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ENHANCING END-USER SATISFACTION IN THE POST-IMPLEMENTATION PHASE OF ISD:

AN EXPLORATORY STUDY OF A LARGE MULTINATIONAL COMPANY

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DECLARATION

I, Colman Gantley declare that this thesis is submitted by me in partial fulfilment of the requirements for the degree of Masters in Science, is entirely my own work except where otherwise accredited. It has not at any time either whole or in part been submitted for any other educational award.

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EXECUTIVE SUMMARY

A large-scale information system (IS) can enable an organisation to dramatically improve their business model, change internal structures and over time increase profit margins (Lucas, 2005). Due to this, many organisations in Ireland and across the world have invested a considerable amount of money in setting up these systems (Hawking & Stein, 2002). An IS can enable an organisation to dramatically improve its business model, change internal structures and increase profit margins, thus, enabling an organisation become more effective and efficient in the way it does business (Lucas, 2005). Although an IS can bring a competitive advantage to an organisations, the high failure rate in deploying such systems is a major worry (Kim et al., 2005). Many organisations have suffered from ineffective information systems, for instance: Whirlpool, Irish Health Authority, Allied Waste Industry, Mobile Europe, Applied Materials, Waste Management Inc, Irish Prison Service, Irish League of Credit Unions and Nestlé (Weston, 2001; Yu, 2005). An example of one major IS failure in Ireland is the Personnel, Payroll and Related Systems (PPARS) project developed for the Irish Health Authority (IHA). Originally, the PPARS project was due to cost just €8.8 million. However, the system has so far cost €116 million and still is not fully implemented and is only operating in four out of the eleven health board regions (McGee 2005). Users of the PPARS project reported problems with the systems interface, functionality, and the level of training administrated. In 2006, the IHA suspended any further expansion of the PPARS, as it threatened the hospitals basic functioning (Hunter 2006); (INBITE, 2006); (Irish-Health, 2006).

An IS can be judged to be successful if its users are satisfied with the workings of the system, for example: A system that reduces the work load of the user, without a high degree of difficulty, will be highly regarded amongst users, satisfaction will be high and the system will be utilised. This was not the case with the PPARS project. Problems users encountered with PPARS included technical difficulties, utility failure and usability issues. Other factors that can contribute to user dissatisfaction with an IS include the environment where the system is managed and the degree of support and training provided.

Technical difficulties include the degree of reliability with the IS software, hardware and networking failures. A reliable product has the ability to perform its function when required, for a specified time, in a particular environment and must support the needs of the user in a fast, consistent manner. A system's reliability can only be

determined when the system is been utilised in the post implementation stage of the development life cycle. If the system is not available or induces errors, it does not matter how well the interface is designed-the user will become frustrated, satisfaction will be low and the system will not be utilised.

Utility comprises of the features and capabilities (business functionality) that are encapsulated within the IS. An IS must meet both the needs of the user and the needs of the business, respectively. Different users will have to carry out various tasks and the IS must have the scope to allow users carry out a wide variety of jobs. A system that does not address the diverse work practices of the business will cause user irritation and can ultimately lead to users resisting to work with the system. If the functionality is inadequate, it does not matter how well the interface is designed or how reliable the software is, ultimately the system will create low user morale and a decrease in productivity. Creating a system that meets user needs in an easy and effective style can have a number of positive affects on the user and the business. The system can create an upbeat user attitude towards the system, which will inevitably lead to a decrease in staff turnover and increase productivity that can guide the business to improved profits margins ((Plummer, 2001); (Palvia et al., 2001)).

Usability is the concept of satisfaction users can derive from using a system's functionality in a reliable manner within a particular environment. If the IS is poorly designed, unpredictable, or incomprehensible for the users, it can cause huge problems and ultimately lead to the system's demise. Users of an IS that has poor usability use 20 – 30 percent of the available features, this leads to high productivity slumps, huge loss of profits for the organisation and low user morale (Palvia et al., 2001); (Nielsen & Coyle, 2001); (Mohamed & Fadlalla, 2005). The interface is part of the system, which the user sees, hears and communicates with. Depending on the user experience with the interface, a computer system may succeed or fail. It is irrelevant how well engineered the software code or how sophisticated the hardware is; a bad interface can ruin an otherwise excellent system. On the other hand, a good interface can save poor software and make a system acceptable. Ergonomics can contribute to a large number of social problems, such as comfort, health and safety and user performance within the environment of the IS. Systems with high usability have natural interfaces, are easy to learn, easy to use, and include well designed business ergonomics, which can result in a reduction in user frustration ((Hix & Hartson, 1993); (Fruhling et al., 2005); (Shang & Seddon, 2000)).

Training is intended to provide users with an understanding of the IS, which will enable them to carry out their work affectively. Lack of user training and a failure to fully understand how the system works, is a major cause why recently implemented IS fail ((Chang, 2004); (Nicolaou, 2003)). New users of a high-function application system can become frustrated and confused by the errors they make in the early stages of learning (Carroll & Carrithers, 1984). Providing training and support for the user not only helps them develop their skills and knowledge, but it is also motivational and a building block for an organisational success. It is important for any organisation, large or small, to plan the training that their employees require. Training needs to target the right people, at the right time for a correct kind of person ((Kendall & Kendall, 1999); (Bradford, 2003); (Wixon et al., 1990)).

Many organisations expect users to find the new system easy to learn. Unfortunately, this is usually an over optimistic hypothesis (Wixon et al., 1990). Recent research on advanced IT deployment identifies the post-implementation phase as the critical period during which the new IS becomes embedded in the host organisation (Halpin, 2003). Conducting a post-implementation evaluation on the system during this critical period can provide the organisation with an understanding of what the IS can and cannot do and highlight flaws that went unnoticed in the development stage. Repairing these flaws can ultimately limit the chances of a large-scale system failure (Nielsen et al., 2001; Kueng, 2002). Including users in the evaluation of the system can determine whether the system is easy to use, manage and learn. Evaluations should be carried out shortly after the system has been introduced. Early assessments can be extremely useful to enable modifications to problematic areas (Nicolaou, 2004; Yu, 2005). Past research proves that very few organisations review their system after it goes 'live' (Nicolaou, 2003; Woodings & Everett, 1999; Tallon et al., 2001). The literature identifies a number of key elements that can create or diminish user satisfaction with an IS. These key elements include the interface, functionality, training, ergonomics, and system reliability.

To identify the main elements that create user satisfaction and improve the understanding of usability in the post-implementation phase a constructivist approach was adopted (Guba & Lincoln, 1994). Accordingly, a qualitative, interpretive, case-based research strategy was implemented. The study targeted an organisation, which had recently implemented a large-scale information system in the past eighteen months in Ireland. For the purpose of this study the participants requested that the

company name not be disclosed. Therefore, the company will be referred to as 'Company A'. Company A is a leading supplier of equipment for mobile and fixed line telecommunications networks across the world and operates in the Republic of Ireland. Eighteen months prior to this study, Company A introduced a new IS to its workforce, affecting over 56,000 employees throughout the world. A case study was conducted over a period of five months. The IS in use at Company A was a complex and multifaceted system; hence, it was necessary to conduct several exploratory interviews. The researcher carried out eighteen semi-structured interviews with key personnel, including administrators of the system, and a number of employees and managers who use the system. Each meeting lasted between one and two hours. This type of elite interviewing is sometimes necessary to investigate little understood phenomena (Marshall & Rossman, 1989). The general interview guide approach was chosen as being the most appropriate for this particular study, and a semi-structured interview strategy was selected (Patton, 1990). Each interview was tape-recorded and was up to two hours in length. A wealth of documentary evidence was also gathered, and a significant amount of data accrued from informal conversations and observations while on-site at the research location.

The findings state that, enhancing user satisfaction with an IS in the post-implementation phase can be obtained through adequate support and training, an amiable working environment, the correct functionality, an easy-to-use interface and high system reliability. Through this the research study has developed a conceptual framework called the Post-Implementation Usability Synergy (PIUS). The PIUS framework acts as a synergy. It contains six different parts but operates as one. Each element has an importance, but combining all the elements together would be greater than the sum of their individual effects. The PIUS framework was designed to identify areas of user satisfaction or dissatisfaction with the new IS, from the user point of view. The users are the people working first hand with the system. If the users, for instance, are having trouble with interface, the systems usability will be low, no matter how reliable the system is. By not considering the thoughts and opinions of the user in the post-implementation phase it is impossible to establish whether the system has an adequate level of reliability, interfacing, functionality, or training supplied to ensure the user can work effectively and efficiently with the new system. All of these elements are grouped together to produce a usability synergy. If one element of the synergy is missing or is problematic, user satisfaction will not be achieved.

ABSTRACT

This thesis presents a theoretical framework for enhancing user satisfaction for recently implemented large-scale information systems and attempts to bridge a significant gap in information systems development (ISD) research. ISD methodologies concern themselves primarily with pre-implementation activities, rather than the post-implementation period, and ignore the processes by which people learn to use information systems effectively after they have gone live. Continually organisations ignore this critical phase in the system development life cycle and seldom evaluate the system once it has gone live. When this occurs poor interfacing, for example, can go undetected until eventually the end-users stop using the system, which renders the system an expensive failure. A poorly designed system interface becomes a barrier for users and they will become more reluctant to tolerate it. If users resist working with the technology, the potential for the system to generate significant organisational performance gains may be lost, rendering the introduced system a costly mistake. This thesis attempts to reframe usability beyond just human-computer interaction (HCI). It introduces the Post-Implementation Usability Synergy (PIUS) framework. The PIUS framework focuses upon six different elements, including: Support and Training, Work Practices/Functionality, Working Environment, System Reliability and User Interfacing, all centred around the actual Users of the system. The aim of the PIUS framework is to ensure user satisfaction towards the new system and ensure a happy, productive, and satisfied employee. The PIUS framework should be incorporated into a post-implementation evaluation of the new large-scale information system. A well-planned and executed post implementation evaluation should assist organisations to identify needed changes in the system structure. This can help the user realise the full potential of the system, by correcting any errors that may have gone unnoticed in the development stage.

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CHAPTER 1 INTRODUCTION

This chapter provides an introduction to the problem under investigation, motivated by the main failure issues experienced by organisations adopting an information system. The extent of this research is then presented, where the issues, research questions and methodology used to conduct the investigation are summarised. A brief overview of each chapter is then presented and represents the structure of the thesis.

1.1 Background

A large-scale information system enables an organisation to dramatically improve their business model, change internal structures and over time, increase profit margins (Lucas, 2005). Due to this, many organisations around the world have invested a considerable amount of money in setting up these systems (Hawking & Stein, 2002). Although information systems (IS) can bring a competitive advantage to organisations, the high failure rate in deploying such systems is a major concern (Kim et al., 2005). A number of prominently publicised IS failures have highlighted the difficulties involved in implementing an IS (Yu, 2005). There are a number of reasons why there is such a high level of IS failure, such explanations include the omission of potential users from the IS development process, the exclusion of usability evaluations, and the lack of attention given to post-implementation period (Halpin, 2003). In an empirical study of large-scale ISD projects in Ireland, (Stapleton, 2001) ascertained that the majority of respondents expressed the need for an improvement of post-implementation processes. Quoting from (Stapleton, 2001), 'the extended post-implementation ISD activity is virtually ignored in the information system literature…future research must address this paucity of knowledge' (pp. 384). Introducing a usability evaluation during the post-implementation period of a new system can identify any problematic areas, such as poor user interfaces, limited system reliability or incomplete business functionality (Kueng, 2002). Identifying and dealing with these issues can make the system more 'usable' for the user (Nielsen et al., 2001). Creating a system with a high level of usability can achieve a number of positive outcomes, such as a reduction in errors and a positive user attitude towards the system. This can lead to greater productivity and profitability for the company (Fruhling et al., 2005). A system can be judged to be a success if its users are satisfied with the workings of the system. A system that reduces the workload of the end-user, without a high degree of difficulty, will be highly regarded amongst users and user

satisfaction will be high. In some cases this does not happen and the system is unusable. A poor IS environment, a lack of user training and a failure to fully understand how the system works, are major reasons why users become dissatisfied with the IS ((Chang, 2004); (Nicolaou, 2003); (Wixon et al., 1990)). Creating user satisfaction is an essential ingredient to a successful implementation of any IS. However, past research indicates that little time or resources is made available for any sort of user evaluation within industry, and quite often the IS is believed to be acceptable for the users (Kilambi et al., 1998).

There is a growing need for research, which endeavours to develop a framework that captures and aggregates usability issues in the post-implementation phase for large-scale information systems. This thesis attempts to bridge a significant gap in information systems research and endeavours to synthesise a framework that will both examine and indicate specific user satisfaction issues that may arise within the post-implementation phase of a large-scale information system. To achieve this objective, the researcher will target a large multinational firm that had just implemented a 'complex' information system, located in the Republic of Ireland. A case study approach will be selected, as it was deemed the most appropriate method based on the exploratory nature of this research.

1.2 Information System Failures

Although information systems can bring a competitive advantage to organisations, the high failure rate in deploying such systems is a major worry (Kim et al., 2005). Many organisations have suffered from ineffective information systems, for instance: Whirlpool, Allied Waste Industry, Hershey Foods, Boeing, Mobile Europe, Applied Materials, Waste Management Inc, Kellogg's, Irish Prison Service, Irish League of Credit Unions and Nestlé (Weston, 2001; Yu, 2005). Recently in the Republic of Ireland the Irish Health Authority (IHA) developed a system that ultimately failed costing the Irish taxpayer millions.

In 1997 the IHA identified that there was a need to implement an integrated Human Resources Management (HRM) system to supersede the old predominately manual based system. This system focused on personnel administration, and had limited interfaces between payroll, personnel and finance functions resulting in large volumes of paper transactions. The existing HRM system was no longer appropriate to support the delivery of a 'world-class health service'. For these reasons the IHA decided to

invest in the Personnel, Payroll and Related Systems (PPARS) project. This system would manage the development and implementation of a fully integrated HRM system throughout each health board region in the Republic of Ireland (PPARS 2005). The project commenced in 1998 with a budget of €8.8 million. IBM were appointed to deliver and manage the system platform, SAP were to support the implementation, whilst Deloitte & Touche managed all consultancy practices (PPARS 2005); (Kennedy 2005). In 2005 the system was introduced to four hospitals on a trial bases. Six months later, the IHA announced it had suspended any further development of the project due to massive cost over-runs, limited take-up and significant failures in the system, including overpaying: mistakenly paying one employee £690,000 (€1m) in a salary transfer. In 2007, the PPARS project has yet to be fully integrated into the workforce, largely because the system was difficult to use, lacked general training and did not fulfil the basic needs of the use. To repair these problems it is estimated to cost up to €231 million, 25 times the original estimate. Key reasons for high profile failures such as the PPARS project is that organisations focus primarily on the pre-implementation activities, rather than the extended post-implementation phase and often excluding user involvement after the system has gone live.

1.3 Post-Implementation Review

The systems development life cycle is a systematic and orderly approach to solving system problems. It is the basis for the most widely used ISD methodologies for developing large-scale information systems and usually incorporates the following general problem solving steps (Whitten, 1998):

- Planning
- Analysis
- Design
- Implementation
- Post-Implementation and Support

The post-implementation phase occurs after the information system has been developed and gone live. This is one of the most critical stages in the systems development life cycle. Despite the huge importance of the post-implementation phase, past research indicates that very few organisations review their system after it

goes live ((Nicolaou, 2003); (Deloitte & Touche, 1999); (Woodings & Everett, 1999); (Tallon et al., 2001)). By conducting regular reviews on the new information system, IS/IT managers can identify problems and correct any errors in the system that went unnoticed in the development stage. As a consequence of this intervention, the post implementation review can repair the system and get it operating to its full potential (Fruhling et al., 2005) (Nicolaou, 2003); (Woodings & Everett, 1999). Early assessments involving users of the system can be a useful method to determine whether the system requires any modifications ((Palvia et al., 2001); (Nicolaou, 2004); (Yu, 2005)). A post-implementation review (PIR) can also highlight areas of the system users are having problems with. Correcting any user related issues can reduce the chances of rejection and can create a high level of job satisfaction.

1.4 A Need for a Revised Perspective of the Post- Implementation Review

An IS failure may be described as a project that is unusable or does not deliver its expected outcome, on time and within budget. The success of an IS project depends on realistic deadlines, sufficient reliability, adequate functionality, appropriate personnel and good communication between the developers, users and managers of the system. End-user dissatisfaction is a major reason for expensive failures (Palvia et al., 2001). One of the critical reasons for this is that ISD methodologies disregard the post-implementation phase and ignore the processes by which people learn to use information systems effectively after they have gone live ((Nicolaou, 2004); (Stapleton, 2000b)). Performing a post-implementation review can uncover areas of discontent users are facing with the IS, such as poor reliability, functionality, or training. User satisfaction is one of the key factors leading to an information systems success (Calisir & Calisir, 2003). For example, users who must wait more than a few seconds to see on-screen results of their input can become frustrated, which will lead to end-user resistance and potentially a huge drop in productivity (Krasner, 2004). Identifying users' problems and issues early is essential for the system to be successful; this can be achieved by ensuring a high level of end-user participation throughout the systems usability evaluation (Shneiderman, 1998) (Fruhling et al., 2005). Currently, usability evaluations only occur throughout the early testing phases of the systems implementation. In spite of this, very little work has been done to establish key development activities for end-users after the system goes 'live' ((Nicolaou, 2004); (Stapleton, 2001)). Furthermore, limited research addresses

usability concerns throughout the post-implementation phase of an information system. Ensuring usability and user satisfaction in this critical phase, can create enormous benefits for the organisation and the ultimate success of the new information system (Palvia et al., 2001).

Summarising, there is a very serious need to identify the main elements that create user satisfaction and improve the understanding of usability in the post-implementation phase.

1.5 Objective of this Study

Usability and post-implementation reviews are critical for identifying user dissatisfaction, improving system functionality and correcting any errors that went undetected in the development process (Krasner, 2004). A successfully implemented review can outline any issues users are having with the new system. By managing and resolving these issues, organisations can greatly increase user satisfaction, and therefore, prevent the system becoming rejected by the workers. A review of the new system can also outline the causes of IS project failure and may provide guidelines on how to prevent future IS failure ((Nielsen & Coyle, 2001); (Woodings & Everett, 1999); (Willcocks et al., 1997)). But forcing users to utilise and accept problematic systems can have negative, serious consequences for the organisation, the user and the IS. Such consequences include an increase in errors, a negative user attitude towards the system and a decrease in system use. These negative outcomes lead to a reduction in productivity for the company and decreased job satisfaction for the employee and can ultimately lead to the new system being redundant (Fruhling et al., 2005); (Cranny et al., 1997) (Ardito et al., 2004). Despite these effects, organisations still ignore these two important system evaluations (Krasner, 2004). This study attempts to address the post-implementation and usability concerns associated with the users of a new information system, and to provide a springboard from which new research may be launched. The objectives of this research are:

- To identify the various components that can create user satisfaction.
- To develop an appropriate theory, which addresses user satisfaction in the post-implementation phase.

This research will address the following research question, which will be aimed to benefit the IS/IT manager or the development IT team.

Research Question: What are the elements that have most impact on user satisfaction with a large-scale information system in the post-implementation phase?

The main research outcome of this study will shed light on how to increase user satisfaction with the introduction of an new information system and help aid organisations identify the most important issues that affect user dissatisfaction with the introduction of an information system.

1.6 Thesis Roadmap

Chapter 2: Literature Review: Large-Scale Information System Development

Chapter two provides a comprehensive review of the literature in the field of information systems, the post-implementation phase and usability.

This chapter begins by providing a background to information systems, and endeavours to establish possible reasons why there is such a high failure rate amongst large-scale information systems. The second section looks at the post-implementation phase of the systems development life cycle and identifies the importance of conducting a post-implementation review on new information systems to diminish the chance of failure. The third and final section of the literature begins by acquiring a background into usability and the factors that make a product or system 'usable', and identifies a number of usability evaluation techniques available.

Chapter 3: Post-Implementation Usability Issues

This chapter provides an overview of the main causes of user-dissatisfaction in the post-implementation phase of an IS. Based on the literature review, this chapter is broken up into various sections, examining reliability, functionality, interface, training and support. A conceptual framework designed to ensure user satisfaction of a system throughout the post-implementation phase is introduced. The framework design appears as a jigsaw, and highlights the most important elements of user satisfaction.

Chapter 4: Research Methodology

Chapter four highlights various research strategies available to the information systems researcher. This chapter identified and justified a field research approach using semi-structured case study interviews, as the most appropriate strategy for the present study. The chapter concludes with a detailed discussion on the development of the research instrument. This research instrument is used to analyse the various aspects of user satisfaction in the post-implementation phase of an ISD project.

Chapter 5: Data Analysis

Chapter five presents a detailed analysis of the case study undertaken within a large telecommunication company in the Republic of Ireland. The findings are synthesised and related back to the issues and questions identified in the literature review. The findings also reflected a change in the conceptual framework identified in chapter three. This chapter concludes with the implications of the findings based on the current thinking and practice.

