observations from the literature review and the empirical inquiry for the purpose of establishing the findings of the entire dissertation. Following this, a critical review will be given of the research strategy presented where the limitations of the research presented in this dissertation are identified. Then there will be a summary of the novel contribution to the body of knowledge, which will be followed by the research implications. Finally, the chapter gives recommendations for further work.

7.1 Research Findings

Conclusions were presented in the literature review (Chapter 2, section 2.7) and in the empirical data analysis (Chapter 5, section 5.9). It is not the intention of this section to further the discussion of those conclusions. Rather, this section will address the questions asked of the entire study as indicated in table 4.4 (level 4 question). To do so, common grounds between the observations of the literature review and findings of the empirical inquiry will be highlighted.

The literature review in section 2.6 presented challenges to IT/IS evaluation and inferred that those challenges may indicate the existence of barriers to the application of IAT. During the empirical inquiry, a total of 34 barriers to the application of IAT were identified within the case study organisations (table 5.3), which supported the inference made in the literature review between challenges to IT/IS evaluation and barriers to IAT. Furthermore, both the literature review and the empirical inquiry demonstrated that the organisational justification process, the time available for evaluation and the funds available for evaluation could represent barriers to the application of IAT. However, both the literature review and the empirical inquiry acknowledge that barriers would be case sensitive, as the context of the organisation may change from one to another. As such, the literature review and inquiry are in agreement that generalisation of those identified barriers (from the empirical data) is not possible, but may be suitable as a *frame of reference* (figure 6.1) for decision makers investing in new systems.

The literature review showed that when employing a traditional or non-traditional life-cycle approach, decision makers will have some flexibility with when, why and how to evaluate their IT/IS systems. The life-cycle model employed may depend on the decision makers' perception of value, worth or usefulness of IT/IS evaluation. For example, decision makers may decide to only conduct evaluation before and/or after the implementation of the IT/IS system (*ex-ante* and/or an *ex-post* evaluation) in which case a traditional life-cycle approach may be more suitable for the decision maker. On the other hand, the literature review suggests that a non-traditional life-cycle approach may be more suitable for decision makers who constantly use evaluation (for example to learn).

The empirical inquiry demonstrated that the concept of IT/IS evaluation was viewed by the organisations used in the case study to be a pre-implementation/post-implementation activity, rather than a process that spans the entire life-cycle of the IT/IS system. However, it was only conducted when investing in new systems (pre-implementation). As such, and in contrary to reports in the normative literature about the importance of continued evaluation, the empirical inquiry did not show any evidence of appreciation of the concept of continuous evaluation.

The case study investigations demonstrated that decision makers did not apply life-cycle models on inherited systems, as they were unable to categorise the phase in which the inherited system was in. Inherited systems were composed of increments of islands of technology, which makes their evaluation with IAT a difficult task as the. As such to evaluate inherited systems, criteria were developed in-house and used to justify keeping or eliminating alternative inherited systems. The literature review showed incremental systems were indeed troublesome to place within life-cycle models as the increments of technology extend the life-cycle of the system, making it without a definitive starting or end point. As such, both the literature review and the empirical enquiry agree that incremental (inherited) systems may not be suitable for application in life-cycle models. This brings into question the very usefulness of life-cycle models as most organisations may have some form of incremental systems.

Section 1.4 presented a group of surveys that indicated that managers have often employed financially based IAT to justify IT/IS investments, giving little or no attention to non-traditional IAT. However, the literature review does not account for all the factors behind the lack of application of non-traditional IAT, only to indicate that barriers to the application of IAT may exist in the form of challenges to IT/IS evaluation (section 2.6). The literature review also showed that there is no consensus among researchers on which IAT may be applied, in what situation, and during what phase of the systems' life-cycle. Therefore, it is unclear whether decision makers from the reported surveys in section 1.1 were unwilling or unable to apply non-traditional IAT. From the empirical inquiry, evidence supports the view that decision makers were unable (not unwilling) to apply non-traditional IAT as the result of identified barriers. Specifically, the case studies showed that decision makers were under time caps to complete the evaluation process within a specific budget during reorganisation.

After reorganisation, decision makers were forced by the organisational rules and regulations to justify projects according to the procurement policy of the ICT. Furthermore, decision makers were forced to justify any new IT/IS projects according to the elected Councillors' official criteria as will as their unspoken criteria (which can be based on their skills and experience). As such, decision makers in the case studies may not have been able to apply IAT that did not comply with the ICT and the elected Councillors' criteria.

During the literature review, the effect(s) of the organisational rules and regulations was identified as a potential barrier to the application of IAT. This may take the form of a corporate policy, official development procedures or an unofficial standard organisational practice. It has also been demonstrated in the empirical study that organisations will follow an official (or unofficial) process to justify their IT/IS systems, which can suggest in what way, when and why IT/IS justification is conducted. As such, the literature review and the empirical inquiry agree that the organisational justification can impede the application of IAT.

It has also been identified in the literature review, and confirmed in the empirical inquiry, that time is a factor in determining which IAT will ultimately be applied to evaluate the IT/IS system. It has been argued that IT/IS evaluation is a process (not an activity) and should be treated as any other project. As such, the IT/IS evaluation process may require a minimum duration to complete, which in turn may be dependent upon the number of decision makers involved, as well as the size and function of the system being evaluated. The literature review suggests that managers under time constraints may need to reduce the evaluation effort to suit the available time. As such, reduction of the evaluation effort can result in choosing an IAT that will fit the time available. During the multi-case empirical inquiry, time was confirmed as one of the main barriers to the application of IAT, as the reorganisation effort was assigned a specific schedule.

It has finally been identified in the literature review, and confirmed in the empirical inquiry, that the process of IT/IS evaluation will require financial support to complete. Financing is required to employ the necessary staff, or pay external consultants to perform the task. As such, shortage in this resource can act as a barrier to the application of IAT, leaving the decision maker with little or no choice of IAT.

Financial support may only be available if decision makers account for it during the budgetary allocation process. As such, both the empirical enquiry and the literature review agree that financial resources should be made available at the outset of the project if IT/IS evaluation is to be conducted.

7.2 Research Evaluation

The normative literature argues that ignoring soft or intangible IT/IS project variables may cause concealment of project costs and may result in benefits not detected (as presented in section 1.4). As a result, the author recognised the need to improve upon the IT/IS evaluation process by recognising barriers that may impede the application of IAT. Therefore, it was proposed that a *frame of reference* would be developed to guide decision makers to better recognise barriers to the application of IAT, which was stated by the aim of the dissertation (section 1.6.1). Even though the *frame of reference* only targets a number of barriers, it is a starting point to understanding those identified barriers (that is organisational rules and regulations, time available for evaluation and funds available for evaluation). Whilst targeting specific barriers, the *frame of reference* is limited, in its ability to give decision makers an advanced warning, to the identified barriers from the case studies. As such, the *frame of reference* may only be useful for decision makers in the public sector. Consequently, the research in this dissertation did not cross into the privet sector, or identified barriers to the application of IAT in it.