Chapter 6: Conclusion

Chapter six is the final chapter in this thesis. It provides an overview of the research and summarises the main findings. This chapter gives a detailed synopsis of the theoretical and practical contributions of the PIUS framework, followed by the limitations and suggestions for future research in the area of post-implementation-usability testing methods.

CHAPTER 2 LITERATURE REVIEW: LARGE-SCALE INFORMATION SYSTEMS DEVELOPMENT

> This chapter reviews large-scale information systems, the post-implementation phase and usability, while focusing upon the elements that create user satisfaction within these areas.

Background

Large-scale information systems (IS) continue to report serious difficulties for the firms in which they are deployed. Systems designed to increase productivity and user performances are frequently doing the opposite, and making the user's life increasingly complicated and problematic. A key explanation for these difficulties involves organisations failing to conduct reviews on the IS after it has been introduced to the workplace. Within industry, little time or resources are made available for any kind of post implementation review (PIR). Failure to conduct a PIR on the IS can result in user issues and IS problems going undetected until it is too late. Systems that are inadequately designed or implemented can be related to many negative affects, such as an increase in errors and a decrease in system use. These negative outcomes lead to a slump in productivity for the company and reduction in job satisfaction for the employee. Users can become reluctant to use a system that fails to meet their needs and makes their working life difficult. The high failure rate in implementing IS is a major concern and is proving very expensive for those involved. The objective of this chapter is to identify the elements of user satisfaction, and to examine usability issues associated with an IS throughout the post-implementation phase of an information systems development (ISD) project. In order to attain these objectives, the author will investigate the current literature in the following fields: Large-Scale Information Systems, Post Implementation Phase of a Large-Scale Information System, and Usability in a Large-Scale Information System

Chapter one has confirmed the need for and importance of a revised theory to enhance user satisfaction towards an IS in the post implementation stage of an ISD project. This chapter sets out to ascertain, from the available literature, the various aspects that create user satisfaction in the post implementation phase of a large-scale IS.

2.1 Large-Scale Information Systems

2.1.1   Introduction

A large-scale information system (IS) is an arrangement of people, data, processes, interfaces, networks and technology that interact to support and improve day to day operations in an organisation (Whitten & Bentley, 1998). Large-scale IS's are designed to help manage organisational resources in an integrated manner, in addition to supporting problem solving and decision-making needs for management ((Hirschheim & Smithson, 1999); (Whitten & Bentley, 1998)). An IS must process information for different users: customers, suppliers and others. Therefore, the system must structure and arrange the data to fit the information needs of different users, and satisfy the different work practices of each person interacting with the IS. Some typical examples of users and their information include (Steenis, 1990):

- Customers who need an invoice with their order;
- Warehouse managers who want an inventory report;
- Storeowners who must identify what stock need replenishing;
- Marketing people who require customer profiles for a new campaign.

A large-scale IS consists of hardware, software, and otherware. *Hardware* includes the physical computer, terminals, printers and other parts that can be seen and felt. The basic design of an IS is done through s*oftware*, which comprises of multiple computer programs. The software programs of an IS are the instructions that control the hardware. *Otherware* can be described as additional entities that are required for an IS, this includes the user working with the hardware and software specifically (Clifton & Sutcliffe, 1994); (Steenis, 1990). The design of the otherware must properly complement that of the hardware and software included in the system (Turban et al., 1999).

2.1.2   Why Invest in a Large-Scale Information System?

Businesses today face a stark reality: anticipate, respond and react to the growing demands of the marketplace, or perish. In a fiercely competitive environment, making an incorrect decision can make the business insolvent ((Nah & Lau, 2001); (Mohamed & Fadlalla, 2005)). Introducing an IS to an organisation can dramatically

improve how the company operates on a day-to-day basis, by taking advantage of the capabilities of the new system. A new system, that is properly implemented, could be capable of returning 100 percent or more of the entire investment (Langenwalter, 2000). An operational and robust IS should provide the right information to the right person at an accurate time with minimal costs (Snene et al., 2004).

A large-scale IS can help a firm become more competitive through changes in strategy and direction, and can make an organisation become more effective and efficient in the way it does business. An IS can enable an organisation to dramatically improve its business model, change internal structures and over time increase profit margins (Lucas, 2005). Furthermore, an IS can be broken up into two separate systems; these include (Halpin, 2003):

1. A social system made up of people with distinct biological, social and psychological needs, and
2. A technical system, comprising of machines, methods and the knowledge they embed.

For an IS to be successful it must incorporate and achieve social and technical (*socio-technical*) aspects. The social and technical systems can be studied separately, but are inter-dependent. The social domain is where requirements originate in the form of usability processes and organisational structures. The technical domain consists of the provision of functionality provided by the information tools. The aim of this is to give equal weight to social and technical issues when new systems are being designed ((Mumford, 2000); (Halpin, 2003)). Large-scale IS are now a critical part of the profitability and even survival for many companies (Clifton & Sutcliffe, 1994). The following table summarises the reasons for investing in and evaluating IS.

Figure 2-1 Reasons for Investment in an Information System

Reasons for IS Investment	
To reduce costs	To improve efficiency
To enable business change and growth	To develop new business
To increase profits	To gain competitive advantage
To enable new ways of managing and organising	To improve productivity and performance
To improve customer services	

There are many reasons why an organisation may decide to invest in an IS. It may be to enable business change, to improve customer service, to develop new business, along with more reasons, as seen in Figure 2-1. Whatever reason or combination of reasons an organisation has for investing in an IS, it will only discover it has reached its objective by evaluating that investment after it has been introduced.

The introduction of a large-scale IS can lead to many advantages, most of all a competitive advantage over close rivals. A large-scale IS can give a company a clearer view of the structures and processes within the organisational. This can help with anticipating and reacting to growing demands of the marketplace. The most significant intangible benefits of introducing a large scale IS relate to internal integration, improved information and processes, and improved customer service. Tangible benefits relate to cost efficiencies in inventory, personnel, procurement, as well as, improvements in productivity, cash/order management and overall profitability (Nicolaou, 2004). Other benefits of the introduction of an IS can be seen by the provision of timely information control, improved planning, and decision-making processes for an organisation. Hence, resulting in higher effectiveness and efficiency in operations, improved user satisfaction, and increased productivity ((Spathis & Constantinides, 2003); (Calisir & Calisir, 2003); (Mahadevan, 2001); (Mohamed & Fadlalla, 2005)).

While many factors contribute to a new technology's successful adoption and use, system usability has recently gathered increasing attention. A critical attribute of what we commonly refer to, as usability is users' satisfaction with the systems they use. The International Standards Organisation (ISO) defines usability as "the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency, and satisfaction in a specified context of use (ISO-9241, 1998). Shackel's notion of *attitude* suggests that a usable system should result in "acceptable levels of human cost in terms of tiredness, discomfort, frustration, and personal effort". A systems success can only be generated through the satisfaction of the users working with the system, in a safe and comfortable environment (Shackel 1986). Bevan described satisfaction as a combination of comfort and acceptability of use:

> Comfort refers to overall physiological or emotional response to use of the system (whether the user feels good, warm, and pleased, or tense and uncomfortable). Acceptability of use may measure overall attitude towards the

system, or the user's perception of specific aspects such as whether the user feels that the system supports the way they carry out their tasks, do they feel in command of the system, is the system helpful and easy to learn (Bevan, 2005). Tynan, 1980 identified a number of conditions after the implementation of an IS that will affect job satisfaction. They have been grouped together in three classifications as illustrated in Figure 2.2. The classification includes job content, organisational issues, personal issues, and are incorporated from a user point of view (Smith, 1997).

Figure 2-2: Elements of job satisfaction

Personal Issues

Job Content

The User

Organisational Issues
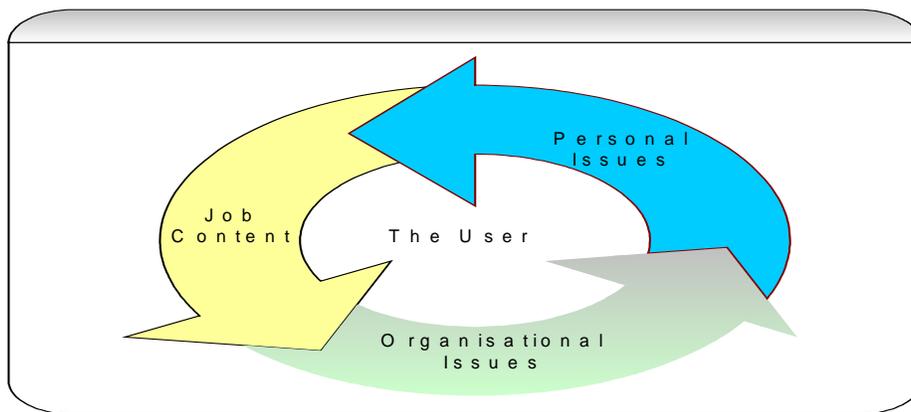
Adapted source: (Smith, 1997)

The User

The users are the people who are required, or decide, to use the IS in order to complete the tasks they have as part of either their work or leisure activity. Users clearly have a stake in the system as it will either enhance or inhibit the way in which they complete their tasks. The user is a crucial element in the successful acceptance of an IS within the organisation. For job satisfaction to be successfully created within an organisation, the users approval is essential. Producing a happy, satisfied user involves developing an accurate vocation for each user within the correct environment. User support is a major building block in the process of achieving job satisfaction.

Job content

The aims of job design should be to reduce stress by making work both worthwhile and meaningful. Dissatisfaction with job content can lead to stress and a lack of job satisfaction. There are a number of specific issues:

- *Task variety*, a mix of tasks and a variety of methods tend to enhance satisfaction;
- *Task complexity*, the appropriate level of complexity is required to help maintain users from becoming bored with the system;
- *Work pace and load*, the quality of work required and how it matches the employee's capacity;
- *Task identification,* the degree to which the job makes coherent sense to the workers. This can aid employees to make a visible contribution to the organisation and identify with an end product of their efforts.

By creating an environment that offers the user a variety of tasks, complexity and functionality can ultimately lead to an increase in job satisfaction for the user.

Organisational issues

A number of determinants of job satisfaction have been found to relate to interpersonal communication and contacts within the organisation:
- *Discretion, autonomy and privacy*, the extent to which employees are able to execute their tasks independently from other, and carry responsibility for their own actions.
- *Standardisation/formality,* the extent to which the technical system affects the flexibility in which the task can be achieved.
- *Feedback mechanisms,* the way in which the organisation informs individuals about their performance.
- *Social support*, a lack of personal, face-to-face, support from colleagues and supervisory staff increases stress: IT and IS tend to reduce social support.

Personal issues

The single most important personal aspect of job satisfaction is that of job security. IT is often perceived as such a threat. In addition the following issues are relevant:
- *Individual status*, how the proposal of an IS may affect the user's status within the organisation.
- *Pay and rewards*, performance should be linked to rewards.

- *Physical environment*, ergonomic issues relating to work station design, issues such as system response time and computer breakdown can cause stress.

2.1.3   Large-scale Information Systems Failure

Laudon & Laudon identified as many as 75 percent of all IS can be considered to be operating failures (Laudon & Laudon 1998). By saying that so many information systems fail it does not necessarily mean that the IS do not work; rather that they fail to meet initial aspirations. In this context success can be described as *being used effectively for the users for which it was commissioned* (Raskin, 2000). An IS can be judged to be successful if its users are satisfied with the workings of the system, for example: A system that reduces the work load of the end-user, without a high degree of difficulty, will be highly regarded amongst users and user satisfaction will be high. In some cases this does not happen and the system is not usable; users resist change and return to their old methods, therefore leaving the new system idle and pointless. There are three ways in which failure might occur, which include: technical failure, utility failure and usability failure (Smith, 1997):

Technical Failure

Failure may occur at the technical level, through either hardware, software or communication fault.

Utility Failure

An IBM Dictionary of Computing (1993) report defines *utility* as: 'the capability of a system, program or device to perform the functions for which it was devised' (IBM, 1993).

A software system may be correct in that it does not suffer from technical failure, but it may not meet the real, or full, task-related needs of the organisation and the individuals within it. In the situation of poor utility, failure may have occurred in the requirements capture stage of the analysis and design process. Utility is also equated to *functionality*. An IS that suffers poor utility is highly likely to result in a lack of acceptance by the user community (Smith, 1997).

Usability Failure

The IBM Dictionary of Computing (1993) defines *usability* as: 'the quality of a system, program or device that enables it to be easily understood and conveniently applied by the user' (IBM, 1993).

Systems that are both technically correct and fully meet the specified utility requirements may still fail as a result of a lack of user acceptance or even total user *rejection*. For some reason the people for whom the system is designed are unable to make full, or appropriate use of the end product. Reasons for this might relate to the lack, or the inappropriateness, of training methods, or a poorly designed software interface. Alternatively, the way in which the overall software system matches, or fails to match, the organisational culture, ethos or management style may be significant (Smith, 1997). Usability is the central issue within this study and therefore deserves a greater coverage. Consequently, section 2.3 of the literature review will focus directly on usability, and usability issues.

2.1.3.1   Technical Failure

Technical failure can occur when external entities fail, such as software. Technical failures or reliability issues can be detrimental to trying to gain user satisfaction toward the new IS. The reliability of a product is the measure of its ability to perform its function when required, for a specified time, in a particular environment. A reliable IS must support the needs of the user in a simple, fast and consistent way (Leitch, 1995); (Hoyland & Rausand, 1994). The reliability of a large-scale IS can be categorised into three different components, these include:

1. The systems software
2. The systems hardware
3. The systems communications (Networks)

A system's *software* comprises of written coded commands that tell the system what tasks to perform. A system's *hardware* consists of devices that are capable of accepting and storing computer data. A system's *communications* device allows different information systems the ability to interact and communicate with each other over a network. If one of these three components fails, the system may be less reliable, which may prevent users from completing their work ((Kopetz, 1976);

(Abbot, 1990)). The division between hardware, software and communications'
reliability are somewhat artificial. They may be defined in the same way. Therefore,
you may combine hardware, software and communication component reliabilities to
get system reliability. These depend on the physical environment of the IS (Musa et
al., 1987); (Abbot, 1990). The software architecture, hardware components, and
network support must ensure high availability. If the system is not available or
introduces errors, then it does not matter how well the human interface is designed
(Shneiderman, 1998).

A system's reliability may only be determined when the IS has been utilised, in the
post implementation phase of the development life cycle, however, the importance of
reliability for a business success is undeniable. Users who must wait for on-screen
results can become frustrated and may lead to a huge drop in job satisfaction (Briand
& Wust, 2002). (Ardito et al., 2004); (Rosenbaum et al., 1999); (Kopetz, 1976);
(Krasner, 2004).

2.1.3.2 Utility Failure

Utility comprises of the business functionality that is encapsulated with the IS. The
business functionality of an IS indicates the features and capabilities the system
comprises of (Dennis & Wixson, 2000). Organisations need to have clear and
unambiguous understanding of the business objectives before the system is designed,
to ensure that the correct functionality is obtained (Holland & Light, 1999); (Rolland
& Prakash, 2001). The functionality of a large-scale IS can be categorised into two
different components, these include:

1. Meeting the business requirements
2. Meeting individual users requirements

The two most important issues regarding usability are the users' tasks, and their
individual characteristics and differences (Nielsen, 1993). Large-scale IS should do
exactly what they were intended for and assist the users do their job effectively and
efficiently. Different users will have to carry out various tasks. The system needs to
have the scope to allow users carry out a wide variety of jobs. A system that does not
address the work practices of the business will cause users frustration and will
ultimately lead to end-users resisting the use of the system ((Dennis & Wixson, 2000);

(Palvia et al., 2001); (Mohamed & Fadlalla, 2005)). Systems with inadequate functionality frustrate the user and are more often rejected or under-utilized. Excessive functionality is also a danger, and providing it is probably the more common mistake of designers because from the user point of view clutter and complexity can make learning and usage more difficult (Shneiderman, 1998). Users will become reluctant to use a system that fails to meet their needs and makes their working life difficult (Calisir & Calisir, 2003); (Palvia et al., 2001); (Mohamed & Fadlalla, 2005). (Stair, 1996) warns that there is a real risk in problems regarding functionality, as often small problems accumulate to quite large and series difficulties in the future (Halpin, 2003). For an IS to become a success it must include the correct functionality for users to work the system adequately. The system must aid users do their particular jobs or tasks properly, efficiently and quickly (Dennis & Wixson, 2000). If the functionality is inadequate, it does not matter how well the interface is designed or how reliable the software is, ultimately the system will create low user morale and a decrease in productivity. Creating a system that meets user's needs in an easy and effective style can have a number of positive affects on the user and the business. The system can create an upbeat user attitude towards the system, which will inevitably lead to a decrease in staff turnover and increase productivity that can guide the business to improved profits margins ((Plummer, 2001); (Palvia et al., 2001)).

2.1.4   Summary

A large scale IS can be defined as an arrangement of people, data, processes, interfaces, networks and technology that interact collectively, to support various operations within the organisation, in which it is employed. For the system to be accepted into the work force it must accomplish the needs and requirements of the people using it. Many factors can inhibit an IS from achieving these objectives and three ways in which failure might occur include: technical failure, utility failure and usability failure. Technical difficulties can involve problems with the reliability of hardware, software or network devices, and can only be determined when the IS been utilised, in the post implementation phase of the development life cycle. Utility issues can be classified into two different groups, these include: meeting the business requirements meeting individual user requirements Users will become reluctant to use

a system that fails to meet their needs and makes their working life difficult, and are more often rejected or under-utilized. Systems that are both technically correct and meet the fully specified utility requirements may still fail as a result of a lack of user acceptance or even total user rejection. Reasons for this might relate to the lack, or the inappropriateness, of training methods, or a poorly designed software interface. Evaluating the satisfaction users have with the system can determine whether the organisation is reaping the potential benefits of an IS. User satisfaction can be classified into job content, organisational issues, and personal issues. Ignoring these issues can leave users dissatisfied with their work, and the organisation they work with.

The next section of the literature review introduces the post-implementation phase of a systems development life cycle and identifies the importance of conducting a post-implementation review on new information systems.

2.2 Post-Implementation Phase of a Large-Scale Information System

2.2.1   Introduction

The post-implementation stage occurs after the system has been developed and gone live as illustrated in Figure 2-3. This stage can be described as the process of collecting and evaluating evidence to ensure all costs and benefits are identified and analysed, enabling justification for the project (Jacko & Sears, 2003). A post-implementation review (PIR) on a system can be defined 'as the process of establishing by quantitative and/or qualitative means, the worth of Information Systems/Information Technology (IS/IT) projects to the organisation (Wilcocks 92). The PIR provides the organisation with an understanding of what the IS can and cannot do, and provides a benchmark for what is to be achieved in economic, operational or organisational terms from investment in IT. These benchmarks can be used to measure the success of the IS project (Coffey, 2001). With increasingly high levels of IT investment and the growing centrality of IS within organisations, reviewing the IS is becoming widely recognised as a very important activity (Wilcocks & Lester, 1993). By conducting a PIR, an organisation can analyse the finished product.

Figure 2-3: Systems Life cycle
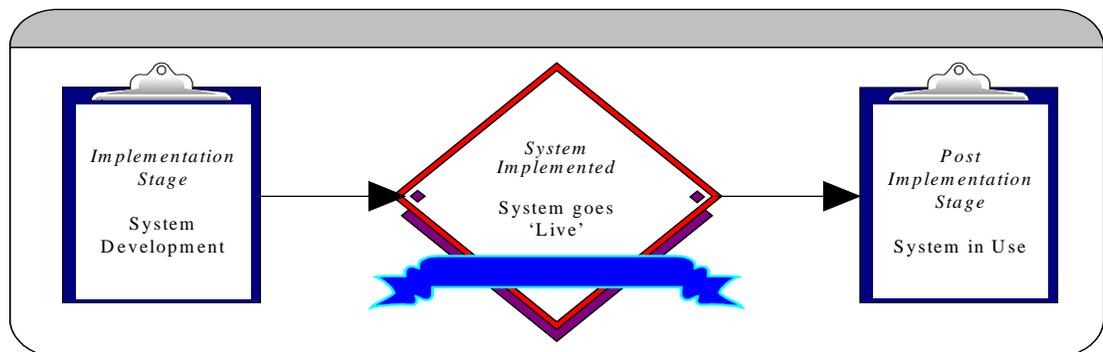
Adapted Source: (Deloitte & Touche, 1999)

An evaluation of IS/IT investment is accepted as an important business process, ensuring that an organisation's assets are being employed efficiently and effectively. The PIR is considered a key component of best practice in this area. However, despite the importance of this stage, past research proves that very few organisations review

their IS after its implementation. A report in 2001 documented that only 12 percent of organisations considered conducting regular reviews on their implemented system (Tallon et al., 2001). Research indicates that little time or resources is made available for any sort of PIR within industry, and quite often the IS is assumed to be satisfactory for the users to use (Kilambi et al., 1998). There are a number of reasons why PIR are not pursued more effectively:

- At the end of each phase of a project the assembled team disbands and moves quickly to the next project.
- Long project timeframes. Some asset-based projects can have extensive timeframes between feasibility and occupation (up to 3-5 years).
- Due to the long turnover period many of the factors that produced the original asset solution change. These factors include service delivery requirements, political factors, budget, state of the economy, industry prices, etc.
- Where projects exhibit shortcomings there is an unwillingness to expose participants to perceived 'criticism'.
- In an increasingly litigious society criticism may be taken as libellous.
- There are rarely funds for effective and continuous PIRs.
- PIR itself can be seen as ineffective. Overly complex and long-winded studies are perceived as time wasting.

IS/IT costs are continuously rising. These include not only the costs of purchasing technology, but also cost of maintaining systems, ergonomics and training users. It has been estimated that support costs represent 73 percent of total costs of computer ownership (Hilton & Kaye, 1996).

2.2.2   Reasons for the Post Implementation Review

There are many reasons why a PIR should take place, as shown in Table 2.1. It may be used to justify an existing or a new system. This appraisal process needs to produce a good estimation of the outcomes of developing, maintaining or installing a system. The evaluation may focus on costs and benefits, competitive position or users opinions, depending on the objective of the organisation. The PIR also enables an organisation to make comparisons between different projects, with resources being allocated to the 'best' project. Another important objective of the PIR is the learning

experience; by comparing estimates with actual outcomes, the estimation process may be improved (Cohen .et al, 2004).

Table 2:1: Reasons for Information Systems Reviews

Reasons for IS Review	
To enable justification of the system	User satisfaction
As a project closure	Development method
To learn from past experience	To ensure benefits are achieved
To improve system, developer, and financial performance	To enable comparison of different projects

Creating a high level of job satisfaction can create a better quality of life for the employee, better health (both mental and physical), increased job stability, and greater cooperativeness. The first step toward improving job satisfaction is determining its causes and correlates. Practitioners need to know what to change in the work situation to improve satisfaction (Cranny et al., 1997). A change in how people do their job can lead to a drop in job satisfaction and lead to user resistance ((Chang, 2004); (Yu, 2005)). Carrying out a PIR can determine if the implementation is actually a success or not. Reviews should be carried out after the system has been introduced. Early assessments involving users of the system can be a useful method in determining whether the system requires any modifications ((Palvia et al., 2001); (Nicolaou, 2004); (Yu, 2005)).

2.2.3   Post-Implementation Review Method

The implementation of an effective and successful PIR requires the dedication of those involved in the review process, access to all relevant information and personnel, and finally a commitment to apply the knowledge learnt from the study. During the course of the PIR it must be stressed that criticism of specific individuals is undesirable and counter productive. A PIR should not be used to find fault or apportion blame. A professionally performed PIR should provide a balanced assessment focusing on positive and negative feedback.

A PIR is designed to evaluate how well the predicted project is against the stakeholders expectations. In a rapidly changing environment many projects that meet

the briefed requirements, perform poorly because service requirements have changed dramatically. This is caused by the inability to accurately predict project requirements not the quality of the project solution. By conducting a PIR, system managers can assess realised IT payoffs against their original objectives and initiate corrective action where necessary. As a consequence of this intervention the PIR can prove extremely useful for system managers (Woodings & Everett, 1999); (Palvia et al., 2001).

2.2.4 Benefits of performing a Post Implementation Review

PIR's are the last step in the project delivery process and represent closure of the feedback loop. PIR means the lessons learnt from previous projects are fed-back into the process, to benefit future projects. Undertaking a PIR can generate both short and long term gains. Short-term gains include:

- Identification of ways to improve the functionality value of a project
- Identification of ways and means to assist asset users overcome occupational problems and increase user morale through the continuous improvement of asset created environments.

Long-term gains include:

- Learning from precedent
- Economics resulting from improved project performance
- Improved concept criteria and project briefing
- Development of more precise design criteria
- Improved decision-making

2.2.5 The Need for the Post Implementation Review

A successfully implemented PIR will outline the causes of IS project failure and may provide guidelines on how to prevent future IS failure. An IS failure may be described as a project that is unusable or does not deliver its expected outcome, on time and within budget. It is important to know how, when and why IS projects fail, as lessons can be learnt to ensure the success of future IS investments. The success of an IS project depends on realistic deadlines, sufficient funding, appropriate personnel and

good communication between the developers, users and managers of the system. A wide variance exists between the percentage of IS failure. Lyytinen identified two categories of IS failure (Lyytinen, 1988) see table 2.2.

Table 2:2 Reasons for IS Failure

Development Failure *(Occurs when systems are:)*	Use Failure *(Occurs when systems are:)*
Abandoned before completion	Implemented, but not used
Implemented, but terminated after a short time in use, also known as 'runaway systems'	Implemented, but only used for a short time due to flaws in the system, resulting in inadequate functionality and performance
Implemented, but difficult to maintain	To enable comparison of different projects
Over time & Over budget	

IS failure may be caused by a variety of different types of errors and mistakes. According to Humphrey, 'Software engineers make errors or mistakes that result in program defect or faults' (Humphrey, 1995). Inaccurate judgement or mistakes made by management may also be the cause of IS failure. For example (Remenyi et al., 1995):

- Lack of IS evaluation
- Inadequate funding
- Not taking users suggestions into consideration
- Investing in IS just because other organisations are
- Lack of alignment of IT and business strategies

According to Markus, the leading cause of IS/IT failure is due to a poor implementation of the businesses' work practices, that is the inability of developers to execute detailed business requirements (Markus, 1994).

2.2.6   Summary

The system development life-cycle incorporates three major milestones, these include: implementation, going live and post-implementation stages. The post-implementation stage occurs after the system has been developed and implemented into the business structure. This stage of the systems development life-cycle can be described as the

process of collecting and evaluating evidence to ensure all costs and benefits are identified and analysed, enabling justification for the project.

The PIR provides the organisation with an understanding of what the IS can and cannot do, and provides a benchmark for what is to be achieved in economic, operational or organisational terms from investment in IT. Other benefits of the PIR include: evaluating user satisfaction, ensuring project aims are achieved, improving system development, and to complete the development of the project. A successfully implemented PIR method will outline the causes of IS project failure and may provide guidelines on how to prevent future IS failure. Creating job satisfaction can create a better quality of life for the employee, better health, increased job stability, and greater cooperativeness. The main step towards improving job satisfaction is determining its causes. A change in how people do their job can lead to a drop in job satisfaction and lead to user resistance. By conducting a PIR on the new system can determine if the system requires any modifications from the view of the people using the system directly.

The next section of the literature review evaluates the term usability and establishes various areas that create user satisfaction with an information system.

2.3   Usability of an Information System

2.3.1   Introduction

The International Standardisation Organisation (ISO) established a usability standard that can be defined as 'the extent to which a product can be used by specific users to achieve specified goals with effectiveness, efficiency and ease of use' (ISO-9241, 1998). The definition states that usability is always context-and-user-dependent. It is divided into three main areas (ISO 1998):

- *Effectiveness*: Accuracy and completeness with which users achieve specified goals.
- *Satisfaction*: Freedom from discomfort, and positive attitudes towards the product.
- *Efficiency*: Resources expended in relation to the accuracy and completeness with which users achieve goals.

The definition above explicitly takes into account the importance of considering the specificity of users, their goals (accomplished by executing tasks) and environment in establishing usability. A system that is usable in a laboratory set-up might not be as practical in the proposed context of use. The acceptability of an implemented system does not depend only on usability of its interface; the system should fit the physical, social, organizational and technical context in which is will be used (Karat, 1997 and Bevan and Macleod, 1994). Usability is the concept of satisfaction users can derive from using a system's functionality (Grudin, 1992 as quoted by Hilbert and Redmiles, 2000). The overall aim of usability is to make a user's quality of life better

(John, 1996); (Shneiderman, 1998). Jakob Nielsen sees the concept of usability as a part of the total system acceptability, practical system acceptability and system usefulness (Nielsen 1993). The position of usability in his conceptual field can be seen in the figure 2.4.

Figure 2-4: System Acceptability
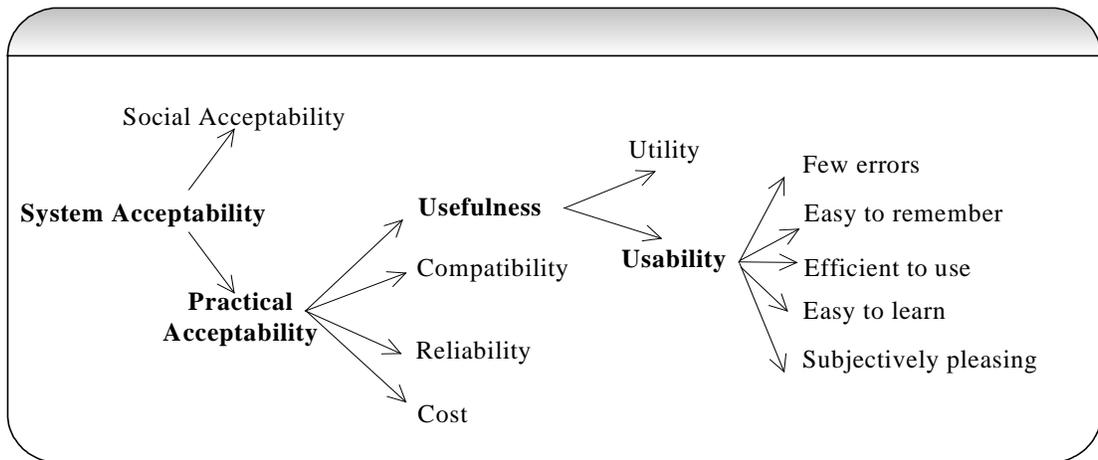
Source: (Nielsen 1993)

In this model, utility is defined as the question of whether the functionality of the system can do what is required to do their job successfully, and usability, is defined on how well users can exploit that functionality. Therefore, usability applies to all aspects of the system with which a human might interact. Usability has a combination of five characteristics, these include: errors, memorability, efficiency, learnability, and satisfaction (Nielsen 1993):

- *Errors*: The system should have a low error rate, preventing users making a large number of errors during the use of the system. This can enable users that make a few errors to recover more easily, without getting to frustrated. Further, catastrophic errors must not occur.

- *Memorability*: The system should be easy to remember, allowing the casual user to return to the system after some period, without having to relearn everything all over again.

- *Efficiency*: The system should be efficient to use, so that once the user has learned the system, a high level of productivity is possible.

- *Learnability*: The system should be easy to use enabling the user to work with the system.

- *Satisfaction*: The system should be pleasant to use, so that users that are subjectively satisfied with using it; they like it.

Looking at the specifications above, usability can be summarised as *ease of use and learning, high efficiency and productivity, low error rate and user satisfaction*. This specification is used throughout this thesis. As can be seen from the definitions, usability is a multi-dimensional aspect, which is often a difficult aspect to control in product development (John, 1996).

2.3.2   Features of High Usability

Systems with high usability are associated with many positive outcomes, such as a reduction in errors, a positive user attitude towards the system and an increase in system use. These positive outcomes lead to greater productivity for the company and increased job satisfaction for the employee (Fruhling et al., 2005); (Cranny et al., 1997). Systems with high usability have natural interfaces, are easy to learn, easy to use and can reduce frustration for users ((Hix & Hartson, 1993); (Fruhling et al., 2005); (Greene & Finnegan, 2004); (Shang & Seddon, 2000)). For instance, reducing the number of windows a user must navigate through, can limit frustration and therefore create a happier more effective, and competent user ((Shneiderman, 1998); (Ardito et al., 2004); (Calisir & Calisir, 2003); (Keirnan et al., 2002)).

2.3.3   Features of Low Usability

Once a large-scale IS is fully loaded with the necessary data, performance can suffer if there are flaws in the system. If the IS is poorly designed, unpredictable, or incomprehensive for the users, it can cause problems and ultimately lead to the systems demise. Users of IS's that have low or poor usability often familiarise and use only 20 – 30 percent of the available features, this leads to high productivity slumps, huge loss of profits for the organisation and low user morale (Plummer, 2001); (Palvia et al., 2001); (Mohamed & Fadlalla, 2005) ((Mahadevan, 2001); (Nielsen & Coyle, 2001). A working example of a usability flaw in an organisation could be the following scenario: numerous times each day a customer service representative opens the same software screens to review customer accounts. Assume there is one design flaw that takes 10 seconds to overcome each time it appears, and this occurs 25 times a day for 50 representatives. This single usability issue alone can waste up to 900 hours a year. Research shows that systems have up to 40 design flaws, which

translates to 36,250 hours wasted each year (Nielsen & Coyle, 2001). The biggest challenge before and after implementation is not related to technology but to people and people issues. Organisations have a tendency to push people and process related issues (e.g. interfaces or training) to the bottom of the list, due to time and cost overruns (Mahadevan, 2001). Studies have shown that organisations dramatically underestimate the importance of user interfaces to the success of information systems, which end up tripling costs after the system has gone live (Krasner, 2004); (Mahadevan, 2001); (Shang & Seddon, 2000); (Deloitte&Touche, 2003); (Hawling et al., 2004); (Shneiderman, 1998). Recently, it has been documented by Jonathon Priestly, director of enterprise and management at BMC, that "80% of projects fail" because they are not been implemented or designed correctly, costing companies €80 - €145 billion annually (Kennedy, 2004).

2.3.4 Usability and the User

User characteristics can affect system use. A system that is usable for one might not be for the next. Often used dimensions to define users are system experience, domain knowledge and experience with computers (Nielsen, 1993). Not only the amount of user's experience and knowledge, but more emotional attitudes like computer anxiety can affect the perceived ease of use of a system (Hackbarth et al., 2003). In devising a system user characteristics have to be considered to develop a system that is acceptable for the prospective users and will actually be perceived by them as useful and usable. It needs to be considered that system users can encompass a wide group of people and that not only users who directly interact with a system should be considered. The concept of 'stakeholders' is used to refer to people or organizations who will be affected by the system and who have a direct or indirect influence on the systems functionality (Kotonya and Sommerville, 1998 as quoted in Preece et al., 2002). Stakeholders include e.g. the development team itself, managers, direct users and users of system output (Preece et al., 2002). Eason (1983, as quoted in Preece et al., 2002) offers a clear structure for defining and categorizing users and stakeholders. Eason distinguishes three categories of users: primary, secondary and tertiary. *Primary* users are the frequent hands-on users of a system. *Secondary* users use a system occasionally or use the system through an intermediary. *Tertiary* users are

those who will influence its purchase or will rarely use the system. The three types of users can together be defined as stakeholders, as illustrated in Figure 2.5.

Figure 2-5: Different Categories of User
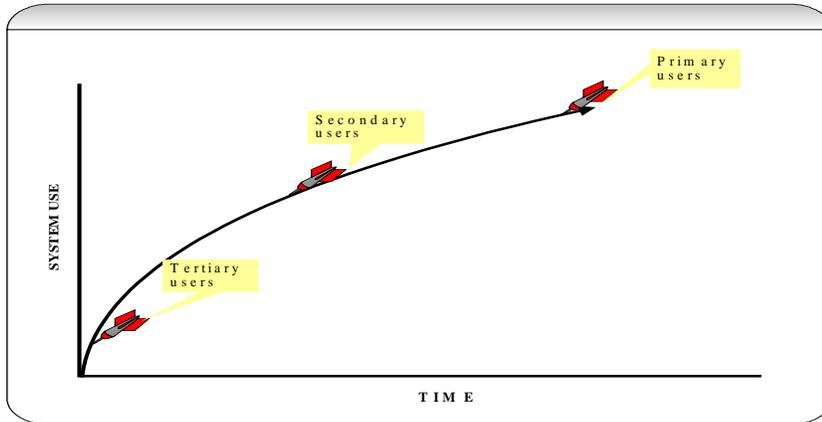
Adapted Source: (Avison & Fitzgerald, 1988)

A different category of user can uncover different problems, thus it is important to use a large sample of user when evaluating or reviewing the system. Identifying users' problems and issues early is essential for the system to be successful; this can be achieved by including a cross-section of end-users throughout the systems usability evaluation ((Shneiderman, 1998); (Kujala & Kauppinen, 2004)). Far too often computer systems are implemented with only very limited user involvement and with, at best, only a cursory analysis of user needs. Often system developers may merely equate user needs with utility. Clearly users require systems to perform functions for which they were devised: but their needs are much wider. User needs can be identified into three categories: functional, aspirational and physical (Smith et al., 1997).

Functional

While users plainly need a high level of utility in the system they use, it is possible that the functions for which the IS was devised are not the same as those that are needed when the system is operative. Sometimes not all the requirements are captured and often requirements change. Therefore, the functionality of an IS can be defined as 'the requirements for the IS to perform the specific tasks which the users require it to do in the operational situation'.

Aspirational

Past research has cited job satisfaction to be a crucial element in IS design. Mumford and Weir (1979) define job satisfaction as 'the attainment of a good 'fit' between what the employee is seeking from his work – his job needs, expectations and aspirations – and what he is required to do in his job – the organisational job requirements which mould his experience'

Physical

The third category of the user needs is derived from physical requirements. People will vary in their own personal ability and disability to use computer equipment. At one extreme, visually impaired and even blind users are unable to use visual display terminals and normal keyboards. Speech output systems are required to access screen-based textual information, and Braille readers can be used for input. At a more common level, as we have seen, all users need appropriately ergonomically designed workstations. Individuals will also vary in their inherent adaptability to IT equipment. Physical needs can be defined as 'the requirements of the IS to perform the tasks in a manner which is well-suited to the physical characteristics of the user.'

2.3.4.1   The Interface

A usable interface is a means '*to improving communication between the user and the machine*' and should hide any complexity and ambiguity. As far as the user is concerned, the interface is the product (Ehlert, 2003); (Raskin, 2000). The data displayed throughout the interface should be clear and concise. Abbreviations, formats, colours, and capitalisation should be standardised to avoid any user irritations (Shneiderman, 1998). An interface should provide the user with an easy and flexible interaction with the system, thus preventing users from becoming disorientated, helping them carry out their working objectives effectively (Calisir & Calisir, 2003). What makes a good interface? Without defining the usability of a software interface too strictly, empirical evidence would suggest that there are a number of elements to a successful interface (Smith et al., 1997):

- *Ease of use*, interfaces should be easy to use in that, through simplicity and consistency, access by the user is made as intuitive as possible.
- *Efficiency*, which can be achieved though the use of short cuts and inherent flexibility.

- *Supportiveness*, which can be provided by a number of mechanisms, including helpful feedback, so that users feel safe and secure when using the system.
- *Acceptability*, by ensuring an appropriate match between user tasks and the functions provided and by meeting user needs in satisfying ways to overall acceptability can be enhanced.

The interface is part of the system, which the user sees, hears and communicates with. Depending on the users experience with the interface, a computer system may succeed or fail. It is irrelevant how well engineered the software code or how sophisticated the hardware is; a bad interface can ruin an otherwise excellent system. On the other hand, a good interface can save poor software and make a system acceptable. Poor interface design can have the following consequences (Shneiderman, 1998):

- *Increased mistakes in data entry and system operation*; Mistakes cost money to rectify and errors, which go uncorrected, can have very damaging consequences if decisions are taken on the basis of incorrect data.
- *User frustration*; this may manifest in low productivity, employee stress, sabotage of the system and under-utilisation of the system.
- *Poor system performance*; the system may not handle the volume of throughput it was designed for, or the accuracy of output may not agree with the specification. Poor interface design makes it too cumbersome to use or too obscure to learn.
- *System failure because of user rejection*; this may seem to be an extreme case considering the tolerance of users to appalling software, but it does happen.

The US Department of Defence ascribes its worse systems failures to the combination of poor interface design and inadequate system requirements. The human side of the interface forms the basis of system operation manuals, training documentation and user guides. Interfaces do not exist in isolation. The interface functions in an environment, which influences the performance of the interface and may impose constraints upon it. Design of the interface/task environment has two considerations:

- *Physical design of the workplace*; this subject is within the realm of ergonomics.

- *Design of interface support documentation*; this consists of the user manuals, technical documentation, training courses and training manuals.

Since the functionality of systems is made available through its user interface, its design has a huge influence on the usability of the system. The interface must be developed according to the needs of the users and the business, and should be designed after all the business process have been finalised. A good interface requires deep understanding of the work practices in the context of the tasks that the IS will help carry out.

2.3.4.2   The Environment

The concept of 'environment' as part of usability refers to the technical, social and physical environment of users that could potentially affect system use.

First of all the *technological* environment of a system needs to be considered; what tools are in use now that it might replace, what tools have to be used together with the system, which systems it will need to be compatible and share files with.

The *social* constraints for a system need to be taken into consideration. Are there any ethical considerations for the system? Will implementing a system change working relations in a department? Does the system fit the workflow in an organisation, what could be improved in the department, or what cannot be changed?