To develop the *frame of reference*, an approach was taken whereby a conceptual model was formed to represent the life-cycle aspect of the *frame of reference* and propositions were formed to represent the original aspects of the *frame of reference* (that is specific barriers to the application of IAT). In doing so, research in this dissertation has depended on one concept that represents the effects of barriers on the employment of IAT. Thus, leaving no room for other representation (concepts) that describe the occurrence of barriers in the public sector. The propositions were tested through empirical data, which was chosen on the basis of the Units of Analysis (UOA) (that is organisational context, investment process and evaluation practices). As such, the research in this dissertation has further restricted the strategy by which data would be collected to those methods that can satisfy the UOA.

The research methodology was discussed in Chapter 4, but essentially utilised qualitative research methods to gather data from case studies in the public sector. This research method was chosen because it is able to gather rich primary data from organisations in their real life context. As with any data collection tool, qualitative methods have their disadvantages, which include the production of large amounts of data. As such, the collection and analysis of data proved to be a lengthy and challenging task, as the combination of interviews and documentation from the case study organisations produced extensive amounts of data. However, the amount of data was manageable as the UOA focused the empirical inquiry on what data was relevant and what was not. In addition, it is recognised that the data collected was interpreted from one point of view (the authors') and therefore other analyses may produce different conclusions. However, care was taken to reach the most logical conclusions, as inferred by the evidence from the data collected. Specifically, data was collected from different sources (data triangulation), and the results of the analysis were sent back for verification by the case study organisations.

Unitary Councils from the public sector were chosen for the case study investigation, as the author of this dissertation was able to secure access to them. However, access was not the only motivation, as conducting the case studies in Unitary Councils gave the author a unique opportunity to study organisations within the same context and passing through the same phenomenon (that is reorganisation). In selecting Unitary Councils for case studies, the research in this dissertation has ignored other potential sources in the public sector such as among others hospitals and schools, which may have provided insight into the occurrence of barriers to the application of IAT. By establishing common grounds between the case studies the author was able to draw parallels between the Councils, which facilitated the establishment of common barriers to the application of IAT. The common barriers reinforced assumptions made in the proposition that the organisational context, investment processes and evaluation practices can impede the application of IAT. As such, those barriers formed an integral part of the *frame of reference*. In doing so, the research in this dissertation has not included other barriers that may have added value to the *frame of reference* due to time and resource limitations.

Another perceived disadvantage of using qualitative research is that it appears to be unable to demonstrate a scientific link between theory and research.

140

However, as discussed in Chapter 4, this is incorrect. Qualitative research can be subjective, as the result of the interpretation element. However, that subjectivity also implies flexibility in developing explanations and cross testing them with other empirically collected data. Moreover, qualitative research is structured when a research protocol (or action plan) is developed for it and is reliable when the sequence of logic leading to the conclusions can be clearly demonstrated. In this research, sequence of logic is achieved through propositions (theoretical conjunctions) and units of analysis (sub-theoretical conjunctions within the propositions).

7.3 Research Novelty

The novel contribution of this dissertation is *the empirically validated frame of reference that is underpinned by three barriers to the application of IAT during the evaluation process in the public sector*. The *frame of reference* was achieved through two actions:

1. *Identifying barriers to the application of IAT in the public sector*

The dissertation proposes and empirically tested three propositions that identified specific barriers to the application of IAT in the public sector. The propositions named those barriers as: (i) Organisational IT/IS investment process (ii) Insufficient duration allowed for IT/IS evaluation and (iii) lack of financial support for IT/IS evaluation. In doing so, novelty was achieved through empirically demonstrating that barriers do exist, with three of them having been identified.

2. *Developing the frame of reference*

In reviewing IT/IS life cycle models, challenges to IT/IS evaluation and the IAT, a focus has been made on barriers to the application of IAT during the evaluation process in the public sector. To that end, a conceptual model (figure 3.2) was developed that recognises the effect(s) of barriers to the application of IAT in the public sector. The proposed conceptual model is based on the traditional IT/IS life cycle, in addition to the element of the barriers to the application of IAT. The conceptual model was then empirically tested for application in the case studies.

141

This resulted in its modification to accommodate both traditional and non-traditional life cycle models, thus forming the *frame of reference* (figure 6.1). Decision makers can consult the *frame of reference* during the IT/IS development process. It can also be employed by system evaluators who may wish to consider barriers (as named by the *frame of reference*) during the justification of new IT/IS investments. The *frame of reference* looked at the traditional and non-traditional life cycle models and suggested that barriers may impede the application of IAT during different phases of the life-cycle.

7.4 Research Implications

- The normative literature argues that decision makers employ financially based IAT over non-financial IAT. However, little or no empirical evidence is available to explain this employment, until now. As a direct result of research in this dissertation, practitioners and academics can claim that barriers to the application of IAT do exist in at least 34 distinct forms (as named in table 5.3). The empirical foundation established in this research (that is barriers exist in the public sector) will enable researchers to investigate other barriers, in other sectors, and different countries.

- Decision makers performing IT/IS evaluation may need to consider a host of barriers that can complicate their evaluation effort, and reduce the possibility of successful evaluation. These may include but are not limited to organisational investment process, time available to conduct evaluation, and funds available for evaluation.

- As a direct result of research in this dissertation, decision makers have a *frame of reference* that can be used to recognise barriers to the application of IAT. Furthermore, the *frame of reference* can be used by academics as a starting point for future research into barriers to the application of IAT.

- Case studies as research strategy were able to satisfy the data requirements to test the validity of propositions by detecting barriers to the application of IAT. As such research in this dissertation has demonstrated that such a strategy may be applicable for similar research in the public sector.

142

7.5 Recommendations for Further Work

The author of this dissertation recognises that research should answer questions, but more importantly, should generate more questions. As such, the work in this dissertation has generated a number of issues that warrant further research. One direction of research is to carry on investigating barriers to the application of IAT. This could be a direct extension of the work described in this dissertation, where local UK authorities act as case studies. This might also serve to externally validate the proposition suggested in this research. Alternatively, the research can investigate barriers, but from a different business perspective, such as organisations in the private sector. Further research may also attempt to confirm the existence of the identified barriers in other countries.