The *physical* environment can provide for specific requirements and design considerations also; is there enough space for the system, what are the light and noise levels of the room a system could be placed in. Stand-alone system using voice recognition may be very usable in a quiet dedicated space, but may not be the right choice for a hectic and noisy open office (Carroll 1991); (Copper & Reiman, 2003). It can be too easy to overlook important considerations when not actually visiting the context of use. This is especially important when developing a large system that cannot be considered a 'standard' desktop application and relatively unknown issues might come into play. Ergonomics is becoming an increasingly important aspect of the implementation of computerised system. Dul and Weerdmeester (1993) provide the following definition of ergonomics: '*ergonomics aims to design applications, technical systems and tasks in such a way as to improve human safety, health, comfort and performance*'. According to Dul and Weerdmeester (1993) a large number of

factors play a role in ergonomics; these include body posture and movement, environmental factors, information and operations as well as tasks and jobs. Ergonomics can contribute to the solution of a large number of social problems, such as comfort, health and safety and user performance within the environment of the system.

2.3.4.3   Training

Training is intended to provide users with an understanding of the system, which will enable them to carry out their work properly (Nicolaou, 2003)**.** Training is described as 'the way a firms builds, supplements and organises knowledge and routines around their activities and within their cultures, which can develop an organisation efficiency by improving the use of the skills of the work force' (Dodgson, 1993). Lack of user training and a failure to fully understand how the system works, is a major cause why recently implemented IS fail ((Chang, 2004); (Nicolaou, 2003)). New end-users of a high-function application system can become frustrated and confused by the errors they make in the early stages of learning (Carroll & Carrithers, 1984). Providing training and support for the end-user not only helps them develop their skills and knowledge, but it is also motivational and a building block for an organisational success. It is important for any organisation, large or small, to plan the training that their employee's require. While there can be enormous benefits, training is expensive. Training needs to target the right people, at the right time for a correct kind of person ((Kendall & Kendall, 1999); (Bradford, 2003); (Wixon et al., 1990)). Many organisations expect users to find the new system easy to learn. Since the system is presumed to be so simple, management often assume that the end-users should be able to learn it with little effort. Unfortunately, this is usually an over optimistic assumption ((Wixon et al., 1990); (Devaraj & Babu, 2004); (Carroll & Carrithers, 1984)). Every new system requires new skills either because the basic work processes have changed or because the computer system used to support the processes is different (Simonson & Sein, 2004). Training is intended to provide users with an understanding of the system, and allow users do their work effectively and efficiently (Grimes-Farrow, 1983). Organisations need to realise that training users properly into the new system not only improves the chances of success for the system, but also improves the users ability to do their job (Chang, 2004). Often there is a gap between

training employed and the training needed to work effectively with the new system. Without the proper training or support the success of the system can easily be derailed ((Chang, 2004); (Nicolaou, 2004)).

In terms of training delivery a number of generic criteria have been identified. Each particular training method should have a distinct emphasises in general training, and should be (Smith et al., 1997):

Task-centred, as opposed to system-centred so that users are able to work though tasks which are based on their own work and not on generic activities.

- *Learner-centred,* providing the user with opportunities for exploration and discovery.
- *Paced*, ideally users should be encouraged to work at their own pace, as a whole class, to achieve specific goals by a specific time.
- *Structured*, spreading the necessary training over a number of elements of training; no attempt should be made to cram all the necessary learning into one training course.
- *Assessed*, so that both learner and trainer can recognise the learning outcomes for individual participants.
- *Evaluated*, by the training provider to identify the success and failures within a particular training initiative.

An effective training program is one that, under particular conditions will provide an effective and efficient mechanism through which an identified group of users can acquire necessary skills, knowledge or attitudes at various levels. If training providers prove unable to identify accurately the nature of the training requirements for individual users, the result can leave users unable to carry out their work correctly (Smith et al., 1997). Therefore it is important for any organisation, large or small, to plan the training that its people may need. Providing adequate training for the users helps them develop their skills and knowledge, which increases user satisfaction towards the IS ((Kendall & Kendall, 1999); (Bradford, 2003); (Wixon et al., 1990)).

2.3.4.4   Support

Although training can be provided any time throughout their operational use of the IS, it is an especially important that training is carried out early in the post-implementation phase. During operational usage, training is just one element within a range of individual user support services. The other support mechanism can be classified as support materials. User support materials are an important part of the total user-system interface and often constitute the user's first encounter with a system. According to Mayhew (1992) users may form impressions of the usability of a system through reading the manual or accessing the online help or tutorial. If the manual or tutorial is easy to use, users will assume that the system itself will be easy to use. The quality of user documentation therefore can determine the perception and the actual ease of learning and use, of the system. Support materials can therefore be seen to either enhance or degrade the overall usability of the system.

Each information system is different and will require various support materials; however according to (Shneiderman, 1998), materials should include:

- Words and icons
    - Terminology (objects and actions), abbreviations, and capitalisation
    - Character set, font, font sizes, and styles (bold, italic, underline)
    - Icon, graphics, and line thickness
    - Use of colour, backgrounds, highlighting, and blinking

- Screen-layout issues
    - Menu selection, form fill-in, and dialog-box formats
    - Wording of prompts, feedback, and error messages
    - Justification, white-spaces, and margins
    - Data entry and display formats for item and list
    - Use and content of headers and footers

- Input and output devices
    - Keyboard, display, cursor control, and pointing devices
    - Audible sounds, voice feedback, touch input and other special input modes or devices
    - Response times for a variety of tasks

- Action sequences
    - Direct-manipulation clicking, dragging, dropping and gestures
    - Command syntax, and sequences
    - Programmed function keys
    - Error handling and recovery procedures

- Training
    - Online help and tutorials
    - Training and reference materials

2.3.5   Usability Testing

Several methods can be used to evaluate the usability of a product. These methods include empirical studies, heuristic analysis, cognitive walk-throughs, scenarios, simplified thinking aloud and usability-expert reviews (Nielsen, 1993; Virzi, 1997). Empirical studies are used to quantify the time and errors associated with a task. Empirical studies are generally completed in a laboratory environment, where a user is assigned a task and the time to complete the task and errors are quantified. Empirical studies often require large numbers of participants and are completed near the end of the design lifecycle (Hix and Hartson, 1993).

Heuristic analysis is a usability inspection method that requires product developers to compare the product interface to a list of usability heuristics. These heuristics, or "rules of thumb", can assist those with little usability experience in finding and avoiding usability problems (Nielsen, 1993).

A Cognitive Walk-through is a usability inspection method that helps assess the learnability of an interface. A cognitive walk-through can help to determine if there is enough information in a user interface to learn and accomplish a goal (Virzi, 1997).

Scenarios are mock-ups of situations where users are asked to complete a specific task to achieve a specific outcome, under specified circumstances, over a certain time interval. Scenarios can be used early in the development lifecycle to elicit usability information without constructing an elaborate prototype (Virzi, 1997).

The Simplified Thinking Aloud method requires users to verbalize their thoughts while using an interface to accomplish a task. The session is transcribed and a content analysis is performed to quantify usability issues (Nielsen, 1993).

A Usability-Expert Review employs usability experts to act as the user and critique the user interface. Usability experts identify issues that would cause users difficulties by using their prior usability and system experience (Virzi, 1997).

Usability inspection methods can be employed early in the product development lifecycle, or after the product is developed (Nielsen, 1993). Evaluations that occur early in the product development lifecycle are called "formative evaluations", while those that occur near the end of the development lifecycle, or after the product is developed are called "summative evaluations" (Hix and Hartson, 1993). Both types of evaluations use different data collection methods, and can be used to elicit different usability information (Nielsen, 1993).

Summative evaluations are generally empirical in nature, often evaluating the performance of a device, or comparing it with another (Nielsen, 1993). Qualitative methods such as questionnaires and rating scales are often used in conjunction with empirical methods to elicit as much information about usability as possible (Hix and Hartson, 1993). Since summative evaluations occur near, or sometimes even after the production phase of the product lifecycle, major usability concerns cannot be addressed until the next generation of the product is designed (Hix and Hartson, 1993). This position in the product lifecycle allows usability evaluators to complete a more formal usability evaluation, often using a large pool of participants. This results in a test that provides a more robust statistical analysis, however any recommendations cannot be implemented until the next product development cycle (Hix and Hartson, 1993).

2.3.6   User Centred Design

One method to ensure that a usable system is designed and implemented is to use a User Centred Design (UCD) approach. UCD is a multi-disciplinary design approach for large-scale information systems, based on the active involvement of users. This is to improve an understanding of user and user task requirements (Mao et al., 2005). UCD is an approach to design a system or product that is easy to use, and to ensure the total user experience with the large-scale information system is good. It involves two fundamental elements, these include: a multi-disciplinary team, and a set of specialised methods for acquiring user input, which is converted into the design of the system (Vredenburg et al., 2001); (Iivari & Abrahamsson, 2002). UCD is a philosophy and a process. It is a philosophy that places the person (user) at the centre; It is a process that focuses on cognitive factors, (such as perception, memory, learning, problem solving etc) as they come into play during peoples' interactions with the system (Usability.Net, 2003). The focus of UCD is centred on users and their goals and tasks (Vrendenburg et al., 2001); (Kujala & Kauppinen, 2004).

The ISO 13407 provides guidance on achieving quality by incorporating UCD activities throughout the life cycle of interactive systems. ISO 13407 describes UCD as a multi-disciplinary activity, which incorporates human factors and ergonomics knowledge and techniques. The overall objective is on enhancing effectiveness and productivity, improving human working conditions, and counteracting the possible adverse effects of use on human health, safety and performance with the system (Jokela, 2002); (Seffah & Andreevskaia, 2003); (Usability.Net, 2003). UCD prescribes that the environment where the system is to be introduced is thoroughly analysed by designers with regard to user and the organisation characteristics, goals, tasks and context (Irestig et al., 2004). UCD requires that the user be involved during the whole design phase. The process is iterative: after each important design stage, a user evaluation is performed and redesign follows. The process does not begin with a prototype, but with preliminary ideas of what the system should do, which is compared to what users are doing (Petrelli et al., 2004); (Siewiorek et al., 2001).

2.3.7   Summary

Usability is defined as 'the extent to which a product can be used by specific users to achieve specified goals with effectiveness, efficiency and ease of use'. Systems with high usability can be related with many positive effects, such as a decrease in errors and an increase in system use. These positive outcomes lead to greater productivity for the company and increased job satisfaction for the employee. Users of an IS that has low usability often get to know and use only 20 or 30 percent of the available features, this leads to high productivity slumps, loss of profits for the organisation and low user morale. Users can be broken up into three different categories. These include primary, secondary and tertiary. By classifying users into different categories can help evaluators discover user related problems that are directly affecting the work they are doing. Problems users face regarding a new IS often involved the interface, environment or the training and support provided. There are a number of different procedures organisations can carry out to ascertain the new system, such methods include: empirical studies, heuristic analysis, cognitive walk-throughs, scenarios, simplified thinking aloud, usability-expert reviews and a user-centred design approach. With each method the user is the central figure. The user is given the opportunity to express the concerns or fears they may have with the system.

The next chapter addresses all the issues relating to user dissatisfaction towards a new IS and projects a conceptual framework that can reduce the failure rate of such systems within the post-implementation phase.

CHAPTER 3   POST-IMPLEMENTATION USABILITY ISSUES

This chapter provides an introduction to the problem under investigated, motivated by the main failure issues experienced by organisations adopting an information system. The extent of this research is then presented, where the issues, research questions and methodology used to conduct the investigation are summarised. A brief overview of each chapter is then presented and represents the structure of the thesis.

3.1 Introduction

The post-implementation stage occurs after the system has been developed, the IS has gone live and is utilised by its users. This is an extremely important stage, as users can become frustrated and confused by the errors they make in the early stages of learning (Carroll and Carrithers 1984). Resent research on advanced IT deployment identifies the post-implementation phase as the critical period during which the new system becomes embedded in the host organisation (Halpin 2003). Conducting a post-implementation review on the system during this critical period can highlight usability flaws. Repairing these flaws can limit the chance of the system becoming a failure, increase job satisfaction and determine whether the implementation is actually a success or not ((Kueng 2002); (Nielsen, Coyne et al. 2001)). Job satisfaction is an imperative element in achieving user contentment with a new or existing IS. Mumford and Weir (1979) define job satisfaction as 'the attainment of a good 'fit' between what the user seeks from his/her work – job needs, expectations and aspirations – and what is required to do in the job – the organisational job requirements which mould the users experience'. Creating an IS that accomplishes job satisfaction can be extremely beneficial to both the user (employee) and to organisation. Such advantages can include a reduction in errors, a positive user attitude towards the system and an increase in the use of system. These positive outcomes can lead to greater productivity for the company and increased user satisfaction for the employee. There are a number of usability evaluations available to developers that will identify troublesome areas that can create user dissatisfaction with the system. These evaluation techniques can also establish if the users working the system are content with it, if they are able to use it and if it reliable, which can proof extremely significant in determining if the system is a success from the users perspective. Reviews should be carried out shortly after the system has been introduced. Early assessments involving users can be a useful method to determine whether the system requires any modifications. However,

despite the huge importance of the post-implementation phase, very few organisations review their system after it goes live (Krasner 2004).

3.2 Key Post-Implementation Usability Issues

An organisation should anticipate a temporary dip in performance after introducing a large-scale IS to the workforce. When an IS goes live, the process by which users do their job can dramatically change. It takes time for users to grasp new concepts and ideas brought upon them by the new system. System evaluators must not confuse this learning curve with an unusable, poorly designed IS. If this occurs the business will continue to notice a dip in performance. A post-implementation review (PIR) should be conducted to highlight any problematic areas with the IS the user is having issues with. The PIR provides the organisation with an understanding of what the IS can and cannot do, and presents a benchmark for what is to be achieved in economic, operational or organisational terms. The PIR can identify ways to improve the functionality of the IS, establish ways to assist users overcome occupational problems and increase user morale through the continuous improvement of asset created environments.

The literature in chapter 2 identifies a number of key areas that hamper the user satisfaction and ultimately the success of an IS. These issues include: a poor user interface, limited functionality, an unreliable system, ineffective training and the environment where the system is utilised. By actively involving the users in the PIR such issues can be highlighted to the developers and user satisfaction toward the system can progress. However, despite the importance of this process, past research proves that very few organisations re-evaluate their IS after it has been developed.

3.2.1   The user

A system can only be judged to be a success if its users are satisfied with the workings of the system. Therefore, the user must be the central figure in any system evaluation. By not considering their thoughts and opinions, it is impossible to ascertain a holistic evaluation of the system. The user is a crucial element in the successful acceptance of an IS within the organisation. For job satisfaction to be

successfully created within an organisation, the users approval is essential. Producing a happy, satisfied user involves developing an accurate vocation for each user within the correct environment. There are three different users categories: primary, secondary and tertiary. Primary users are the frequent hands-on users of a system. Secondary users use a system occasionally or use the system through an intermediary. Tertiary users are those who will influence its purchase or will rarely use the system. A system that is usable for one might not be for the next. A different category of user can uncover problems that a different user had not come across, therefore, it is important to use a large sample of user when evaluating or reviewing the system. Identifying users problems and issues early is essential for the system to be successful; this can be achieved by including a cross-section of end-users throughout the systems usability evaluation.

User problems can vary between the systems (functionality, interface, reliability) or external entities (training, environment). Whatever the issue, if not identified and repaired, user satisfaction can slump resulting in low productivity and high staff turnover. User satisfaction is the central factor for achieving IS success.

3.2.2   The interface

As far as the user is concerned, the interface is the product, it is the part of the system, which the user sees, hears and communicates with. An interface should provide the user with an easy and flexible interaction with the system therefore, preventing users from becoming disorientated, and assisting them carry out their working objectives effectively. Poor interface design can have the following consequences:

- Increased mistakes in data entry and system operation
- Increased user frustration;
- Poor system performance;
- System failure because of user rejection.

The design of the interface must consider the physical design of the workplace (ergonomics) and the support documentation (training and support). Since the functionality of systems is made available through its user interface, its design has a huge influence on the usability of the system. The interface must be developed

according to the needs of the users and the business, and should be designed after all the business process have been finalised. A good interface requires deep understanding of the work practices in the context of the tasks that the IS will help carry out. It is irrelevant how well engineered the software code or how sophisticated the hardware is; a bad interface can ruin an otherwise excellent system. Depending on the users experience with the interface, a computer system may succeed or fail. However, organisations dramatically underestimate the importance of user interfaces to the success of information systems, which end up tripling costs after the system has gone live.

3.2.3   Functionality

The business functionality of an IS indicates the features and capabilities the system comprises of, and can be defined as 'the requirements necessary to perform the specific tasks which the users require it to do in the operational situation'. The functionality of a large-scale IS can be categorised into two different components, these include:

- Meeting business requirements
- Meeting users requirements

Organisations need to have clear and unambiguous understanding of the business objectives before the system is designed, to ensure that the correct functionality is obtained. Failing to meet the requirements of the business can cause a great deal frustration for the people trying to work with the system. A system that is designed with limited functionality or high inconsistency can cause problems for the user and frequently is the main cause for users rejecting to use the system entirely. The IS should provide the right information to the right person, at an accurate time. If the functionality is inadequate, it does not matter how well the interface is designed, ultimately the system will create low user morale and a decrease in productivity. Creating an environment that offers the user a variety of tasks, complexity and functionality, can ultimately lead to an increase in job satisfaction for the user.

3.2.4   Reliability

The reliability of a product is defined as the measure of its ability to perform its function when required, for a specified time, in a particular environment. A reliable IS must support the needs of the user in a simple, fast and consistent way. Reliability requires that users of the system be able to input and update system information when needed and that decision makers who use the system's information be able to access the information when necessary. A reliable system must be able to protect against unauthorized access to its physical and logical components.

The reliability of an IS can be categorised into three different areas, these include:

- The systems software

- The systems hardware

- The systems communications (Networks)

A reliable system is one that is capable of operating without material error, fault, or failure during a specified period in a specified environment. If a user cannot access the system or can not display data s/he requires, it does not matter how well developed the systems is users will reject using it. For user satisfaction to be achieved IS reliability must be developed effectively.

3.2.5   Ergonomics

A large number of factors play a role in ergonomics; these include body posture and movement, environmental factors, information and operations as well as tasks and jobs. Ergonomics can contribute to the solution of a large number of social problems, such as comfort, health and safety and user performance within the environment of the system. The goals of ergonomics range from the basic aim of making work safe through increasing human efficiency, to the purpose of creating human well-being. A well-designed environment can produce improved productivity, efficiency, acceptance and contentment for the user. The aim of ergonomics is to achieve an increase in user satisfaction by making their working life secure. Despite, the importance of human safety in the workplace, organisations fail to recognise how closely it relates to their success. Users who find the environment they are working in too uncomfortable will have low job satisfaction, and will have poor productivity disregarding how easy the

IS is to use or how reliable it is. For user satisfaction to be achieved the organisation must develop a suitable environment for each user.

3.2.6   Training and Support

Providing training and support for the user not only helps them develop their skills and knowledge, but it is also motivational and a building block for an organisational success. It is important for an organisation to plan the training that their employee's require. Training needs to target the right people, at the right time for a correct kind of person. An effective training program is one that, under particular conditions will provide an effective and efficient mechanism through which an identified group of users can acquire necessary skills, knowledge or attitudes at various levels. If training providers prove unable to identify accurately the nature of the training requirements for individual users, the result can leave users unable to carry out their work correctly Although training can be provided any time throughout their operational use of the IS, it is an especially important that training is carried out early in the post-implementation phase, so users will be able to integrate the knowledge they are receiving with their work. User support materials are an important part of the interface and often constitute the user's first encounter with a system. If the manual or tutorial is easy to use, users will assume that the system itself will be easy to use. The quality of user documentation therefore can determine the perception and the actual ease of learning and use, of the system. Support materials can therefore be seen to either enhance or degrade the overall usability of the system. Many organisations expect users to find the new system easy to learn. Since the system is presumed to be so simple, management often assume that the end-users should be able to learn it with little effort. Unfortunately, this is usually an over optimistic assumption. Lack of user training and a failure to fully understand how the system works, is a major cause why recently implemented IS fail.

3.3 A Conceptual Framework for Post-Implementation Usability Issues

From the literature, we are presented with two major research issues that need to be addressed within this study. First is the lack of knowledge surrounding the post-implementation phase, which organisations frequently ignore. The second area of

concern involves the various elements that create user satisfaction with an information system. There is a growing demand for a conceptual framework that addresses user satisfaction issues throughout the post-implementation phase of the development life cycle.