The cause and effect relationship between the identified barriers remains in question. This leaves the possibility that a more focused line of research could reduce the identified barriers to a handful of fundamental barriers that directly cause other barriers to occur. The author suggests that the cause and effect relationships of those identified barriers needs to be researched, as the elimination of one barrier may prevent the occurrence of a sub-barrier. To use barriers identified in this dissertation as an example, a research question might be: Did the organisation not apply the IAT because the rules and regulations did not allow time to perform the task? Or was the IAT not applied because time limitations exist irrespective of the rules and regulations? In effect, the research would investigate whether the primary barrier was rules and regulations and the side effect was time. Here, new research should attempt to further understand whether barriers to the application of IAT exist in isolation, or whether there is a link between them in the IT/IS justification process. If so, then research in that direction (that is identifying fundamental barriers) could significantly contribute towards recognising (and possibly eliminating) barriers against IT/IS evaluation practices throughout the Unitary County Councils in the UK. It is also recognised that extended research into the effects of the organisational IT/IS justification process on the application of IAT is required. In the same line of research, extended investigation could also be carried out on the effects of the duration available to conduct evaluation, and the IAT applied, and the exclusion of IAT as the result of the absence of financial support. Obviously, research into barriers to the application of IAT is in early days, but essential for the all organisations as they continue to invest in IT/IS.

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APPENDIX A

Appendix A.1: Water Fall Model

The model (also referred to as SADM[1]) was developed in 1970 by W. W. Royce and is considered by researchers[2] to be one of the main traditional methodologies for developing IT/IS. The following are the seven phases of the model:

Phase 1: Initiation

In this stage, the need for a new information system is determined. The need may arise from within the organisation to develop a system that would be able to support the business process in a *better* way. Alternatively, the need may be the result of an external stimulus. For example, an alteration in legislation, developments in technology, or a move by competitors may push the organisation to consider investing in an information system. The source of the initiation may be:

(i) Managing director or other senior management. Such proposals have a strong chance of acceptance as they already have the support of management.

(ii) Information systems department, possibly as part of the IT/IS strategy of the organisation. However, support is still required by senior management.

(iii) Functional department area. A system proposed from this source will often have to compete for organisational funding. A steering group is usually charged with the task of prioritising proposals, including the IT/IS proposal. Table A.1 summarises the inputs and outputs of this stage.

Table A.1: Summary of Phase 1 of the Waterfall Model

Phase 1		
	Input:	Creative thought and/or systematic evaluation of IT/IS needs.
	Output:	Idea for initiation of a new information system.

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[1] Systems Analysis and Design Method (SADM)

[2] Among others Boehm (1988), Jayaratna (1994), Senn (1994) and Anison and Fitzgerald (1995)

Phase 2: Feasibility Assessment

In this stage, a feasibility report is developed to determine whether the proposed IT/IS investment is a viable business proposition. Here, the impact of the system on organisational idiosyncrasies is under investigation. Alternative solutions to the project are also considered. For example, procuring an off-shelf product might be considered a more viable option than developing a system in-house. Essentially, the feasibility report will attempt to answer the following:

(i)   Is the proposed project *technically* feasible? Asking if the technology needed to develop the system exists, or if developing it is an option?

(ii)   Is the proposed project *economically* feasible? Asking if the benefits forecasted outweigh the estimated project costs? Here, the report establishes whether the organisational objectives, and financial status, permit allocating resources for this project. To gain estimates for project costs, the organisation may announce to vendors an invitation to tender (ITT).

(iii)   Is the proposed project *operationally* feasible? Asking if the system is able to work in alignment with current work processes, or if it is feasible to adopt or reengineer the work processes to function alongside the new IT/IS system. Also, will the system perform at the speed, volume, usability and reliability required.

(iv)   Is the proposed project *organisationally* feasible? Here, the inquiry addressed the skill level and attitude of system users towards the proposed investment.

This activity is often referred to as pre-implementation (or ex-ant) evaluation (Farbey *et al.*, 1992; Khalifa *et al.*, 1999). Table A.2 summarises the inputs and outputs of this stage.

Table A.2: Summary of Phase 2 of the Waterfall Model

Phase 2	Input:	Idea for initiation of a new information system.
	Output:	Feasibility report and recommendations to proceed.

Phase 3: Systems Analysis

, This stage aims to establish a detailed list of system requirements, as specified by users. To do so, an analysis must first be conducted on the current information system in place (paper or technology based) to determine the information flow. Once completed, the information flow will be translated into a diagram so that system users and IT/IS professionals can agree about its accuracy. Next, a list of requirements is developed jointly between users and IT/IS developers. That information is again translated into an information flow diagram to establish its accuracy. The list should cover the following:

(i)   Features of the new system, to include the functions as required by the users.

(ii)   The scope of the new system, to include its function as a departmental or organisational system.

(iii)   Users of the new system must be identified, as well as the purpose of their usage.

(iv)   Performance standards must also be defined to include response time, reliability rate and batch processing time.

(v)   Environmental requirements must establish the physical conditions in which the system will be deployed.

If the system requirements appear to be unfeasible, then the development process reverts back to the previous phase in an attempt to develop alternative solutions. Table A.3 summarises the inputs and outputs of this stage.

Table A.3: Summary of Phase 3 of the Waterfall Model

Phase 3	Input:	Feasibility report and recommendations to proceed.
	Output:	Detailed requirement specifications summarising system function. Supported by diagrams showing the information flow and the processes that are required.

Phase 4: System Design

This stage aims to establish how the proposed project will deliver the list of requirements developed from the last stage. The IT/IS system developers will translate those requirements to different design alternatives. To do this, the following must be addressed:

(i)   Selecting a suitable database management system.

(ii)   Establishing a security standard for the system.

(iii)   Selecting system navigation methods.

(iv)   Establishing a standard for printing reports.

(v)   Input/output screen design must have a standard.

(vi)   Data capture and storage requirements.

In the situation where the developers of the system cannot translate the requirements into alternative designs, Phase 3 must be revisited to generate an alternative list of requirements. Table A.4 summarises the inputs and outputs of this stage.

Table A.4: Summary of Phase 4 of the Waterfall Model

Phase 4	Input: Detailed requirement specifications. Output: Detailed design specifications.

Phase 5: System Build

This stage aims to physically construct the database according to the design specifications. Database construction specifically follows a logical plan of tables and indexes. Also in this stage, the programming (code writing) of the software commences, if the software is to be developed in-house. Populating the database and pre-deployment testing are also carried out during this stage. Furthermore, user guide manuals are written, as well as systems documentation for maintenance purposes.

If the design cannot accommodate the specifications required, then Phase 4 must be revisited to develop another set of specifications. Table A.5 summarises the inputs and outputs of this stage.

Table A.5: Summary of Phase 5 of the Waterfall Model

Phase 5	Input: Detailed design specifications. Output: Working software, user guide and systems documentation.

Phase 6: System Implementation and Changeover

In this stage, the system is deployed as a whole, or in phases. The organisation may choose to run the new system in parallel with the old one until users are more comfortable with it. This stage is particularly important to the project as both users and developers will know if the previous phases were carried out properly. The tasks here are as follows:

(i)   Data conversion from the old system to the new one.

(ii)   Placing hardware and software in the correct position.

(iii)   Testing of the system by users and correcting technical defects.

(iv)   Training users.

(v)   Change over from the old system.

Table A.6 summarises the inputs and outputs of this stage.

Table A.6: Summary of Phase 6 of the Waterfall Model

Phase 6	Input: Working software, user guide and systems documentation. Output: Operational information system installed in all locations.

Phase 7: Review and Maintenance

After deployment and sign-off, errors in the design of the system may appear which will need maintenance. The scale of those defects will determine whether the system can be maintained in-house, or whether it will need expert maintenance. In situations where the defect is beyond maintenance, the system may be discontinued. Maintenance may also be required if the system is not defective, but can be improved with the addition of specific performance enhancers.

A review will also occur after the system has been running for a pre-specified period of time (usually six months) to determine whether the functions are what the users actually ordered and whether the level of performance is as anticipated. This review is often referred to as a post implementation (or ex-post) evaluation (Farbey *et al.*, 1992).

Appendix A.2: IT/IS Project Types

Information Technology (IT) is applied in many ways to satisfy objectives. These objectives might be the result of internal or external pressure on the organisation. Therefore, different types of projects exist and in 1993, Farbey classified them. The result of that research is presented in the next table and is followed by a brief discussion.

Mandatory change:

Evaluators must only provide alternatives, technical assistance and costing. Work measurement and cost accounting would be appropriate IT/IS evaluation methods. There are three forced changes and they are:

    a.   Strategic necessity (i.e. ATM technology)

    b.   Technological necessity (i.e. changing obsolete software)

    c.   Regulatory or legal necessity (i.e. privacy laws)

Automation:

Adapting applications that would replace existing functions. This is aimed at cutting costs and increasing labour productivity. Appropriate IT/IS evaluation methods include O&M techniques, OR methods (simulation modelling) and classical work measurements. One good example of this IT/IS project type is payroll automation.

Direct value added:

The purpose of this project is to reduce costs and improve performance in valuable aspects of the business that were not done previously. Thus, the IT/IS system directly adds value to the organisation, some of its stakeholders, or both. Experimental evaluation techniques are recommended. An example of added value that might not directly benefit the organisation is the introduction of ATM machines that make the client's life easier, but may not translate into extra financial returns for the bank.

MIS and DSS systems:

The objective here is to give higher-level management (and professional workers) the tools needed to improve their performance. The tools are designed to make information:

- More relevant
- More reliable

- More accurate
- More timely
- Presentable and user friendly
- Evaluate alternatives
- Give possible scenarios

As this project depends heavily on the capability of the user to make the best of it, IT/IS evaluation methods are tasked to estimate the possible benefits from such a project and the relative costs associated with it.

Infrastructure:

This type of project is aimed at improving the general capability of the organisation. It is the foundation of future IS projects. Specific applications are not targeted here. For the system to prove its value, it must enable the organisation to be responsive to changes in the market. IS evaluators must show management the relationship between this investment and the important role it will play in future IS projects. The installation of a LAN would be one example of this project type.

Inter-organisational systems:

Organisations wishing to cross coordinate certain tasks will adopt a system from this category. The objective of the IS evaluators is to measure the losses incurred by the organisations involved from the inflexibility of the system, against the benefits associated from adopting such a system. The installation of an electronic data interchange (EDI) would be one type of system in this category of IS projects.

Strategic systems:

A system in this project type may enable the organisation to gain a competitive advantage, increase performance and productivity, add new management techniques and open new types of business to the company. The IS evaluation process must demonstrate some or all of these benefits to top management if the system is to be adopted. Therefore conventional ROI and cost-benefit analysis methods may not prove useful. Combining the services of a bank and a securities firm through an IS system may be considered as one project in this group.

Business transformations:

The IS project here is part of a larger change. The IT/IS system will help the organisation to change most or all aspects of its current business operation. The change is usually driven from economic factors and therefore is strategic in nature. Evaluators must look at the picture in its entirety and assess the value of adopting this new IT/IS system. They must also consider the effects on other aspects of the business from this introduction.

Type of project	Purpose	Example
Mandatory change	1. Forced change because of a competitor's action (strategic necessity). 2. Forced change to meet technology changes (technological necessity). 3. Forced change to obey a new law (regulatory or legal necessity).	1. Banks adopting ATM. 2. Changing obsolete software. 3. Car production laws to protect the environment.
Automation	1. Reducing the cost base of business. 2. Increasing labour productivity to reduce costs.	1. Computerising data to improve the efficiency of information distribution. 2. Computerising bank transactions.
Direct value added	1. Reducing cost and modifying the business process to add value to the company.	1. Giving the details of past purchases to small retailers to improve customer service and inform the supplier.
MIS and DSS systems	1. To improve the productivity of upper level management by providing more 'valuable' and 'focused' information.	1. EPOS systems provide marketing information for supermarket managers.
Infrastructure	1. To build the general foundation to support other added value projects.	1. Email, Local Area Networks, word-processing and local databases.
Inter-organisational systems	1. Systems that are shared by two or more organisations. Used mostly by trading partners.	1. EDI (Electronic Data Interchange Systems).
Strategic systems	1. Gaining competitive advantage. 2. Improving productivity and performance. 3. Enabling new ways of managing an organisation. 4. Developing new types of business.	1. Merrill-Lynch combined a credit card, brokerage services and a current account into a single product.
Business transformations	1. IT projects that turn round the nature of the business process. Forced on the organisation due to specific economic conditions.	1. The transformation in the 1980s of the US car industry to overcome the Japanese pressure. Management practice and IT/IS strategy were combined with human resource management to bring about the change.

Source: Farbey et al., 1993

APPENDIX B

Relationship Between Propositions and Interview Agenda

APPENDIX B1: Interview Agenda

This questionnaire is divided into five parts, with all sections being qualitative in nature and acting as a comprehensive agenda for each case study.