A conceptual framework has been developed from the literature, identifying the most important areas of user satisfaction, which are critical to the success of an IS. This section constructs the conceptual framework that will provide a foundation for the research instrument. This framework is called the Post-Implementation Usability Synergy (PIUS) and is shown in Figure 3-1. The PIUS framework acts as a synergy. The word synergy means *working together* and occurs when a group of elements work as a team to increase performance towards a common goal. The ISO 9241 standard classifies a product to be 'usable' if it incorporates a number of elements, such as learn-ability, flexibility, satisfaction, effectiveness and robustness. When all these elements are grouped together, they create a usable synergy. The PIUS contains six different parts, but operates as one to create user satisfaction. Each element has an importance, but combining all the elements together, similar to a gestalt, would be greater than the sum of their individual effects. The PIUS framework comprises of the six major components that identify user satisfaction with an information system throughout the post-implementation phase. These components include: user interface, work practices/functionality, system reliability, support and training and ergonomics. All these components are built around the users of the system.

Figure 3-1: The Post-Implementation Usability Synergy (PIUS) Framework
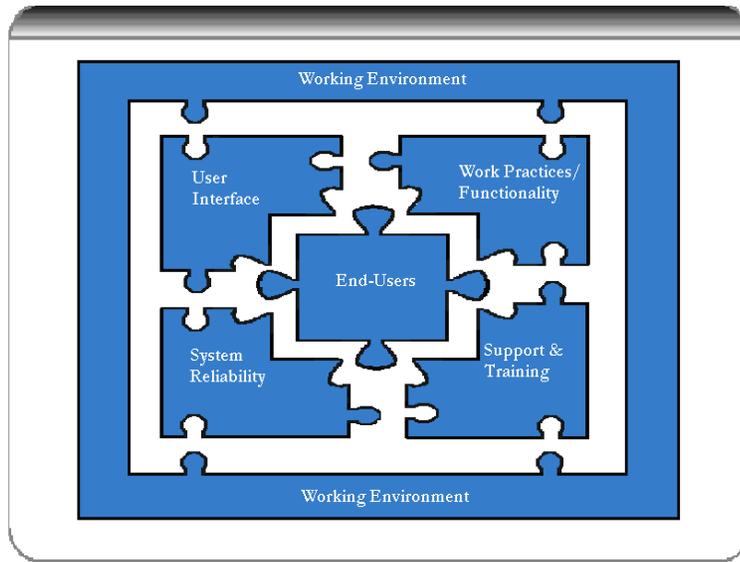
Only when each piece of a jigsaw is fitted together properly can a jigsaw be deemed finished. The PIUS framework is no different. For example, if the end-users are having difficulties working with the interface – no matter how reliable or functional the system is – the PIUS framework will not piece together entirely. Only when each component of the PIUS framework is pieced together properly can the large-scale information system achieve usability and user satisfaction will be high. The PIUS framework should be incorporated into a post-implementation evaluation of the new large-scale information system.

End-Users

The purpose of the PIUS framework is to help identify areas of user satisfaction or dissatisfaction users are having with an IS. The best way to achieve these areas is to know exactly what the user wants and needs, this can be accomplished by working closely with the user and establishing which area(s) of the system s/he is having most trouble with. The user is the person for whom the system is designed for. If the user is having difficulties with a certain part of the system, satisfaction with the system will inevitably be low. It is essential that the system is reviewed in the post-implementation phase from the users point of view, to uncover any issues with the system. By not considering the thoughts and opinions of the user in the post-implementation phase it is impossible to establish whether the system has an adequate level of reliability, interfacing, work practices, or training supplied to ensure the end-

user can work effectively and efficiently with the new system. For an organisation trying to successfully implement an IS, the user (employee) is the most important piece. If they are having difficulties with any aspect of the system user satisfaction will be low and the PIUS framework will not able to piece together properly. The synergy will be incomplete until the issue have been resolved.

Work Practices/Functionality

Since different users will have to carry out various tasks, the system needs to have the scope to allow users carry out a wide variety of jobs. A system that does not address the work practices of the business will cause users frustrated and will ultimately lead to users resisting the use of the system. If the functionality is inadequate, regardless on how well the interface is designed or how reliable the software is, eventually the system will create low user confidence. If this occurs, the PIUS framework will be incomplete and the elements will not piece together. User satisfaction will remain low until the functionality is fixed.

System Reliability

Users get very frustrated when the system fails and they have to redo any work they have already completed. A system with poor reliability can reduce a user's satisfaction dramatically, and can affect the work practices of the user. If this component of the PIUS framework is missing, the user and the work practices will be also be affected, resulting in a dissatisfied user and a poor system.

User Interface

The end-users ability to interact with the system must be made very easy. An interface should provide the user with an easy and flexible interaction with the system, thus preventing users from becoming disorientated, helping them understand the system better. Poorly designed user interfaces are unpredictable, incomprehensive, fail to provide users with a feeling of control and ultimately cause huge problems for the end-user. Ultimately, a systems interface can have a huge bearing on the training, the work practices and the user. If this component is poor or limited the overall PIUS framework will not be complete and will affect the user's ability to learn (training) and to carry out their work appropriately.

Support and Training

Effective support and training is crucial when users are being introduced to a new system. New end-users of high-function application systems can become frustrated and confused by the errors they make in the early stages of learning. Lack of end-user training and a failure to fully comprehend how the IS works, is a major reason why newly implemented systems fail. A systems support is made up of documentation, both online and physical manuals and technical support, offered by individuals who are experts in the system architecture. If the support and training component is missing the PIUS framework will be significantly be hampered. Poor support and training will have a knock on affect and can lead to an unproductive and unsatisfied user. Training should provide the user with the knowledge required to do their job, if training is inadequate the user would not be able to do their job correctly.

3.4 Summary of Research Issues

The literature suggests that large-scale IS are not ensuring user satisfaction is achieved and regularly fail to present users with a process that enables them to voice their opinions. A system that increases the workload upon the users will eventually become an unused system. End-users will not accept a system that makes their working life difficult and stressful. In order to address this post-implementation usability shortfall - one primary research questions has been identified for this study and will be discussed in the subsequent sections. This research questions includes:

Research Question: What are the elements that have most impact on user satisfaction with a large-scale information system in the post-implementation phase?

3.5 Conclusion

This chapter introduced the PIUS framework, which is anticipated, will identify key areas within the system that create user satisfaction. The PIUS framework is broken up into six elements, which include the user interface, ergonomics, work practices/functionality, system reliability and support and training. All these components are built around the end-users of the system. Each element of the PIUS framework has its own significance, but amalgamating all the elements together, would be greater than the sum of their individual effects. The PIUS framework was designed to identify areas of discontent with the new large-scale information system, from the end-users point of view. If the PIUS framework is pieced together correctly, this will ensure ultimate system usability for the users it was designed to assist. However, if the PIUS does not piece together correctly a flaw in the design of the large-scale information system has been uncovered. If the system evaluator fails to fix this flaw, it may be detrimental to the overall success of the system. By actively involving the end-users in a post-implementation evaluation, it is possible to identify business requirements and other potential usability problems that went unnoticed in the development stage.

The next chapter identifies the research methodologies that are available within the research surroundings. It establishes the most appropriate type of method to investigate this research.

CHAPTER 4   RESEARCH METHODOLOGIES

This chapter outlines the research methodology undertaken to conduct the investigation into the Information Technology/Information System (IT/IS) investment evaluation practices of three Irish organisations. Following an examination of the underlying positivist and interpretive paradigms and research methods available, an interpretive approach was selected for this research and a case study approach was used as the research method. A description of how the sample frame was selected, how the research was carried out, and a framework of the research questions are then explained.

4.1 Introduction

The purpose of this chapter is to explore the various research methodologies and philosophies that must be considered during the course of a research study. This will provide an outline of the methods undertaken in the pursuance of the objectives of this study. This chapter reviews the current methods used in Information Systems research. Following an examination into the philosophies and various research methods, a field study is proposed and justified. This research method draws upon case studies and semi-structured interviews as a means of data collection. Also discussed in this chapter is the organisation from which the research was conducted in, the design of the research instrument and the selection process for interviewing candidates. The chapter is a direct continuation from the previous two literature view chapters, where the Post-Implementation Usability Synergy (PIUS) framework was introduced. The PIUS framework is used to construct an interview guide (questionnaire) that will help assist the researcher ask the appropriate questions, and assist the researcher in gathering the appropriate data for analysis and interpretation.

4.2 Philosophical Views

Researchers approach their study by either explicit or implicit assumptions about the nature of the social world and the way in which it may be investigated (Burrell & Morgan, 1979). Research methodology refers to the approach or paradigm that underpins the research (Blaxter et al., 2001). A paradigm may be viewed as a set of basic beliefs that define the nature of the world and how to enquire it (Denzin & Lincoln, 1994). Failure to consider philosophical issues and underlying assumptions of the research methodology can affect the quality of research (Easterby-Smith, 1991). There are three main reasons why this is useful (Easterby-Smith, 1991). Firstly, it can help to clarify the research design and the overall configuration of a piece of research.

Secondly, an understanding of underlying philosophies can help the researcher recognise the most suitable research design for their project and indicate the limitations of particular approaches. Thirdly, a knowledge of these philosophies can help the researcher identify research designs that may be outside their past experience and allow the adaptation of research designs according to the constraints of different subject or knowledge structures. Careful thought should be given to the choice of research approach to take into account contextual factors. Faith plays a role in the acceptance of a particular paradigm, however well argued there is no way to establish their ultimate truthfulness (Denzin & Lincoln, 1994). In choosing the research paradigm the researcher should be aware of the weaknesses of the preferred approach as well as being able to satisfy their own epistemological preferences (Remenyi, 1998).

4.2.1 Epistemological Assumptions

Epistemology assumptions can be described as the grounds of knowledge, about how one might begin to understand the world and communicate this as knowledge to fellow human beings (Burrell & Morgan, 1979). The researchers' epistemological perspective determines what they consider as a valid, legitimate contribution to theory development or generation (Brannick & Roche, 1997). Epistemology deals with the relationship between the researcher and what can be known (Denzin & Lincoln, 1994). Epistemological assumptions determine extreme positions on the issue of whether knowledge is something that can be acquired on the one hand, or is something which has to be personally experienced on the other (Burrell & Morgan, 1979). This has lead to some division between researchers on the basis of methodological orientation, or a positivist/interpretivist split (Goulding, 1999). This split between the positivistic approach and the interpretive approach pervades the social sciences (Bernard, 2000).

Positivism

The main idea behind positivism is that the social world exists externally and that its properties should be measured through objective methods rather than subjectively through reflection, sensation and intuition (Easterby-Smith et al., 2002). Positivists believe that the world is external to them and adopt the role of independent observers

of social reality in conducting research. The positivist philosophy emphasises objectivity, repeatability, and generalisability of the research findings (Chen & Hirschheim, 2004). Positivists employ objective measurement methods to collect data in order to test theory. For example, positivists commonly use the quantitative method of surveys (Chen & Hirschheim, 2004). Criticism however has arisen for the positivist approach, from which it separates people from their social context and maintains that a researcher can remain objective throughout the process. This inflexible approach may lead to the omission of vital findings, thus reducing the validity of the research to a certain degree.

Interpretive

The terms 'interpretivism', 'anti-positivism' and 'phenomenology' routinely appear in the lexicon of research methodologies (Blaxter et al., 2001). From the interpretivist perspective, the social world is understood through the individuals directly involved in the phenomena being studied (Falconer & Mackay, 1999). The interpretive approach seeks to understand and explain why people have different experiences, rather than search for external laws and fundamental laws to explain their behaviour (Easterby-Smith, 1991). The interpretive approach implies that every event studied is a unique incident in its own right (Remenyi, 1998). Interpretivist research does not predefine dependent and independent variables, but focuses on the complexity of human sense making as the situation emerges (Myers, 1997). Interpretive studies rarely generalise the results of the study to the larger population; rather they favour using the in-depth understanding of the phenomenon to inform other situations ((Chen & Hirschheim, 2004); (Orlikowski & Baroudi, 1991)). The collection of data by interpretivists requires submersion of the researcher into a social setting, to learn how and why the interactions take place. Field studies are an appropriate method for interpreting interactions.

Philosophical Position Adopted

The present study is primarily concerned with measuring qualitative data, from a social perspective. This reflects an interpretivist, subjectivist approach to data gathering. The interpretivist paradigm is centred on a concern to understand the world as it is, and the fundamental nature of that social world at the level of subjective experiences. This philosophical position is ideally suited to the current study, as the

researcher had to examine the post-implementation activities that occurred with the introduction of a large-scale information system, and examined the components that encapsulated user satisfaction with the large-scale information system. These research objectives could not be validated through the positivist approach.

4.3 Research Methods

The central part of any research project is the collection of data and should begin with the question *"What do I want to know in this study?"* ((Robson, 2002); (Janesick, 1994)). The answer that the researcher gains from this question enables them to choose the most appropriate methodology to use within their of the research, or the 'glue' that holds the research together (Sekaran, 1992). This research will discover whether the elements of the PIUS framework, working as a synergy, result in user satisfaction for the selected information system. Therefore, the most appropriate methodology must be selected to study this particular research.

4.3.1   Qualitative Methods Verses Quantitative Methods

Researchers should avoid creating a situation whereby they either take the quantitative route for its own sake, or undertake qualitative research simply to avoid handling numerical data (Mumford, 1991). A combination of qualitative and quantitative methods is not a simple task and without critical awareness, the researcher runs the danger of conducting research studies, which are stereotyped or distorted (Garcia & Quek, 1997). This opens the debate on qualitative verses quantitative methods. As can be seen from Table 4.1, quantitative research is a research strategy that seeks to quantify the data and apply some form of statistical analysis. It consists of a deductive approach to understanding the relationship between theory and research with the theory testing being the emphasis (Bryman, 2004). In contrast, qualitative research is a research strategy that is based upon an inductive approach, where the importance is on the generation of theories.

Table 4:1: Quantitative Verses Qualitative Approaches

Qualitative approach (Interpretivist Approach)	Quantitative approach (Positivist Approach)
Human-centred approach: people's ability to think and abstract requires special consideration	Natural science model: humans are just another organism
Interpretivist	Positivist
Constructionist	Realist
No variables ruled out; internal, perceptual variables expressly considered	Emphasis on observable variables that are external to the individual; social facts
Direct, qualitative verbal reports are preferred; quantifying responses is a step removed from people's words and perceptions	Quantitative measures are preferred for their precision an amenability to mathematical analysis
Emphasis on processes: perceptions and their meanings, and how these emerge and change	Emphasis on causes and effects: what goes in, and how it comes out; inputs, outcomes
Valid data come from closeness and extended contact with research participants	Objectivity is achieved through social distance and a detached, analytical stance
The criterion for understanding is *verstehen*: understanding behaviour in context in terms meaningful to the actor	The criteria for understanding are the ability to predict, and statistically significant associations between variables
Preference for idiographic, case-study analysis	Preference for nomothetic analysis aggregated over many cases
Preference for an inductive approach: starting with observation and allowing grounded theory to emerge	Preference for a deductive approach: starting with theory and creating situations in which to test hypotheses

Source: ((Palys 1997) pp 22).

Quantitative Methods

Quantitative research is a goal orientated process in which the researcher wants to make definitive statements about relationships among variables (Brannick & Roche, 1997). Quantitative research is essentially 'data driven' in nature (Yin, 1994). The primary objective of quantitative research is to study facts, test hypotheses and identify causal relationships using mathematical and statistical approaches. The

results obtained from the selected sample population are usually generalised to the larger population (Fitzgerald, 1998b).

This type of research method includes surveys, numerical, formal methods and experiments; where statistical analysis can be applied on the evidence collected. This research method does not require people to be exposed directly to the researcher. Surveys are used in the collection of data, providing the researcher with quantitative data in a standardised format on one or more variables. Sampling can involve a small proportion of either representative or random participants. The results deriving from the population surveyed can then be generalised to give an overall view of the problem under investigation from a view of a wider audience. The quantitative approach implies that there is an objective truth existing in the outside world, which can be revealed through the use of the scientific method of measuring relationships between different variables systematically and statistically (Garcia & Quek, 1997). To achieve success in a quantitative approach it is critical that the data obtained is reliable, valid and generalise-able in its predictions of cause and effect (Garcia & Quek, 1997). Quantitative research by nature tend to be inflexible and are ineffective in the generation of a hypothesis and therefore lack forward vision (Easterby-Smith et al., 2002). This method of research fails to analyse people's attitudes and behaviour to certain actions.

Qualitative Methods

Qualitative research can be considered as being 'an umbrella term covering an array of interpretative techniques which seek to describe, decode, translate and otherwise come to terms with the meaning not the frequency, of certain more or less natural occurring phenomena in the social world' (Saunders et al., 1997). (Sarantakos, 1998) defines qualitative research as 'a number of methodological approaches based on diverse theoretical principles' and furthermore views qualitative research as describing 'reality as experienced by the respondent'. Over the last number of years there has been an increased interest in Information System research, away from technological properties and toward social and organisational issues. This change in researcher has lead to the increased use of qualitative research methods (Myers, 1997). Qualitative research methods are designed to help researchers understand people in the social and contexts, which they live in. Understanding a phenomenon

from the point of view of the participants and its particular social and institutional context is largely lost when researchers use a quantitative method (Kaplan & Maxwell, 1994). The qualitative approach is ideally suited to research areas where little is known about it (Stern, 1980). Strengths of qualitative research include realism, significance, richness, high face validity and potentially a more precise way to access causality (Miles, 1979). This approach involves the use of qualitative data such as interviews, documentation and observation to understand and explain social phenomenon (Myers, 1997). A limitation of qualitative research may be that researchers are open to misinterpretation because of the subjective biases of the people undertaking the research (Miles & Huberman, 1984). Qualitative techniques emerge from phenomenology and interpretative paradigms and emphasise a constructive approach where there is no clear-cut objective or reality. According to (Van-Maanen, 1979) the label 'qualitative method' has no precise meaning in any of the social sciences. The purpose of qualitative research is not to measure, but to provide insight through experiencing attitudes and behaviours which are dismantled, interpreted and integrated into a composite of research issue (DeRuyter & Scholl, 1998). Five qualitative traits are reflected in this type of research. Firstly, the use of small samples facilitates a greater depth of understanding within the confines of the sample (Grant et al., 2001). Secondly, qualitative samples tend to be purposive, rather than random, when compared with quantitative research (Miles & Huberman, 1984). Thirdly, sampling techniques in qualitative research are flexible, prioritising the representative nature of the results, in terms of the topic being investigated and not the research population ((Grant et al., 2001); (DeRuyter & Scholl, 1998)). Fourthly, sampling also concentrates to maximise resource parameters within which the research issue can be addressed to maximise resource usage (Grant et al., 2001). Finally, the fifth characteristic of qualitative research is that it is theory driven, generating new hypotheses ((Grant et al., 2001); (DeRuyter & Scholl, 1998)). The range of qualitative research generally employed in this methodology can include direct observation, interviews, case studies, verbal protocols and archives, designed to maximise comprehension of the research issues involves. The principal advantages of qualitative research are, firstly it is considered the best type of research for discovery, creating ideas and exploring new areas. Secondly, the methods tend to be flexible, where data collection methods can be varied as the study proceeds and also provides

rich descriptions, with a strong potential for revealing complexity (Amaratunga et al., 2002).

Combined Methods Approach

Qualitative and quantitative research have been represented as two fundamentally different paradigms though which to study the world. These paradigms act as lightening conductors to which sets of epistemological assumptions, theoretical approaches and methods are attracted and that are treated as incompatible across paradigms (Bryman, 1988). Qualitative and quantitative techniques divergence grows as time goes by, with quantitative analysis adopting ever more complex statistical techniques, with qualitative employing more and more reflexivity (Brannen, 2004). One method does not have to be chosen by the researcher to the total exclusion of the other. Both methods can be combined to help offset the inherent weaknesses associated with each paradigm (Easterby-Smith et al., 2002). Furthermore, each method can offer valuable and useful research design to aid understanding of a topic or subject. One of the most often cited advantages of combining the two methods is triangulation. Some researchers choose to 'triangulate' their approach by using a variety of methods to study the same phenomenon (Webb et al., 1966). Through using a combination of data types validity increases as the strengths of one approach can compensate for weaknesses of another approach (Marshall & Rossman, 1989). Triangulation provides richer detail facilitating elaboration or development of analysis. Valuable insights can be attained from quantitative data when qualitative evidence is introduced (Lee, 1999). This helps overcome the risk of providing a predetermined or stereotyped view of the research by supplying a fresh insight. However, there are those who urge caution in mixing methodologies. (Guba & Lincoln, 1989), argue that the internal consistency and logic of each approach diminishes the ability to mix different inquiry models and data collection strategies. This can lead to potentially disjointed results. Significant differences in the quality of the research section may arise since researchers tend to be educated in one or the other of the two research methods (Lee, 1999). (Easterby-Smith et al., 2002) advise caution when using different research methodologies during the data collection process as the use of more than one type may lead to contradictions and confusion while providing little added richness to the study. It should be noted that the method chosen should be

the one, which best achieves the research objectives. In many cases this will be either qualitative or quantitative

Research Method Adopted

Researchers have different preferences when it comes to research. Many quantitative researchers dismiss qualitative studies as giving no findings. On the other hand qualitative researchers often reject statistical and other quantitative methods as only producing shallow and misleading information because it ignores cultural values and social behaviours (Strauss & Corbin, 1994). After analysing the two available methodologies and the combined methodological approach, the researcher asserts that the use of a qualitative method would best suit this research. The qualitative method will allow the researcher test the components of the PIUS framework and achieve 'real-life' data from participants. The principal advantages of qualitative research are, firstly it is considered the best type of research for discovery, creating ideas and exploring new areas. However, the quantitative approach would only allow the researcher obtain statistical data, this would not clarify whether the PIUS framework was correct. This research is to explore and validate (or otherwise) the PIUS framework. Through this exploration, the components of the PIUS framework will be queried to establish if each piece is necessary to achieve user satisfaction with a large-scale information system within the post-implementation phase of the development life-cycle. This study will also estimate whether the framework works as a synergy. For those reasons the qualitative approach is deemed most suitable.