The questions aimed to address the following:

- ⇨ To establish general company information
- ⇨ To gather data about the IT/IS reorganisation effort
- ⇨ To establish the IT/IS Investment Process and Evaluation Practices
- ⇨ To investigate which IAT was used and how it was selected
- ⇨ To establish the overriding factor(s) for choosing/excluding IAT

Company Name:	_____
Company Address:	_____
Interviewee Name:	_____
Interviewee Position:	_____

Questionnaire Sections

Section A – General Company Information

Section B – IT/IS Reorganisation

Section C – IT/IS Investment Process

Section D – IT/IS Evaluation Practices

Section E – Barriers to the Application of IAT

Section A – General Company Information

What is the background of the organisation?

What are the departments in your organisation? ....

....

....

How many employees does each department have? ....

....

....

What is the general function of each department? ....

....

....

What are the general activities of the IT department? ....

....

....

Section B – IT/IS Reorganisation

What are the key issues during reorganisation?

How was the reorganisation effort initiated? ....

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How was the IT/IS reorganisation effort conducted? ....

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....

Who developed the IT/IS reorganisation plans? ....

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....

Was there any methodology used to facilitate the transition of IT/IS systems?

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How did reorganisation affect IT/IS in the new authority?

What was the condition of IT/IS prior to reorganisation? ....

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How was the IT/IS reorganisation team selected?   ....

....

....

Were there evaluation criteria? ....

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What was the total number of systems under consideration? ....

....

....

How were redundant IT/IS systems dealt with? ....

....

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How were stakeholders identified? ....

....

....

What factors contributed to the formulation of the current IT/IS system?

Was reorganisation the only force for change?   ....

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....

Were there any operating conditions that might have affected the IT/IS

reorganisation effort? ....

....

....

Were there any factors that complicated reorganisation? ....

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Section C – IT/IS Investment Process

Does the organisation have official rules and regulations that govern investment decision-making?

Is the decision making structure clear in the organisation? ....

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What is the general decision making structure of the organisation? ....

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Who are the key decision makers in the organisation? ....

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Which departments have representatives on the Board Of Directors? If none, to whom does the IT director report? ....

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What is the position of the IT department within the decision making structure of the organisation? ....

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What is the decision making structure within the IT department? ....

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Does the IT department decide on the type of functions it performs, if not, who does? ....

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....

Does the IT department decide on the type of IAT conducted? ....

....

....

Section D – IT/IS Evaluation Practices

What is the IAT Used To Evaluate The System?

What was the evaluation method (IAT) used for the initial justification of the IT system? ....
....
....

What was the IAT used for the post implementation justification of the IT system? ....
....
....

Were the results satisfactory in both cases? ....
....
....

How long did the organisation have the IT system? ....
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How many times was it significantly modified or replaced? ....
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....

How did you rate the success of the IT evaluation conducted? ....
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Did the system fail to deliver the benefits desired at the costs established after implementation? ....
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What are the factors contributing to the success (or failure) of the IT system? ......
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Was the appropriate IAT used? ....

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Has the organisation suffered because of not using any other IAT? ....

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How knowledgeable is the organisation about the different types of IT IAT? ......

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What are the primary and secondary objectives for conducting an IT evaluation?

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Did The Organisation Conduct An IT Evaluation?

Pre-implementation, post-implementation, both or neither? ....

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With what frequency do you conduct post-implementation evaluations (historic, present)? ....

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How do you decide on the type of IAT? ....

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Have you excluded any IAT because of cost, time restriction and/or organisational investment process? ....

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....

Section E – Barriers to the Application of IAT

What is the IAT Used To Evaluate The System?

What is the overriding factor in choosing the type of IAT: (a) cost,

(b) appropriateness, (c) time constraints, (d) resource limitations, (e) direct orders

from top management, (f) other? ....

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What is the Organisational Strategy?

Does the organisation have a strategy? ....

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What is the approximate time scale of this strategy? ....

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Would you say it has been implemented successfully? ....

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How often does the organisation modify/change its strategy? ....

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Does the organisational strategy impede the application of IAT? ....

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What is the IT Strategy?

Does the organisation have an IT strategy, if yes, what is it? ....

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Has the strategy been implemented as planned, if not, what prompted the change?

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What are the overriding factors in choosing this strategy? ....

....

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Does the ICT strategy impede the application of IAT? ....

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....

What is the Relationship Between Spending And Decision Making in the IT Department?

Who decides on the overall budget of the organisation? How is this task

accomplished? ....

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Who decides on the specific budget of the IT department? How is this task

accomplished? ....

....

....

Who decides on the appropriate cost of conducting an IT evaluation? How is this

task accomplished? ....

....

....

Who decides on the frequency of the IT evaluation? How is this task

accomplished? ....

....

....

Does financing for the IT/IS evaluation process impede the application of IAT?

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....

What is the relationship between the application of IAT and the duration

allowed for evaluation?

For how long does the evaluation process run? ....

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....

Who decides on that duration? How? And why? ....

....

....

Does the duration allowed for the IT/IS evaluation process impede the application

of IAT? ....

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APPENDIX B2: Relationship Between Proposition A and Interview Agenda

Proposition A: *Organisational IT/IS evaluation process will recommend the use of specific Investment Appraisal Techniques*

A1. What is the background of the organisation?	A1.1 What are the departments in your organisation?	A1.1 This question looks at the potential scope of the IT evaluation project.
	A1.2 How many employees does each department have?	A1.2 This question investigates the amount of potential participants in the evaluation.
	A1.3 What is the general function of each department?	A1.3 This question aims to understand the operation of the organisation.
	A1.4 What are the general activities of the IT department?	A1.4 This question aims to understand the operation of the ICT.
A2. What are the key issues during reorganisation?	A2.1 How was the reorganisation effort initiated?	A2.1 Who was involved and for what purpose?
	A2.2 How was the IT/IS reorganisation effort conducted?	A2.2 Who was involved and who was responsible?
	A2.3 Who developed the IT/IS reorganisation plans?	A2.3 ICT, MD or other?
	A2.4 Was there any methodology used to facilitate the transition of IT/IS systems?	A2.4 This question investigates whether any criteria were developed for the purpose of IT/IS evaluation.
A3. How did reorganisation affect IT/IS in the new authority?	A3.1 What was the condition of IT/IS prior to reorganisation?	A3.1 How many systems, what function?
	A3.2 How was the IT/IS reorganisation team selected?	A3.2 Who did the selection and why?
	A3.3 Were there evaluation criteria?	A3.3 Who developed them and what was the justification?
	A3.4 What was the total number of systems under consideration?	A3.4 This question aims to establish the workload on the reorganisation team.
	A3.5 How were redundant IT/IS systems dealt with?	A3.5 Who decided they were redundant and why?
	A3.6 How were stakeholders identified?	A3.6 How were they identified and who identified them?
A4. What factors contributed to the formulation of the current IT/IS system?	A4.1 Was reorganisation the only force for change?	A4.1 Did the organisation have other motives to change the systems?
	A4.2 Were there any operating conditions that might have affected the IT/IS reorganisation effort?	A4.2 Did the organisation need to maintain delivery of services to the local population?
	A4.3 Were there any factors that complicated reorganisation?	A4.3 As stated.
A5. Does the organisation have official rules and regulations that govern investment decision-making?	A.5.1 Is the decision making structure clear in the organisation?	A.5.1 This question looks at the general perception of decision making as observed by the interviewee.
	A.5.2 What is the general decision making structure of the organisation?	A.5.2 This question investigates the general shape of decision making in the organisation.
	A.5.3 Who are the key decision makers in the organisation?	A.5.3 This question locates employees capable of influencing the IT Evaluation in the organisation.
	A.5.4 Which departments have representatives on the Board	A.5.4 This question investigates whether the IT department has

	Question		Proposition / Description
	Of Directors? If none, to whom does the IT director report?		a representative able to influence IT evaluation.
	A.5.5 What is the position of the IT department within the decision making structure of the organisation?	A.5.5	This question establishes the political strength of the IT department to influence IT evaluation.
	A.5.6 What is the decision making structure within the IT department?	A.5.6	This question looks at employees able to influence the selection of IAT in the IT department.
	A.5.7 Does the IT department decide on the type of functions it performs, if not, who does?	A.5.7	This question investigates the general ability of the IT department to operate independently of external influences.
	A.5.8 Does the IT department decide on the type of IAT conducted?	A.5.8	This question investigates the general ability of the IT department to choose the IAT used.
A6. Did The Organisation Conduct An IT Evaluation?	A6.1 Pre-implementation, post-implementation, both, or neither?	A6.1	This question verifies whether the organisation carried out an IT evaluation during the initial justification of the system and during its life cycle.
	A6.2 With what frequency do you conduct post-implementation evaluations (historic, present)?	A6.2	This question investigates the familiarity of the organisation with IT evaluation.
	A6.3 How do you decide on the type of IAT?	A6.3	This question is part of a series of questions to establish whether cost is the overriding factor for choosing the IT evaluation method.
	A6.4 Are organisational rules and regulations the overriding factor in the choice of the evaluation method?	A6.4	This question directly addresses the assumption in Proposition A.
	A6.5 Have you excluded any IAT because of cost?	A6.5	This question is part of a series of questions to establish whether cost is the overriding factor for choosing the IAT.
A7. What is the IAT Used To Evaluate The System?	A7.1 What was the evaluation method (IAT) used for the initial justification of the IT system?	A7.1	This question investigates the relationship between the IAT used and its cost.
	A7.2 What was the IAT used for the post implementation justification of the IT system?	A7.2	This question investigates the relationship between the IAT used and its cost.
	A7.3 Were the results satisfactory in both cases?	A7.3	This question investigates the general perspective of the interviewee on the information supplied by the evaluation.
	A7.4 How long did the organisation have the IT system?	A7.4	This question looks at the organisational experience of IT functions.
	A7.5 How many times was it significantly modified or replaced?	A7.5	This question examines changes in the function of the IT system.
	A7.6 What prompted the change in A7.5?	A7.6	This question investigates the organisational use of information from IT evaluation projects.
	A7.7 How did you rate the success of the IT evaluation conducted?	A7.7	This question investigates the criteria used to declare the chosen evaluation method a success.

	A7.8 Did the system fail to deliver the benefits desired at the costs established after implementation?	A7.8	This question asks whether the results of the evaluation were appropriate in helping the organisation achieve the benefits/costs desired.
	A7.9 What are the factors contributing to the success (or failure) of the IT system?	A7.9	This question aims to establish whether the use of an inappropriate IAT partially or completely caused the failure of the IT system.
	A7.10 Was the appropriate IAT used?	A7.10	This question investigates whether other IAT should have been considered.
	A7.11 Has the organisation suffered because of not using any other IAT?	A7.11	This question further reflects on A7.10.
	A7.12 How knowledgeable is the organisation about the different types of IT IAT?	A7.12	This question investigates whether the lack of knowledge was a factor in choosing the 'wrong' evaluation method.
	A7.13 What are the primary and secondary objectives for conducting an IT evaluation?	A7.13	This question establishes the organisational drive to perform an evaluation.
	A7.14 What is the overriding factor in choosing the type of IAT: (a) cost, (b) appropriateness, (c) time constraints, (d) resource limitations, (e) direct orders from top management, (f) other?	A7.14	This question re-addresses the assumption in Proposition A.
	A7.15 Can you further explain and exemplify A7.14?	A7.15	This question seeks detailed information from A7.14.
A8. What is the Organisational Strategy?	A8.1 Does the organisation have a strategy?	A8.1	This question looks at strategy practices in the organisation.
	A8.2 What is the approximate time scale of this strategy?	A8.2	This question differentiates between long term and short term strategy formulation in the organisation.
	A8.3 Would you say it has been implemented successfully?	A8.3	This question investigates the perception of the interviewee with regards to the strategy adopted.
	A8.4 How often does the organisation modify/change its strategy?	A8.4	This question looks at the organisation's reactions to internal and external inputs.
	A8.5 Does the organisational strategy impede the application of IAT?	A8.5	This question directly addresses the assumption in proposition A.
A9. What is the IT Strategy?	A9.1 Does the organisation have an IT strategy, if yes, what is it?	A9.1	This question looks at IT strategy practices in the organisation.
	A9.2 Has the strategy been implemented as planned, if not, what prompted the change?	A9.2	This question investigates whether wrong IAT partially caused the IT strategy not to be implemented. The other part of the question investigates specific factors.
	A9.3 What are the overriding factors in choosing this strategy?	A9.3	This question directly addresses the assumption in Proposition A.
	A9.4 Does the ICT strategy impede the application of IAT?	A9.4	This question directly addresses the assumption in Proposition A.