4.3.1 Action Research

Action research methods are rather clinical in nature, and place the researcher in a "helping-role" within the organisation that is been studied (Baskerville, 1999). The researcher takes a consultant's role for a specific duration, where usually, some form of change in the system is being introduced. The researcher interprets the situation, intervenes where appropriate, and then reviews the results of the intervention (Jonsson 1991). Action research is concerned with enlarging the stock of knowledge of the social science community. It is this aspect that distinguishes action research from applied social science, where the goal is simply to apply social scientific knowledge but not to add to the body of knowledge. The key assumptions concerning an action

researcher are twofold. Firstly, the social settings cannot be reduced for the study. Secondly, is it the assumption that action brings understanding (Baskerville, 1999). Action research is also characterised by intervention experiments that operate on problems or questions perceived by practitioners within a particular context (Argyris & Schon, 1975). There are two main arguments against the use of action research in the present study. Firstly, the researcher would be required to have an influence over the post-implementation activities within the participating organisation. This is unachievable in the current study. Secondly, given the time-scale required to carry out a longitudinal study, action research was not adapted for the present study.

4.3.2   Phenomenology

A phenomenologist is concerned with understanding group behaviours from that group's point of view. The researcher tries to suspend the theories and presuppositions that guide their investigation of the subject (Boland & Day, 1982). Phenomenology highlights the researcher's role as an active interpreter of the research subject (Boland, 1985). A phenomenological inquiry requires the researcher to go through a series of steps to try and eliminate their own assumptions and biases. The phenomenology study greatly overlaps with the ethnographic approach. Phenomenological studies require the researcher to enter the life-world of participants; this could establish whether the PIUS framework is correct, as it could indicate the elements that create a usable system. However, phenomenological studies are longitudinal in nature and are typically measured in years rather than in months. This feature makes it very difficult to conduct such a study given the timescale available for the present study.

4.3.3   Ethnography

The ethnographic research approach requires the researcher to closely observe and engage in the everyday life of cultural groups and document their personal observations and experiences in detail (Schultze, 2001). An ethnographer will try to define a particular culture and make sense of what people are doing by asking question such as '*What's going on here? How does this work? How do people do this?*' (Massey, 1998). The purpose of such a research approach is to gain an understanding of the relationships and culture variables in the society ((Myers &

Avison, 2002); (Denzin & Lincoln, 2003)). This allows the researcher to collect first-hand, key observational data about the phenomenon under study (Vidich & Lyman, 1994). Ethnography research is suitable for research projects where the phenomenon embedded in the social situation is complex and unclear and the social situation is poorly understood (Schultze, 2001). This research is concerned with establishing whether the elements of the PIUS framework are correct and identifying different usability patterns that may evolve over time. Therefore, the ethnographic approach may have suited this study. However, if such an approach were adapted, the researcher would have been required to stay at the participating organisation during the 'extended' post-implementation phase. This study focuses on a more holistic approach rather than certain individual contexts. Not only do ethnographic studies take a long time to conduct, they also take a considerable amount of time for analysis and write up the findings. Due to time restrictions this approach was not possible to conduct.

4.3.4   Field Research

Field research is a means by which current theories and their underlying assumptions can be challenged (Fahy, 1995). Field research is very useful for obtaining the richness of complex organisational settings such as Information Technology (IT) adoption within firms (Warren, 1988). It requires the researcher to process and arrange large amounts of data from multiple sites in order to answer a particular question (Miller, 1991). Various terminologies for field research include participant observation, qualitative observation, and direct observation. All of these terms refer to the circumstance of being in or around an on-going social setting, for the purpose of making a qualitative analysis of that setting ((Lofland, 1971) pp 93). A combination of both qualitative and quantitative techniques can provide the researcher with a rich source of data (Stapleton, 2001). The Information Systems area deals with human activity in a social setting, therefore, field research can help researchers understand and realise the context in which observations occur. According to (Yin, 1994) field research can be used to:
- Explain casual links in very complex areas of study.
- Describe real-life situations, including the context in which they exist.
- Evaluate what is happening within these situations

- Provide a means by which a situation can be explored where evaluation had resulted in no clear set of results.

Field research is ideally suited to the present study. Firstly, user satisfaction cannot be clearly identified from the context in which it occurs. For example, determining user satisfaction with a system implies gaining an understanding of the complex system, the work practices, and the users working it. Field research allows the researcher to examine, in detail, system usability in its natural environment. This approach will allow the researcher test the PIUS framework by adopting semi-structured interviews with the use of a questionnaire. The questionnaire will guide the researcher and enables him to probe the interviewee where necessary. This enables the researcher to obtain all the necessary information.

4.4 Data Sources

As discussed in the previous section, a field research approach has been chosen as the most appropriate research method for the present study. The following discussion examines the most suitable techniques used to gather the data for this study.

4.4.1 Case Study

The value of the case study approach is preferred when, "… 'how' or 'why' questions are being posed, the investigator has little control over events, the focus is on contemporary phenomenon within some real life context … The case study allows an investigation to retain the holistic and meaningful characteristics of real life events such as individual life-cycles, organisational and managerial processes, neighbourhood change, international relations, and the maturation of industries" (Yin, 1994). The case study is usually employed where there is a need to get at rich data, to demonstrate causality and to appreciate the 'natural' setting for the study (Wynekoop & Conger, 1991). Case study research excels at bringing us to an understanding of a complex issue and can extend experiences or add strength to what is already known through pervious research. Case studies typically consist of a combination of data collection techniques such as interviews, observation, questionnaires and document and text analysis (Yin, 1994). This approach allows the researcher to investigate

previously inaccessible phenomena and to conduct research in greater depth than in a statistically based design. The information, which is obtained, tends to be much richer and more forthcoming than many alternative methods. Table 4.2 demonstrates the usefulness of a case study approach given the present research project and the research issues that the study attempts to address (Benbasat et al., 1987).

Table 4:2: Key Characteristics of Case Studies

Characteristics of Case Study Research	This Research?
Phenomenon is examined in a natural setting	✓
One or few entities (person, group or organisation) is examined	✓
The complexity of the unit is studied intensively	✓
Case studies are more suitable for the exploration, classification and hypothesis development stage of the knowledge building process	✓
No experimental controls or manipulation are involved	✓
Case research is useful in the study of 'why' and 'how' questions because these deal with operational links to be traced over time rather than with frequency or incidence	✓
The results derived depend heavily on the integration powers of the investigator	✓

The advantages of a case study are that it provides a rich depiction of a client's experience in program input, processes and results and is a powerful means to portray the program to outside users (Curtis, 1997). Case study research is the most common qualitative method used in information systems (Orlikowski & Baroudi, 1991). (Benbasat et al., 1987) argue that the case study research method is particularly well suited to Information Systems, since the discipline often investigates information systems in their organisational settings. The main disadvantages of the case study is that, by their very nature, case studies have a limited generalisability because a small number of organisations – as opposed to the large number targeted in postal surveys – are examined (Stapleton, 2001). On top of this, case studies take a considerable amount of time to perform and it can be difficult to gain sufficient access to firms. There is a danger that the results can be misleading. Semi-structured, open-ended qualitative questions are one way of alleviating this drawback. The use of case studies

in research is now well established ((Miles & Huberman, 1984); (Yin, 1994)). Case study methods, although capable of supporting deductive reasoning, lie within the interpretative paradigm, and therefore are of particular value in situations with a relatively under-developed theoretical framework, which is ideal for this study. The case study approach has been selected for this research as it was deemed the most appropriate method based on the time frame available for the study and the exploratory nature of the research. In addition, a case study method is a well-established research method in the field of information systems (Hamilton & Ives, 1982); (Gibson et al., 1999). Case studies provide a great advantage when it comes to showing how a system works (Stapleton, 2001).

4.4.2 Personal Interviews

The primary methodological approach used in a case research is the in-depth interview process, a term which has traditionally referred to a form of non-disguised questioning in which respondents are encouraged to provide information in as unrestricted a fashion as possible (Parasuraman, 1991). Personal interviewing is based on conversation, with the emphasis on researchers asking questions and listening to the respondent's answers to discover the respondent's personal views (Mingers, 2003); (Gubrium & Holstein, 2002). Personal interviews can typically range from highly structured encounters that have a planned series of questions, to loosely structured conversations (Miller, 1991). Interviews can give additional information about the organisational setting and personal characteristics, which gives researchers more appropriate interpretations of the interview results and an understanding of the context in which the interviewee operates (Krieger, 1979). The principal advantages of personal interviews are that they permit the researcher to clarify doubt, correct ambiguous or adjust questions if necessary (Sekaran, 1992). Furthermore, through human interaction the possibility of non-responses lessen, as the interviewer can rephrase questions to aid comprehension. In addition, interviewers have the scope to adjust the aspects or language of the interview if they perceive it necessary. Personal interviews are more likely to be adopted by the following situations (Halpin, 2003):

- Where it is necessary to understand the basis of the interviewee's beliefs and perceptions.
- Where the internal logic of a situation is unclear.

- Where the researcher wishes to gain an understanding of the interviewee's world.

- Where the confidential nature of the subject means that it would not be expressed in writing.

- Where the interviewee has 'something to hide' and would be unlikely to be truthful other than in an interview situation.

Interviews can be divided up into three different categories. These include: unstructured, structured and semi-structured interviews.

Unstructured interviews are usually informal. The interviewer may begin on a certain topic and then lets the interviewee develop their own ideas, freely talking about their own beliefs. This type of method is best used when the area is new and the researcher is trying to gain an understanding on how something works (Reaves, 1992). Structured interviews are based on a set of predetermined questions. Each question is read out to the interviewee and they have to answer, there is little variation involved in the answers. However, structured interviews lack the flexibility required to probe respondents concerning issues in relation to the research area, whilst on the other hand, the unstructured interviews are seen as having little focus to the interview (Ritchie & Lewis, 2003). Given this, the researcher decided on a semi-structured approach.

Semi-structured interviews are viewed as interviews where the list of themes and questions can be mixed (with regard to whether they are open or closed ended questions) and where the questions can vary between interviews undertaken. This type of interview gives the interviewer scope and flexibility in choosing the range and style of questions asked (Saunders et al., 1997). Semi-structured or unstructured interviews are highly effective when conducting exploratory research, with interviews being most successful where empathy and trust have been achieved(Curran & Blackburn, 1994). This can be affected through utilisation of the language and terminology of the respondent, rather than that of the researcher (Carson et al., 1998).

Interview Guide (Questionnaire)

A questionnaire can be identified as 'a pre-formulated written set of questions to which respondents record their answers within rather closely defined alternatives' (Sekaran, 1992). Questionnaires are an effective data collection tool, when researchers

know exactly what is required (Sekaran, 1992). The use of questionnaires in this study was solely for the purpose of guiding the interviews. To qualify as a research questionnaire the questionnaire should be (Denzin & Lincoln, 2003):

- Designed to collect information that can be subsequently used as data for analysis. As a research tool, questionnaires do not set out to change people's attitudes or provide them with information.

- Consist of a written list of questions. The important point here is that each person who answers the particular questionnaire reads an identical set of questions.

- Gather information by asking people directly about the points concerned with the research. Questionnaires work on the premise that if you want to find out something about people and their attitudes, you simply go and ask them what it is you want to know.

The questionnaire created for this study was designed around key themes emanating from the literature reviewed. Such themes included usability, the post-implementation phase and the PIUS framework. For this study semi-structured open-end questions were used to allow the researcher gather descriptive data in the subject's own words, to observe the subjects body language whilst speaking about certain things and to gain access to more subjective information.

4.5   Designing the Research Instrument

The research instrument is a microcosm of the thesis itself, implicitly or explicitly containing the key tenets of the study ((Stapleton, 2001) pp 126). A copy of the interview guide (questionnaires) can be found in Appendix II and a copy of the second interview guide can be found in Appendix III.

4.5.1   Structure of the First Questionnaire

Each interview conducted was structured upon the interview guide questionnaire. The questionnaire was developed from the primary research issues defined at the end of chapter three. The interview guide questionnaire was organised into four sections as follows:

Section A: General Background Information

This section gathers information about the information system under investigation and the end-user participants involved in the study.

Section B: Information System Characteristics

Section B identifies the characteristics of the system and establishes both the strengths and weaknesses of the information system. This will focus upon the following areas of the information system:

- Business functionality;
- User interfaces;
- System reliability;
- Training and support.

This section will also endeavour to establish other reasons that may cause user dissatisfaction with the new information system.

Section C: Post-Implementation Evaluations

The aim of this section is to gather information on the type of post-implementation evaluation(s) that have occurred with the information system in question. This section was designed to create an understanding of the post-implementation activity within industry, establish who is involved in this process and what areas they focus upon.

Section D: Usability Activities

This section of the interview identifies how important creating an easy to use information system is to the organisation. It identifies the usability types and techniques the organisation uses to ensure that their system will certify user satisfaction, and who is involved in this process.

4.5.2   Interview Protocol

Initial contact with the primary research respondent was made by way of cover letter (see Appendix III) and researcher flyer (Appendix IV). This is a useful way of introducing both the researcher and the nature of the study being conducted (Brannick & Roche, 1997). The cover letter informed each company of the research and asked

permission for an interview. Due to the fact that the study involved information systems that had been recently installed, the timing was very important. The cover letter was used as an explanation of the importance of the respondent to the validity of the research. The researcher followed the cover letter up with an email and a telephone call, where a date and time suitable for the interviewee was established to conduct the interview.

4.5.3 Size and Nature of the Organisation Targeted

To establish whether the components of the PIUS framework were accurate with creating ultimate usability, the researcher decided that the framework would be tested within one organisation. The purpose of this was to establish if each component of the PIUS was correct, and identifying other areas that may hamper end-user satisfaction with the system. The interview guide does not directly show any aspects of the PIUS framework, it will clarify the components that create a successful information system. The study targeted an organisation that had just implemented a 'complex' information system, located in the Republic of Ireland. The organisation was a large-scale multinational firm. The profile of this organisation (excluding company name) is presented in Appendix V. This allows the reader to gain the utmost insight into the organisation under investigation, whilst conforming to the confidentiality requested by the organisation.

4.5.4 Determining the Sample

For this study, the researcher decided that the best way to establish a clear insight into the post-implementation process of a large-scale information system was to obtain a broad sample of user. The type of user varied depending on their use of the system. This will give the researcher evidence of the components that create user satisfaction with a large-scale information system from a holistic point of view. The interviewee's were two system administrators, two supervisors, one systems support [graduate], one line manager, one tester, one software developer and one receptionist.

System Administrator:

The systems administrators role typically included installing and configuring system hardware and software, establishing and managing user accounts, upgrading software and backup and recovery tasks. Within the company the administrator would spend a lot of time working with the new system and is known as a primary user.

Supervisors/ Line manager:

The supervisor/line managers were responsible of a number of people in the company. This person oversaw various working practices and ensured each employee was working to his or her full potential. The supervisor validates hour's worked by their staff and would utilise the system frequently. This type of user would be known as secondary user.

Systems support

The role of the systems support person was to troubleshoot problems users are having with several different systems in the company. Users called the support helpdesk for support and advice on problems they would be having. The support user spends a lot of time working with the new system and is known as a primary user in the company.

Tester/Software developer/Receptionist

The software developer in this company develops software for the telecommunication market. The tester checks and validates this software to ensure that it works correctly. The receptionist role in the company is to manage the front desk. These users would spend a limited time using the system, only a few minutes each month and are known as tertiary users.

4.5.5   Questioning Technique

The researcher used semi-structured open-ended questions in order to encourage respondents to develop points and express their personal views on the areas being asked, which can be seen from the interview guide questionnaire in Appendix II. A good semi-structured interview involves open-ended questions (Ritchie & Lewis, 2003). An example of an open-ended question asked in the interview is 'what are the components that create user frustration with a system'. Furthermore, by using open-

ended, semi-structured questioning techniques the researcher is actively encouraging the interviewee to talk. This indicates to the participants that their role involves opening up and talking, as opposed to giving sample answers. When conducting semi-structured interviews, the researcher must consider their approach to questioning (Saunders et al., 1997). As interviews were the only source of primary information for this research, it was critical that the questions were designed appropriately to extrapolate the necessary information. A 'funnelling approach' was also employed which involves asking more general questions at the beginning of the interview which leads to more effective research (Sekaran, 1992).

4.5.6   Testing the Interview Structure

The researcher asserted that in order to ensure the most beneficial and effective interview occurred a pilot interview was administrated. The interview process was carried out so that any problems could be identified. The researcher took corrective action based on the feedback received, so that a more valuable study could be conducted.

4.5.7   Interview Bias

When conducting any type of interview, the researcher cannot be biased and must be fully aware that the research has to be impartial (Sekaran, 1992). Bias can be described as errors or inaccuracies in the data generated from interviewing. Bias material can be obtained from the interviewer, the interviewee or situational based. The interviewer can bias the interview and subsequently the data generated from such a technique, by failing to establish a good rapport and a relationship of trust with the interviewee (Sekaran, 1992); (Denzin & Lincoln, 2000)).

Secondly, responses might be distorted or misinterpreted by the interviewer, or the interviewer may unintentionally discourage certain responses of the interviewee via facial gestures or movement. Interviewees can also bias the data in terms of giving the response they feel the interviewer would like to hear or providing the most socially acceptable answer. The interviewee may also take a dislike to the interviewer, in terms of their dress or the manner in which they ask questions, or merely fail to build

a trusting rapport with the interviewer. For such reasons, the interviewee may lie and provide false or untrue answers (Sekaran, 1992); (Denzin & Lincoln, 2000)).

Thirdly, situational factors can also bias the data. Situational bias can take three forms (Sekaran, 1992); (Denzin & Lincoln, 2000)).

- Non-participation, where there may be a significant difference between the responses generated by those who were interviewed and those who were unwilling or unable to be interviewed.

- Varying levels of trust between interviewer and interviewee, resulting in different levels of openness from the interviewee's responses.

- The physical setting of the interview itself.

4.5.8 Ethical Considerations

Before undertaking any type of research the researcher had to consider the ethical issues involved. Nowhere is this more important than when undertaking semi – or unstructured interviews. In this type of interviews the researcher has reduced control over the issues that are raised. For this case study the researcher had to give a considerable amount of thought to the psychological well-being of participants before and after each interview. The researcher also had to be prepared to deal with any sensitive issues the interview raised for the respondents. The researcher brought an 'Informed Consent Form' to each interview. Before each interview commenced, the researcher read out the details of the research and emphasised that the interviewees' participation was entirely voluntary (see Appendix VI). Each participant agreed to participate and signed the consent form.

4.5.9 Interview Schedule

The interviews were conducted in March and April of 2006. These dates were chosen, as it suited the participating organisation, with regard to its business and holiday commitments. The interviews were all conducted face-to-face. Table 4-3 shows company name, interviewee's job roles, and the duration of the first and second interviews. For the purpose of the interview participants requested that the company name not be disclosed. Therefore, from now on the company will be called 'Company A'. Details on each participating participant can be seen in Appendix VII. To validate

the findings gathered from *'Company A'*, the researcher conducted two interviews with each participant. The first interview captured the role and tasks of each interviewee and enabled the interviewer gain a valuable insight into the new system. This interview gave the interviewee a chance to get to know the researcher. Often interviewee's are reluctant to speak about certain issues until they are become familiar with the person they are talking too. Based on this, the second meeting allowed the interviewer ask more probing questions to each interviewee within Company A, and also gave an opportunity to query certain comments they had made in the first interview.

Table 4:3: Interview Schedule

Company	Interviewees' Job Title	Duration of Interview 1	Duration of Interview 2
Company A	System Administrator	1 hour	1 hour
Company A	System Administrator	1 hour 30 minutes	1 hour 30 minutes
Company A	System Support	1 hour 30 minutes	1 hour
Company A	Line Manager	2 hours 15 minutes	1 hour
Company A	Supervisor	2 hours	1 hour
Company A	Supervisor	1 hour 30 minutes	30 minutes
Company A	Tester	40 minutes	1 hour
Company A	Software Developer	1 hours	50 minutes
Company A	Receptionist	50 minutes	30 minutes

4.6   Conclusion

This chapter highlights the range of research strategies that are available to a researcher concerned with Information Systems research. From this research study the interpretive philosophical position was identified and justified. The most appropriate method was recognised as the qualitative approach. The research instrument used in this research was identified to be the case study. This was based upon the conclusions drawn on each method. This instrument is deployed in order to analyse and test the PIUS framework. The remaining chapters of this thesis present the results acquired from the use of this research instrument and draw appropriate conclusions about post-implementation issues and the PIUS framework, in light of the proposed research framework. Further avenues for future research are also discussed.

The next chapter reports the findings of the main field study and the results obtained through the case study.

CHAPTER 5 DATA ANALYSIS

This chapter reflects on the findings uncovered from the case study and the implications of this research. The objective is to present an accurate representation of the components the create user satisfaction or hinder it.

5.1 Introduction

The purpose of this chapter is to report the findings of the field research study detailed in the preceding chapter. This chapter presents an in-depth case study on a large multinational organisation located in the Republic of Ireland, which has recently implemented a large-scale information system in the past eighteen months. The case study was aided with an interview guide that can be seen in Appendix II. This study investigated the organisation's post-implementation strategy on the introduction of a large-scale information system, and how it affected different users. A total of nine users were interviewed twice to gain an understanding of their individual thoughts and attitudes on the new large-scale IS. The findings of the case study were presented under six different categories, based on the PIUS framework introduced in Chapter three. This is to establish whether the components of the PIUS work together as a synergy and understand the usability concerns different users have in the post-implementation phase of a large-scale information system.

This chapter begins with a brief overview of the participating organisation used in this case study, and the type of large-scale information system they implemented.

5.2 Background

Company A was a leading global player in the telecommunications industry. It had operations in 120 countries, and was an employer of over 56,000 people world-wide. A detailed profile on Company A can be see in Appendix V.

Prior to the introduction of the large-scale information system, each division of Company A across the world operated under their own terms and policies (a stand-alone company). To keep track of various projects and employees, each division of Company A used the Cable Public Affairs Channel (CPAC) system. The CPAC system was a web-based system working through Microsoft Windows. Each division of Company A had their own internal database. The CPAC permitted each member of

staff enter their hours with regard to a specific project, and enabled the managerial staff follow the progress of any project under construction.

Interviewee's reported in the late 1990's, Company A Headquarters decided to merge each of these stand-alone companies together via large-scale IS. Eighteen months prior to this study, Company A introduced the new IS – the Cross-Application Time Sheet (CATS) system to its workforce, affecting over 56,000 employees throughout the world. This was the third large-scale information system in five years Company A had introduced. The CATS system was built by the German company SAP and was a cross-application tool for recording working times and tasks. The system would enable the company to control all business processes, from the payment of employees, through to monitoring the progress of each project. The system facilitated project managers to identify how many hours a particular project was taking. If one project appeared to be behind schedule, the project manager could ask for more resources (e.g. employees) from different departments to help. This occurred frequently, and users were regularly working on two, if not three projects every week. Company A also used the data stored in the CATS system to interpret a payment system for project sponsors and for individual employees. Project sponsors wanted to know exactly where their money was going. The CATS system could access data globally and was able to pinpoint the exact amount of working hours an entire project had consumed with relation to specific projects. According to one interviewee, this was one of the main reasons Company A Headquarters decided upon purchasing the CATS system. The data within the CATS system was also manipulated to pay each member of staff in the company. Company A integrated the CATS system with previously installed SAP systems. These included the Controlling (CO), Project System (PS) and Time Management (PT) systems. Since 1999, these three SAP systems had been integrated throughout Company A globally. The CATS system was available through a number of different user applications. This enabled the business to tailor time recording to suit their requirements. Company A chose from three different types of user application, these included the CATS *classic*, the CATS *regular* and the CATS *notebook*, as demonstrated in Figure 5-1.

Figure 5-1: Information System Structure in Company A
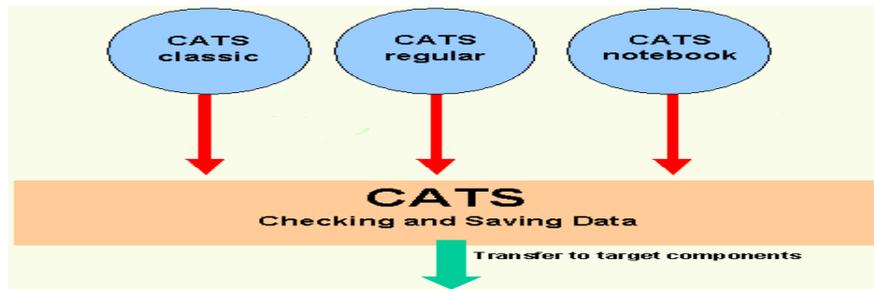
CATS Classic

The CATS *classic* was the original user application, and was the most suitable user interface for entering working times out of the three different applications.

CATS Regular

The CATS *regular* offered a similar data entry screen and comparable features to CATS *classic.* However, this user interface had been optimised for use as an Employee Self-Service (ESS) application in a Web browser. In contrast to CATS *classic,* CATS *regular* users only needed a Web browser and not a SAP GUI for Windows. This made CATS *regular* the most suitable user interface for recording working times in an Intranet or Internet environment (out of the three applications).

CATS Notebook

The CATS *notebook* enabled employees in Company A to record their working times on notebooks or laptop computers, wherever they were in the world. The laptops did not require a connection to SAP CATS database. It was aimed primarily at employees who had to travel a lot and cannot always have a connection to the company's CATS database.

5.3   The Context of the Information System

This section presents the findings of the main field study. Each finding is grouped according to the theoretical framework laid out and discussed in chapter 2 of this thesis.

5.3.1   The Post-Implementation Phase

As mentioned in Chapter two, only 12 percent of organisations considered conducting regular reviews on their implemented system after it went live. A key motive for this was that little time or resources were made available for any post-implementation reviews within industry (Kilambi et al., 1998); (Tallon et al., 2001). The emphasis and money is projected towards getting the system 'live' (Deloitte & Touche, 1999). The findings revealed that Company A was no different, and its main objective was to get the CATS system used in the quickest time possible. The company did not spend time gradually integrating the system to the workplace.

> "I have never heard of anything similar to post-implementation evaluation, not here anyway"
>
> Tester
>
> (Interview 1)

> "I don't recall any reviews"
>
> Line Manager
>
> (Interview 6)

> "To the best of my knowledge the company didn't evaluate the system, nor include any user (I know) participate in any post-implementation evaluation"
>
> Supervisor
>
> (Interview 5)

Evaluating the CATS system did not happen in any kind of structured process. A sample user was not brought into a laboratory and asked to evaluate the system (System Administrator). When the CATS system was introduced to the workforce, Company A's in-house trainers coached everyone with the CATS system. During that training period users were asked to '*mess around*' with the system, as if they were doing their own particular job or task. Trainers went around helping users with any issues or problems they might have had. One interviewee stated that through the training process users uncovered flaws or system bugs that went unnoticed in previous tests. These problems were identified and categorised depending on their priority. Problems were then sent to Company A Headquarters and they established whether the system needed to be taken offline to repair those problems.

> "Company A Headquarters does not always agree and flaws often remain uncorrected for months, or years, if ever. This is one of the biggest difficulties working within a large multinational company, things that we might feel are important might not be important to the overall structure of the business"

<div align="right">Supervisor</div>
<div align="right">(Interview 9)</div>

Errors with the system were more likely to be identified through working directly with the system. If a flaw or bug was uncovered in the system, the user was encouraged to fill out a report and forward it to Company A Headquarters. These reports were anonymous and provide an ideal opportunity for users to express their views. This report consisted of three things:

- A description of the problem,
- Who and what it affected,
- What needs to be done to resolve the problem(s)

Company A felt that empowering the users was the best way to achieve results. Everyone had a say no matter who you were or what their job title was, seven interviewees reported. Everything was done anonymously. If stronger, more outspoken people got their cases heard and more timid individuals did not, this may have lead to internal tensions.

> "If for instance, one individual is not happy with reliability and five hundred are having trouble with the interface, the interface will take priority and be analysed by headquarters to figure out why there are so many difficulties. If it is in the best interest of the company to change the interface it will be modified accordingly. Otherwise nothing will happen"

<div align="right">System Administrator</div>
<div align="right">(Interview 8)</div>

However, interviewees explained that the disadvantage of this approach was changes rarely, if ever occurred, unless it was critical to the overall success of the company globally. Due to the fact only a limited amount of flaws got attention, users often would not bother filling out reports, plus it can be very time consuming.

> "Writing up reports that are anonymous can be good and bad. Good in the sense there is no political favouritism. Bad that people who identified problems and have taken the time to write up a report on the problem don't get any recognition. I can find a lot more productive things to be doing than write up silly reports"

<div align="right">Line Manager</div>
<div align="right">(Interview 6)</div>

"Nobody has ever asked me what I thought of this or any system … I have come across a few flaws. I wrote up a report identifying one, it took me an hour to write it up, but the flaw is still there … if I found one now, I probably wouldn't bother filling a report out … there is no point it takes too long and probably won't get fixed anyway"

<div align="right">
System Developer

(Interview 2)
</div>

Five interviewees stated that since the CATS system was introduced, users had uncovered a multitude of errors. One major flaw in the system, interviewees identified, was the CATS system would not enable them to book time off. Company A notified IBM and SAP with this problem. Company A developed an in-house web-based Common Gateway Interface (CGI) system that would allow each employee book their time off and cover up the problem (System Administrator). However, this system was unable to integrate with the CATS system. This meant users had to enter the same   times and dates into the booking system and the CATS system. All problems were reported directly to Company A Headquarters, and they established whether or not it warranted immediate repair or not.

In company A, users were not asked to examine the contents of the system, or how well it was designed, instead the system went live and any problems the were uncovered users were asked to write it up on trouble reports. This finding is backed up by the literature, as early assessments involving users of the system can be a useful method to determine whether the system requires any modifications ((Palvia et al., 2001); (Nicolaou, 2004); (Yu, 2005)).

5.3.2   Functionality

As discussed earlier, organisations need to have a clear and unambiguous understanding of the business objectives before the system is designed, to ensure that the correct functionality is obtained (Holland & Light, 1999); (Rolland & Prakash, 2001). The findings revealed that Company A Headquarters needed to change internal business structures to cope with the introduction of the new system. These changes were essential if the introduction of the CATS system was going to be a success globally, interviewees revealed.

'Purchasing an "off the shelf" large-scale information system and customising it to meet the needs and requirements of a multinational company could take years. For a large-scale information system to be integrated successfully into a business, the business must change and

customise itself towards the large-scale information system. Staff became aware of these changes six months prior to the introduction of the (CATS) system, which ensured an overall understanding on what was happening and why'

<div align="right">System Administrator
(Interview 8)</div>

'A company customising a system to suit them, may as well burn their money because it is virtually impossible … the business must change to suit the system'

<div align="right">System Administrator
(Interview 7)</div>

IBM managed the CATS system for Company A worldwide, if there was a problem or if something needed to be added, changed or altered. IBM was the only party allowed to fix or change the system. Users were not permitted to change any aspect of the system, no matter what their job role. Company A encouraged users to write up a 'problem report'. A problem report allowed the user express his/her feelings towards the system. If there was a flaw with the system a problem report could be written up and sent to Company A Headquarters, anonymously. Company A Headquarters would prioritise these reports. If they felt the problem was important and must be fixed, they would send the problem report to IBM and IBM would fix the problem immediately.

'There is a few little flaws with this system, and could be fixed easily, just a matter of ticking a box within a table … unfortunately I do not have the power to do this … IBM have to come and sort it out'

<div align="right">System Administrator
(Interview 8)</div>

The literature identifies that a system that does not address the work practices of the business or fails to make their working life easier will cause users frustration and will ultimately lead to end-users resisting the use of the system ((Dennis & Wixson, 2000); (Palvia et al., 2001); (Mohamed & Fadlalla, 2005)). Company A is failing to address issues users are having, and this has caused many problems.

The department code represented which area an employee belonged to. There were a number of different departments in the company, so this was broken down further into different operations. The operation code identified different areas of development amongst the various departments. The project code identified specific projects that were under construction in Company A globally. Users had to search through an Excel spreadsheet to locate particular project codes that matched the project they were working on. Three interviewees stated that, employees would be working on two or

even three projects throughout a week period. Once all these codes matched, the user entered in the amount of hours s/he worked on a specific project. The system would only then allow the user save the information they had entered. If the user entered in incorrect data, the system would display an error message to the user, which would prevent the user from continuing. The use of codes and not names was extremely annoying and very unintuitive, five out of the nine interviewees declared.

Once CATS data fields' had been filled out correctly, the user would confirm and save. Each confirmed time sheet was sent to that particular employee's manager for them to verify. 'Regular users' (non-managerial) were not allowed to verify their own hours, this was against company policy, all nine interviewees said. The individual's manager would receive an email straight away to confirm that employee's hours, which often clogged up email accounts and caused frustrated.

> 'As part of my role here I have to verify hours my staff performs on the various projects … The CATS system makes my life difficult and irritating by bombarding me with emails, I could get thirty on some occasions. When someone fills up their time-sheet, I immediately receive an email, asking me to verify. This is so unnecessary I should just receive the one email at the end of the month, not thirty individual ones. It is just really annoying, I don't even look at the emails anymore just click confirm'
>
> Line Manager
>
> (Interview 6)

The CATS system did not deal with user names or project names, only project codes; this often caused frustration amongst users. These frustrations led to users doing a poor, incomplete job, an interviewee reported.

> 'Often, I don't even look at what they wrote … I just verify it … It is not because I am lazy, it is because the system is so annoying and so difficult to work with. I just don't want to know.
> I tick everyone's hours as quickly as possible whether or not they have to work those hours is another matter … Ahh, they're a good bunch I don't think they would do that'
>
> Supervisor
>
> (Interview 4)

Two interviewees said the CATS system contained information about employees, projects and the hours each employee spent on a particular project. Understanding and manipulating this data was vital to the success of a project. However, users had to transfer the data from the CATS system to a Microsoft Excel spreadsheet just to create a graphical representation of the data. This was very irritating and very time consuming and defeated the purpose of the system. 'The CATS system should have had this functionality'. Changes should have been made to this system, but nobody

here had the power to change anything without clearance from Company A Headquarters. Reports were sent to Company A Headquarters highlighting the dissatisfaction with the interface, but rarely changes ever occurred.

> 'Every time I need to create a report or graphical representation of a project I have to export material from the CATS system to an Excel spreadsheet or to another software application … why doesn't the CATS system have this included? It defeats the point of the system. Problems like this have been queried but nothing has been done'
>
> Line Manager
>
> (Interview 6)

> 'I have complained about the (CATS) system so many times'
>
> Supervisor
>
> (Interview 4)

> 'Overall the system does what it was intended, it could do a lot more to help out employees but a lot of the functionality is not switched on. There are a number of reasons for this such as:
>
> (1)   Would take too long to train all the users … Extra functionality means more training.
> (2)   Due to work practices in different countries/divisions it was decided by 'Company A Headquarters' to create and keep each system identical'.
>
> System Support
>
> (Interview 9)

In Company A users had to ask for time off, this was approved or disapproved by their supervisor. The CATS system had overlooked this process. However, Company A built a web-based CGI system to hide this problem. This was a web-based system that allowed users specify particular dates and times that they wished to have off (System Administrator). When an employee wanted time-off, they would have to sign into the *time-off booking system*. In this system, users enter in the hours they wish to have off. An email would be sent to their supervisor and he/she decided whether or not to grant permission for the time off. This system worked well, however it was not linked with the CATS system at all. This meant users had to enter in certain hours twice. If the user forgot to enter in those specific dates in the CATS system s/he would not get paid, or if a user forgot to enter in the dates s/he wanted off in the booking system, s/he would not get the time off.

> 'The system doesn't allow for time-off. I have to go into another system, which is an internal web-based booking system. Here I enter in the dates and times I wish to have off and an email is then sent to my supervisor, he then approves it. But there is no link from this system to the

CATS. This means I then have to enter in the same times and dates in CATS … This undermines the point and purpose of the system'

System Developer

(Interview 2)

'Users frequently forget that there is no link between the two systems and end up only entering times for the hours they worked and not the hours they had time off, this results in a reduced salary at the end of the month … people get very angry if they haven't got their salary … It can be very upsetting for the employees'.

System Administrator

(Interview 7)

All interviewees agreed that the integration of the CATS system and the time-off system together would have created a better, and a more adequate system. This would have resulted in the elimination of double entry users had to endure and ultimately a decrease in user frustration.

'Double entry is very annoying'

Supervisor

(Interview 4)

The literature backs up these findings, a system that does not address the work practices of the business will cause users frustration ((Dennis & Wixson, 2000); (Palvia et al., 2001); (Mohamed & Fadlalla, 2005)). Users will become reluctant to use a system that fails to meet their needs and makes their working life difficult (Calisir & Calisir, 2003); (Palvia et al., 2001); (Mohamed & Fadlalla, 2005). The literature warns that there is a real risk in problems regarding functionality, as often small problems accumulate to quite large and serious difficulties in the future (Halpin, 2003); (Stair, 1996). The CATS system is failing to provide users with a system that equals their requirements hence users are not carrying out their work effectively.

5.3.3 Reliability

Numerous interviewee's within Company A reported that reliability is a serious issue, it was reported that Company A Ireland required more electricity than a large sized town. To maintain a constant flow of electricity and power, they have two large electrical cables underground running directly from the Electricity Supply Board (ESB) in Dublin (Ireland) and these two cables are only for Company A Ireland.

To ensure a power failure did not interrupt the reliability of any system, Company A purchased three large diesel generators. These motors ran continually to ensure constant electricity was flowing into the building. The running of these diesel machines was very expensive, but maintaining a constant high level of performance was critical. Figure 5-2 shows one of the three diesel generators that were running in Company A. The electrical generators found in Company A ensure that loss of power will not disrupt any employee, and therefore preserving a stable flow of electrical energy.

Figure 5-2: Electrical Generator in Company A
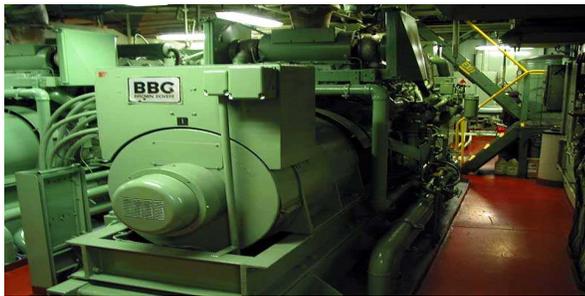
While electrical reliability was sustained by three generators data reliability was overlooked and left unprotected by various users. Section 5.3.2 highlights users dissatisfaction with the CATS system; two interviewees explained that the system was 'annoying', 'difficult' and 'irritating', resulting in hours been validated with been initially checked.

> 'I tick everyone's hours as quickly as possible whether or not they have to work those hours is another matter … Ahh, they're a good bunch I don't think they would do that'
>
> Supervisor
>
> (Interview 4)

> 'It is just really annoying, I don't even look at the emails anymore just click confirm'
>
> Line Manager
>
> (Interview 6)

The CATS system was designed to increase data reliability, however, it is doing the opposite. Managerial users are finding the system so difficult to use they are not carrying out their work correctly, which is having a negative affect on organisational procedures. The data reliability in some cases is untrustworthy and is representing

data that is incorrect and misleading. Some users are been paid for hours they did not actually carry out.

Prior to the CATS system going live Company A Ireland had an internal system, called Cable Public Affairs Channel (CPAC).

> 'This was a web-based system with an easy to use front-end. However, the reliability of the system was poor and it regularly 'crashed' or 'froze'. This caused a lot of frustration amongst the employees. The CATS system reliability is not an issue'
>
> Tester
>
> (Interview 1)

Software reliability issues are a huge problem, not only with the CATS system but also with a number of systems in Company A, one interviewee reported.

> 'There is only one software problem associated with the CATS system that I am aware of. Unfortunately, the CATS system cannot be connected to the time-off system. This is our in-house system build because CATS overlooked this facility. This time-off system allows users to enter in the times and dates they wish to have off. However, this system was not connected to the CATS system, which meant users have to enter in certain hours twice'
>
> System Developer
>
> (Interview 2)

The system administrator stated that the CATS system was similar to the other two SAP systems, and rarely, if ever, 'crashed' compared to the CPAC system. CPAC had an easy-to-use front-end; however, the reliability was extremely poor and often caused frustration. One interviewee said that if the system was slow or unreliable users would become frustrated and less likely to do the job right, forcing users to do their job quickly and carelessly. The CATS systems' reliability was exceptional and rarely caused user frustration.