APPENDIX B3: Relationship Between Proposition B and Interview Agenda

Proposition B: *The choice of the Investment Appraisal Technique will be restricted by the time available to perform the task*

Main Question	Code	Sub-question	Explanation
B1. What is the background of the organisation?	B1.1	What are the departments in your organisation?	This question looks at the potential scope of the IT evaluation project.
	B1.2	How many employees does each department have?	This question investigates the amount of potential participants in the evaluation.
	B1.3	What is the general function of each department?	This question aims to understand the operation of the organisation.
	B1.4	What are the general activities of the IT department?	This question aims to understand the operation of the ICT.
B2. What are the key issues during reorganisation?	B2.1	How was the reorganisation effort initiated?	Who was involved and for what purpose?
	B2.2	How was the IT/IS reorganisation effort conducted?	Who was involved and who was responsible?
	B2.3	Who developed the IT/IS reorganisation plans?	ICT, MD or other?
	B2.4	Was there any methodology used to facilitate the transition of IT/IS systems?	This question investigates whether any criteria were developed for the purpose of IT/IS evaluation.
B3. How did reorganisation affect IT/IS in the new authority?	B3.1	What was the condition of IT/IS prior to reorganisation?	How many systems, what function?
	B3.2	How was the IT/IS reorganisation team selected?	Who did the selection and why?
	B3.3	Were there evaluation criteria?	Who developed them and what was the justification?
	B3.4	What was the total number of systems under consideration?	This question aims to establish the workload on the reorganisation team.
	B3.5	How were redundant IT/IS systems dealt with?	Who decided they were redundant and why?
	B3.6	How were stakeholders identified?	How were they identified and who identified them?
B4. What factors contributed to the formulation of the current IT/IS system?	B4.1	Was reorganisation the only force for change?	Did the organisation have other motives to change the systems?
	B4.2	Were there any operating conditions that might have affected the IT/IS reorganisation effort?	Did the organisation need to maintain delivery of services to the local population?
	B4.3	Were there any factors that complicated reorganisation?	As stated.
B5. Does the organisation have official rules and regulations that govern investment decision-making?	B5.1	Is the decision making structure clear in the organisation?	This question looks at the general perception of decision making as observed by the interviewee.
	B5.2	What is the general decision making structure of the organisation?	This question investigates the general shape of decision making in the organisation.
	B5.3	Who are the key decision makers in the organisation?	This question locates employees capable of influencing the IT Evaluation in the organisation.
	B5.4	Which departments have representatives on the Board	This question investigates whether the IT department has

Of Directors? If none, to whom does the IT director report?

B.5.5 What is the position of the IT department within the decision making structure of the organisation?

B.5.5 This question establishes the political strength of the IT department to influence IT evaluation.

B.5.6 What is the decision making structure within the IT department?

B.5.6 This question looks at employees able to influence the selection of IAT in the IT department.

B.5.7 Does the IT department decide on the type of functions it performs, if not, who does?

B.5.7 This question investigates the general ability of the IT department to operate independently of external influences.

B.5.8 Does the IT department decide on the type of IAT conducted?

B.5.8 This question investigates the general ability of the IT department to choose the IAT used.

a representative able to influence IT evaluation.

B6. Did The Organisation Conduct An IT Evaluation?

B6.1 Pre-implementation, post-implementation, both, or neither?

B6.1 This question verifies whether the organisation carried out an IT evaluation during the initial justification of the system and during its life cycle.

B6.2 With what frequency do you conduct post-implementation evaluations (historic, present)?

B6.2 This question investigates the familiarity of the organisation with IT evaluation.

B6.3 How do you decide on the type of IAT?

B6.3 This question is part of a series of questions to establish whether cost is the overriding factor for choosing the IT evaluation method.

B6.4 Are time caps the overriding factor in the choice of the evaluation method?

B6.4 This question directly addresses the assumption in Proposition B.

B6.5 Have you excluded any IAT because of cost?

B6.5 This question is part of a series of questions to establish whether cost is the overriding factor for choosing the IAT.

B7. What is the IAT Used To Evaluate The System?

B7.1 What was the evaluation method (IAT) used for the initial justification of the IT system?

B7.1 This question investigates the relationship between the IAT used and its cost.

B7.2 W Changing obsolete software hat was the IAT used for the post implementation justification of the IT system?

B7.2 This question investigates the relationship between the IAT used and its cost.

B7.3 Were the results satisfactory in both cases?

B7.3 This question investigates the general perspective of the interviewee on the information supplied by the evaluation.

B7.4 How long did the organisation have the IT system?

B7.4 This question looks at the organisational experience of IT functions.

B7.5 How many times was it significantly modified or replaced?

B7.5 This question examines changes in the function of the IT system.

B7.6 What prompted the change in C8.5?

B7.6 This question investigates the organisational use of information from IT evaluation projects.

B7.7 How did you rate the success of the IT evaluation

B7.7 This question investigates the criteria used to declare the chosen evaluation method a success.

	conducted?	
	B7.8 Did the system fail to deliver the benefits desired at the costs established after implementation?	B7.8 This question asks whether the results of the evaluation were appropriate in helping the organisation achieve the benefits/costs desired.
	B7.9 What are the factors contributing to the success (or failure) of the IT system?	B7.9 This question aims to establish whether the use of an inappropriate IAT partially or completely caused the failure of the IT system.
	B7.10 Was the appropriate IAT used?	B7.10 This question investigates whether other IAT should have been considered
	B7.11 Has the organisation suffered because of not using any other IAT?	B7.11 This question further reflects on B8.10
	B7.12 How knowledgeable is the organisation about the different types of IT IAT?	B7.12 This question investigates whether the lack of knowledge was a factor in choosing the 'wrong' evaluation method.
	B7.13 What are the primary and secondary objectives for conducting an IT evaluation?	B7.13 This question establishes the organisational drive to perform an evaluation.
	B7.14 What is the overriding factor in choosing the type of IAT: (a) cost, (b) appropriateness, (c) time constraints, (d) resource limitations, (e) direct orders from top management, (f) other?	B7.14 This question re-addresses the assumption in Proposition B.
	B7.15 Can you further explain and exemplify B8.14?	B7.15 This question seeks detailed information from B8.14.
B8. What is the relationship between the application of IAT and the duration allowed for evaluation?	B8.1 For how long does the evaluation process run?	B8.1 This question establishes the time allowed for evaluation.
	B8.2 Who decides on that duration? How? And why?	B8.2 This question investigates how the duration is decided upon.
	B8.3 Does the duration allowed for the IT/IS evaluation process impede the application of IAT?	B8.3 This question directly addresses the assumption in proposition B.

APPENDIX B4: Relationship Between Proposition C and Interview Agenda

Proposition C: *Investment Appraisal Techniques will be excluded from the evaluation process due to lack of financial support*

C1. What is the background of the organisation?	C1.1 What are the departments in your organisation?	C1.1 This question looks at the potential scope of the IT evaluation project.
	C1.2 How many employees does each department have?	C1.2 This question investigates the amount of potential participants in the evaluation.
	C1.3 What is the general function of each department?	C1.3 This question aims to understand the operation of the organisation.
	C1.4 What are the general activities of the IT department?	C1.4 This question aims to understand the operation of the ICT.
C2. What are the key issues during reorganisation?	C2.1 How was the reorganisation effort initiated?	C2.1 Who was involved and for what purpose?
	C2.2 How was the IT/IS reorganisation effort conducted?	C2.2 Who was involved and who was responsible?
	C2.3 Who developed the IT/IS reorganisation plans?	C2.3 ICT, MD or other?
	C2.4 Was there any methodology used to facilitate the transition of IT/IS systems?	C2.4 This question investigates whether any criteria were developed for the purpose of IT/IS evaluation.
C3. How did reorganisation affect IT/IS in the new authority?	C3.1 What was the condition of IT/IS prior to reorganisation?	C3.1 Haw many systems, what function?
	C3.2 How was the IT/IS reorganisation team selected?	C3.2 Who did the selection and why?
	C3.3 Were there evaluation criteria?	C3.3 Who developed them and what was the justification?
	C3.4 What was the total number of systems under consideration?	C3.4 This question aims to establish the workload on the reorganisation team.
	C3.5 How were redundant IT/IS systems dealt with?	C3.5 Who decided they were redundant and why?
	C3.6 How were stakeholders identified?	C3.6 How were they identified and who identified them?
C4. What factors contributed to the formulation of the current IT/IS system?	C4.1 Was reorganisation the only force for change?	C4.1 Did the organisation have other motives to change the systems?
	C4.2 Were there any operating conditions that might have affected the IT/IS reorganisation effort?	C4.2 Did the organisation need to maintain delivery of services to the local population?
	C4.3 Were there any factors that complicated reorganisation?	C4.3 As stated.
C5. Does the organisation have official rules and regulations that govern investment decision-making?	C5.1 Is the decision making structure clear in the organisation?	C5.1 This question looks at the general perception of decision making as observed by the interviewee.
	C5.2 What is the general decision making structure of the organisation?	C5.2 This question investigates the general shape of decision making in the organisation.
	C5.3 Who are the key decision makers in the organisation?	C5.3 This question locates employees capable of influencing the IT Evaluation in the organisation.
	C5.4 Which departments have representatives on the Board	C5.4 This question investigates whether the IT department has

	Question		Description
	Of Directors? If none, to whom does the IT director report?		a representative able to influence IT evaluation.
C.5.5	What is the position of the IT department within the decision making structure of the organisation?	C.5.5	This question establishes the political strength of the IT department to influence IT evaluation.
C.5.6	What is the decision making structure within the IT department?	C.5.6	This question looks at employees able to influence the selection of IAT in the IT department.
C.5.7	Does the IT department decide on the type of functions it performs, if not, who does?	C.5.7	This question investigates the general ability of the IT department to operate independently of external influences.
C.5.8	Does the IT department decide on the type of IAT conducted?	C.5.8	This question investigates the general ability of the IT department to choose the IAT used.
C6. Did The Organisation Conduct An IT Evaluation?			
C6.1	Pre-implementation, post-implementation, both, or neither?	C6.1	This question verifies whether the organisation carried out an IT evaluation during the initial justification of the system and during its life cycle.
C6.2	With what frequency do you conduct post-implementation evaluations (historic, present)?	C6.2	This question investigates the familiarity of the organisation with IT evaluation.
C6.3	How do you decide on the type of IAT?	C6.3	This question is part of a series of questions to establish whether cost is the overriding factor for choosing the IT evaluation method.
C6.4	Is cost the overriding factor in the choice of the evaluation method?	C6.4	This question directly addresses the assumption in Proposition C.
C6.5	Have you excluded any IAT because of cost?	C6.5	This question is part of a series of questions to establish whether cost is the overriding factor for choosing the IAT.
C7. What is the Relationship Between Spending And Decision Making in the IT Department?			
C7.1	Who decides on the overall budget of the organisation? How is this task accomplished?	C7.1	This question establishes the primary decision maker(s) on operations spending on an organisational level. It also clarifies that decision making process.
C7.2	Who decides on the specific budget of the IT department? How is this task accomplished?	C7.2	This question establishes the primary decision maker(s) on operations spending on the level of the IT department. It also clarifies that decision making process.
C7.3	Who decides on the appropriate cost of conducting an IT evaluation? How is this task accomplished?	C7.3	This question establishes the primary decision maker(s) that allows the use of financial resources on each IT evaluation. It also clarifies that decision making process.
C7.4	Who decides on the frequency of the IT evaluation? How is this task accomplished?	C7.4	This question establishes the primary decision maker(s) that allows the annual amount of financial resources to be used on IT evaluation. It also clarifies that decision making process.

C8. What is the IAT Used To Evaluate The System?	C8.1 What was the evaluation method (IAT) used for the initial justification of the IT system?	C8.1 This question investigates the relationship between the IAT used and its cost.
	C8.2 What was the IAT used for the post implementation justification of the IT system?	C8.2 This question investigates the relationship between the IAT used and its cost.
	C8.3 Were the results satisfactory in both cases?	C8.3 This question investigates the general perspective of the interviewee on the information supplied by the evaluation.
	C8.4 How long did the organisation have the IT system?	C8.4 This question looks at the organisational experience of IT functions.
	C8.5 How many times was it significantly modified or replaced?	C8.5 This question examines changes in the function of the IT system.
	C8.6 What prompted the change in C8.5?	C8.6 This question investigates the organisational use of information from IT evaluation projects.
	C8.7 How did you rate the success of the IT evaluation conducted?	C8.7 This question investigates the criteria used to declare the chosen evaluation method a success.
	C8.8 Did the system fail to deliver the benefits desired at the costs established after implementation?	C8.8 This question asks whether the results of the evaluation were appropriate in helping the organisation achieve the benefits/costs desired.
	C8.9 What are the factors contributing to the success (or failure) of the IT system?	C8.9 This question aims to establish whether the use of an inappropriate IAT partially or completely caused the failure of the IT system.
	C8.10 Was the appropriate IAT used?	C8.10 This question investigates whether other IAT should have been considered.
	C8.11 Has the organisation suffered because of not using any other IAT?	C8.11 This question further reflects on C8.10.
	C8.12 How knowledgeable is the organisation about the different types of IT IAT?	C8.12 This question investigates whether the lack of knowledge was a factor in choosing the 'wrong' evaluation method.
	C8.13 What are the primary and secondary objectives for conducting an IT evaluation?	C8.13 This question establishes the organisational drive to perform an evaluation.
	C8.14 What is the overriding factor in choosing the type of IAT: (a) cost, (b) appropriateness, (c) time constraints, (d) resource limitations, (e) direct orders from top management, (f) other?	C8.14 This question re-addresses the assumption in Proposition C.
	C8.15 Can you further explain and exemplify C8.14?	C8.15 This question seeks detailed information from C8.14.