> 'The administrators are usually well organised, if for instance, the CATS system required maintenance and users would not be able to access the system for a period of time, an email could be sent to all staff making them aware that the system was going to be offline. This reduces frustration enormously and limits the possibilities of users losing data'
>
> Tester
>
> (Interview 1)

> 'The systems' reliability is an essential component of a system's success. Fortunately for me (system administrator) the CATS reliability doesn't cause too much trouble compared to other systems within the company. Users can get very upset when a system crashes and they lose information, therefore having a system that has high reliability is a necessity'
>
> System Administrator
>
> (Interview 7)

'For this company the system is built around telecommunications and the one thing they want is 100% availability and reliability. If the reliability is 99.5% - this could be translated to 10 hours out per year. If this figure reduced to 50%, the system would be a nightmare … changes would have be made or the system might wipe out the company entirely'.

<div align="right">
System Developer

(Interview 2)
</div>

The literature backs these findings and stated that users got very frustrated when the system fails and they have to redo work they have already completed (Ardito et al., 2004). The importance of reliability for the success of a large-scale IS is indisputable. Users, who must wait for results of their input will not be happy and will lead to end-user resistance towards the system and a huge drop in productivity (Krasner, 2004). The findings reveal that users become unwilling to use a system that is difficult, irritating or annoying to use and often only carry out the 'basics' to get the job done. In Company A this having a huge bearing on the organisational procedures and rendering the system pointless. Company A has identified how significant reliability is by replacing the old time keeping system (CPAC) which constantly 'crashed' leaving the user irritated. The CATS system resolved the reliability issue and users had never reported the system failing. Company A Ireland had over 3,000 computing machines supplied by IBM. These machines were constantly upgraded, so hardware problems do not seem to be a major issue in Company A, one interviewee reported.

5.3.4   The Interface

The CATS system was used for basic time keeping, and enabled users to input the hours they worked with reference to specific projects that were currently being in operation in the company, interviewees reported. Users would click into the CATS system by an icon displayed on each user's desktop. They initially saw a login screen as shown in Figure 5.3. Here users had to enter in their personal *user identification* and their *password* to gain access to the CATS system.

Figure 5-3: CATS Login Screen
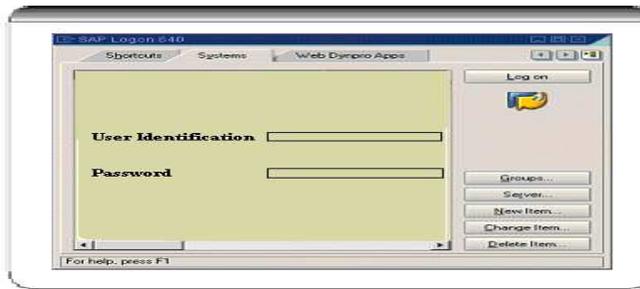
Once logged into the CATS system users were confronted with a web-like interface, and was set a default, which meant every member of staff viewed the same screen. Figure 5-4 demonstrates the default time-sheet screen that each member of Company A had displayed to them.

Figure 5-4: CATS Default Interface
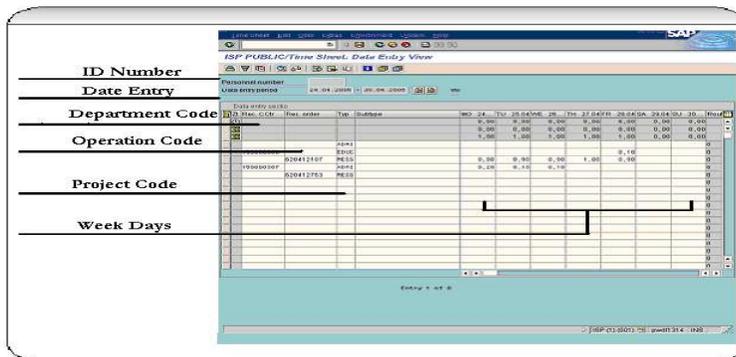
Eight interviewees explained that users who worked with CATS system initially saw their *Identification Number* and the *Date*. This was located on the top of the screen. Below that, viewers saw a grey, spreadsheet-like screen. This area was designed for users to enter in their *Department Code*, *Operation Code*, *Project Code* and hours worked for specific *Week Days*. The department code represented which department an employee belonged to. There were a number of different departments in the company, so this was broken down further into different operations. The operation code identified different areas of development amongst the various departments. The project code identified specific projects that were under construction in Company A globally. Each user had to enter in these codes to continue to the *Employee Hours* section. Once these fields were entered in correctly, users had to enter in the hours they had worked on their specific projects. The CATS system allowed certain users do their job easily and quickly, without having to go through different windows.

'There isn't hundreds of different windows you have to go through to fill in the time sheet, just one … the average user shouldn't have any problem with this system'

<div align="right">System Administrator</div>
<div align="right">(Interview 8)</div>

This coincided with the literature as minimising the number of windows a user goes through to complete a job or making the system easy to navigate through, will prevent frustration and therefore create a happier more effective and efficient user ((Shneiderman, 1998); (Ardito et al., 2004); (Calisir & Calisir, 2003); (Keirnan et al., 2002)). One interviewee explained that although there was only a limited amount of training supplied, the interface was quite easy to interpret and understand. With the CATS system users only have to enter in a few codes and the hours worked. Essentially, if a user knew their codes and the hours they worked, there should be no problem working with the CATS system.

'It is really straightforward, as long as you know your codes.

Basically, all I do is get last week's form and copy paste the fields in, if there is a change in the hours I did on a certain day I would modify the hours and leave the rest'

<div align="right">Software Developer</div>
<div align="right">(Interview 2)</div>

'The interface is easy enough to understand, you basically enter in your three codes, your hours and click submit, it's simple'

<div align="right">Tester</div>
<div align="right">(Interview 1)</div>

The literature identifies systems with usable interfaces are associated with many positive outcomes, such as a reduction in errors, a positive user attitude towards the system and increased system use, therefore gaining greater productivity for the company (Fruhling et al., 2005). Systems with high usability have 'natural' interfaces, are easy to learn, easy to use and reduce annoyance for users ((Hix & Hartson, 1993); (Fruhling et al., 2005); (Greene & Finnegan, 2004); (Shang & Seddon, 2000)). The literature states that a reducion in the number of windows a user must navigate through, can limit frustration and therefore create a happier more effective, and competent user ((Shneiderman, 1998); (Ardito et al., 2004); (Calisir & Calisir, 2003); (Keirnan et al., 2002)).

Interviewees reported how the interface initially gave the impression of a well-structured system with a clear interface, however the more in-depth users working with the system felt it was very difficult to use. The CATS system dealt almost entirely with numbers and codes. If the user (supervisor or line manager) selected

fifteen users from the system, the system would output fifteen numbers. These numbers can be manipulated, but it takes a lot more effort than it should.

'This system is not visual at all, I think it's designed for a database manager I'm not a database manager! Images, names and faces are thing people can identify with, not numbers. Come on we're not computers. All the reports come from a list of numbers, you can collate them, but it takes more effort … I have a notebook with what the numbers represent which takes away from the systems purpose. Presentation is critical and this is something the (CATS) system lacks … The front-end is horrible … I think there is a whole level of abstraction missing … They should have abstracted higher … if the interface was just a little clearer it would make my work a lot easier. When I have to verify 20 or 30 different employee details and half of them are working on different projects. All the codes, just makes verifying them a lot harder, therefore I end up verifying them all, whether or not the codes or hours are correct'.

Line Manager

(Interview 6)

'This system (CATS) works mainly off numbers, it is very unintuitive … the CATS system should be easy for all kinds of user to work with. I understand the purpose of the codes, however it would be just as easy to use a name with 2/3 numbers on the end. Everything would be still kept unique'.

Supervisor

(Interview 5)

'The system (CATS) is awful … It's all numbers, no names … It is so easy to get stuck and there is no way of getting out of or going back to the previous page. All you end up doing is switching off the bloody thing … the interface leaves a lot to be desired; you wouldn't expect such an awkward, unintuitive interface this day and age. The CATS system does not enable users to understand what's going on straight away. To understand what projects are currently in operation, you need a document explaining all the codes. And even then you don't properly understand what's going on … it's a nightmare of a system'

Supervisor

(Interview 4)

The research findings uncovered that three out of the nine interviewees described the user interface was 'unintuitive' and 'horrible'. The findings revealed that these interviewees used the system to validate hours and create reports from the amount of hours specific projects were consuming. The CATS system included no names, or icons that users could relate too, only long encrypted codes. This caused a lot of frustration amongst users. Users felt the system had a level of abstraction missing, and

was over complicated for the job it was supposed to do. The CATS system did not have any kind of navigation tool that might enable users to go through the system with ease. These findings were backed up by the literature. Poorly designed interfaces are unpredictable, incomprehensible, and fail to provide users with a feeling of control, which will ultimately cause huge problems for the user (Plummer, 2001); (Palvia et al., 2001); (Mohamed & Fadlalla, 2005). An interface should be easy to use and provide simple and consistent access for the user (Smith et al., 1997). Two thirds of the interviewees however, felt the system was 'easy on the eye' and users were reported saying they liked the CATS system. These users often had only to enter in their hours and rarely did anything else with the CATS system. A number of these users said they rarely even enter in their hours, as the CATS system allows them to copy/paste hours and codes from previous weeks. The literature states that different users of large-scale information system will have different issues, so therefore the system must structure and arrange the data to fit the information needs of different users (Steenis, 1990). Users will become reluctant to use a system that fails to meet their needs and makes their working life difficult ((Calisir & Calisir, 2003); (Palvia et al., 2001); (Mohamed & Fadlalla, 2005)). An interface should be designed such that, it minimises learning times, increases eventual speed of operation (productivity), decreases error rates and that it is superior to both the client's existing system and competing products (Raskin, 2000).

5.3.5 Ergonomics

The office environment in Company A varied depending on the employee role. Employees, such as middle and senior management had an enclosed office space with their own desk and cabinet. Figure 5-5 demonstrates a typical office used by a line manager or supervisor in Company A.

Figure-5-5: A Supervisors Office

One interviewee mentioned that although the office space could be a lot bigger, nevertheless this type of office allowed employees shut out external noises and distractions. An interviewee said there were no windows in a lot of the offices here, which caused a certain amount of problems. Employees often felt 'boxed in' and claustrophobic; the lighting was also a big issue. Artificial light was the only source of light available; this was distressing and uncomfortable for many employees.

> 'The only thing I wish I had in this office is a window, it's actually depressing … everyday, no matter how bright or dull it is outside, the light goes on. If I switched off the light and closed the door it would be pitch black in here, like a broom cupboard … a window could be a nice distraction too'

<div align="right">Supervisor</div>
<div align="right">(Interview 4)</div>

Other employees (non-managerial) in Company A, had open-planned offices that are separated by partitions. A picture of Company A's workplace is shown in Figure 5-6.

Figure 5-6: The Office Layout

These open-planned offices were categorised into various departments, for instance all market researchers were located in one area, while software developers were located in another. Working in an open-planned environment caused countless problems, such as: lack of privacy, limited amounts of space, constant disruptions, continuous noise and a variation of temperature control, interviewees reported.

> 'I work in an open-plan office with 22 other people. It's great having people around, however during office times it is never quiet. There is never any space and it's always really warm. … If it wasn't so noisy you could fall asleep'

<div align="right">System Support</div>
<div align="right">(Interview 9)</div>

'The size of my desk is tiny, how am I supposed to be able to work properly here? Employees should be provided with a certain amount of space, peace and quiet and knowledge. These things allow employees do a job properly'

<div align="right">System Developer</div>
<div align="right">(Interview 2)</div>

One interviewee stated that initially these offices were designed for twenty people, which included desks, cabinet space and just enough space for each employee to move around in. However, since that time, two more employees, including desks and multiple cabinets moved in. The result of this led to each person barely having the minimum space allowed. Some parts of the office were hazardous to walk around, without bumping into a desk or falling over books. There were a number of stationary boxes stored on top of cabinets, which is highly dangerous and could result in someone getting hurt.

'It's like a mine field in here now – there's no room to do anything let alone work'

<div align="right">Tester</div>
<div align="right">(Interview 1)</div>

'An employee's safety should be the most important thing to an company, obliviously not here … they should build another extension, not have everything just shoved in here together … these are far from ideal working conditions'

<div align="right">Software Developer</div>
<div align="right">(Interview 2)</div>

Findings from this research identified the working environment as a critical aspect to the success of a large-scale information system. The research findings revealed that the place where users carry out their work could directly relate to a user satisfaction with the system and the work they are doing. This coincides with the literature, users who find the environment they are working in too uncomfortable or aggravating will have low job satisfaction, and poor productivity. This is regardless of how easy the actual system is (Palvia et al., 2001); (Mohamed & Fadlalla, 2005). In Company A users are segregated depending upon their job role. The research discovered that supervisory staff had their own office space, although it was small interviewees stated, it enabled them to shut out external noises. None of these offices had any source of natural light or air, which annoyed employees a lot. Other staff in Company A had to perform their work in an open planned office, where each employee was separated by a light partition, which caused numerous problems. One interviewee identified that books were stored everywhere, and eventually someone is going to get

hurt. Creating a working environment that is safe for each employee should be a company's number one objective. This is not the case in Company A, an interviewee claimed.

5.3.6   Training and Support

Interviewees reported that just under eighteen months ago (prior to this study) the CATS system was introduced. The company's in-house trainers educated members of staff on the new system. In the training process, users were asked to '*mess around*' with the system, as if they were doing their own particular job, while the trainers went around helping users with any issues or problems they faced. Figure 5-7 shows the training room inside Company A.

Figure 5-7: The Training Room

Interviewees believed through the training process problems were likely to be uncovered that went unnoticed in previous tests. Training times vary quite considerably depending on the user's job specification. One interviewee explained when the system was introduced to the workplace initially training lasted just over an hour. Everything was explained and the system seemed really easy to use. However, when the CATS system had to be used 'for-real' everything was forgotten. The CATS system provided an online help function that was supposed to help users manage the CATS system and aid the users working life with the system. However, this is not the case; online help is very poor, according to six of the nine interviewees.

> 'When we were taught how to use the CATS system everything seemed easy, but once you start using the system yourself it is not as easy as they made it out to be. You end up calling the local support for help. Then wait a period of time – Puff – you cannot remember … you

> end up calling the support for help again … The online help is a waste of time, I don't even bother with it any more'

<div align="right">Supervisor</div>
<div align="right">(Interview 4)</div>

> 'Refresher courses should be available to those who need them, that's all I need, just to be shown again. For those who need an extra hand it would be very beneficial to get it and would reduce annoyance with the system'

<div align="right">Line Manager</div>
<div align="right">(Interview 6)</div>

The literature stated that a lack of end-user training and a failure to fully understand how the system works, is a major reason why newly implemented systems fail ((Chang, 2004); (Nicolaou, 2003)). New end-users of a high-function application system can become frustrated and confused by the errors they make in the early stages of learning (Carroll & Carrithers, 1984).

With the CATS system users rarely attempt to manipulate data for a report or a graph, it was too difficult, an interviewee stated. Users regularly relied on the knowledge of the system administrator for guidance and not the local support employed for this specific task.

> 'The online help function is so complicated, I have written up my own notes to help me use the system. When I have a problem I go through these notes, trying desperately to solve the problem…Local support is useless too, everybody thinks this … everyone finds it difficult to use … refresher training courses should be supplied to help users get the most from the system'

<div align="right">Line Manager</div>
<div align="right">(Interview 6)</div>

The literature states a system with a poor user guidance scheme will reduce the learnability of the system as well as increase the mental workload of the users, since extra effort will be needed for the users to carry out their tasks (Calisir & Calisir, 2003).

One interviewee said company A Ireland had a technical support team that helped users with any problems or queries they may have with the systems. The technical support team consisted of 4 employees and dealt with calls from both Ireland and Great Britain. Interviewees said the CATS system provided a *help function* that assisted users with any problems they may face while working with the system. This was an in-depth function that aided users navigate through the CATS system and

helped them enhance their work. If anyone was having a problem either accessing or understanding the CATS system they also had the facility to call on the local support, which was located within the building. This support helped users with a wide range of issues concerning CATS system and other systems.

> 'Quite regularly I have the same people ringing me up with various little problems. These people would be moderate users to the system, but just can't understand or don't want to understand how the system works. Calling on me is just the easy option. By accessing the help functions in most cases could resolve these problems'

> System Support

> (Interview 8)

The above excerpts highlight the issues regarding user support within Company A. the findings state that this support team was not good enough and often users would prefer to reboot the entire system and try to fix the problem, rather than contacting this support team. Interviewees explained that the technical support team's main function was to provide forgotten passwords to users, both in Ireland and in the United Kingdom. The literature states new users of a high-function application system can become frustrated and confused by the errors they make in the early stages of learning (Carroll & Carrithers, 1984). Providing training and support for the user not only helps them develop their skills and knowledge, but it is also motivational and a building block for an organisational success. This is not happening in company A. Training and support was limited and inadequate with reference to the CATS system in Company A. Users who came across problems had to figure their own way out, neither the online help or technical support was good enough, the findings reported.

5.4   Implications of the Findings

Given the research findings, one of the major limitations of the theoretical framework lay in the design. The findings identified each element of the PIUS framework worked as a synergy; if one piece of the jigsaw was overlooked the entire puzzle was incomplete. However, the PIUS framework did not accurately reflect the distress one unfinished piece would have on user satisfaction. A new revised framework is proposed which replaces the jigsaw with a domino effect that clearly identifies the cause of user dissatisfaction.

5.4.1 A revised Framework

After conducting the case study the PIUS framework will need to be altered. This will include a change in the PIUS framework structure.

5.4.2 Dimensions of Revised Framework

Similar to the theoretical framework presented in chapter 3, the figure below presents the six dimensions of the proposed framework. A domino represents each dimension.

Reliability and the User

If the system does not perform as expected, it will cause problems for the person who is trying to carry out their work. An unreliable product or IS can cause countless problems for the user, and can ultimately lead to poor user satisfaction (Briand & Wust, 2002). The findings obtained from this research study validated the literature. In Company A the CPAC system used prior to the CATS system was so unreliable users wrote out their hours by hand and gave the hours directly to their supervisor to validate, then went to HR and gave them the approved hours. This rendered the CPAC pointless. Having an unreliable system, caused huge problems for the user in Company A, and eventually led to an extreme low in user satisfaction with the system. Poor reliability affected the process, which users carried out their tasks this then affected user satisfaction with the system. Poor data reliability can be seen when employees fail to carry out their work correctly, which led to failed organisational procedures, a huge cost to the company and is ultimately leading to a pointless system. It is critical that the system be manageable to the extent users can do their work properly.

Functionality and the User

The findings obtained from this research study showed that by creating a system that does not address the needs of the user, will cause frustration. The CATS system did not enable users to book their time off. Company A had to develop another system to allow for this process to occur. However, this system was not connected to the CATS system, which meant users had to input the same data twice. This double entry caused countless problems, as users often forgot about the extra task, which resulted in users not getting their full payment. The literature backed up these findings and stated that a

system with inadequate functionality frustrates the user and are more often rejected or under utilised (Nicolaou, 2004). If the functionality was inadequate, it did not matter how well the human interface was designed users will become frustrated.

Training, Support and the User

The findings revealed a number of users who were unhappy with the level of training and support that was provided. These same users were also unable to carry out their work properly. Three interviewees stated that they were not trained at all, and two other interviewees stated that the overall level of training was so inadequate that they could not carry out their work correctly. The literature coincided with these findings and stated that users with poor training often only get to know and use only 20 – 30 percent of the available features ((Ardito et al., 2004); (Calisir & Calisir, 2003); (Goodwin, 1987); (Ardito et al., 2004)). Failing to understand the system capabilities lead to high productivity slumps, huge loss of profits for the organisation and thus, low user morale. Poor support and training leads to a reduced possibility of the user been able to conduct their work, which has a knock on affect on the user and ultimately leads to user dissatisfaction ((Mahadevan, 2001); (Nielsen & Coyle, 2001)). According to the literature providing training and support for the end-user not only helps them develop their skills and knowledge, but it is also motivational and a building block for the user, which ultimately leads to user satisfaction ((Kendall & Kendall, 1999); (Bradford, 2003); (Wixon et al., 1990)).

Environment and the User

One main finding, which was identified from this research study, was how the working environment played such an important role in the way users carried out their work: this ultimately led to user satisfaction. The findings identified a user's ability to carry out their work with the system was built upon how well the working environment suited their basic requirements. These requirements, the findings uncovered, consisted of fresh air, natural lighting, space (both around the system, such as a desk and around the user, such as the office), and a minimal level of noise. If these requirements were met adequately, the participating interviewees agreed their ability to work sufficiently would increase.

Interface and the User

The literature stated that the interface defines how the users directly interact with the IS and should enable them to see and change data in the system easily and effectively (Lauesen, 2005); (Shneiderman, 1998). As far as the user is concerned, the interface is the product, thus the interface should hide any complexity and ambiguity (Raskin, 2000). The findings revealed that the CATS interface left a lot to be desired, and was based solely on numbers and codes. These codes had caused so much frustration that some users did not want to use the system at all. When these users did use the system they did not carry out their tasks correctly. The findings discovered that the CATS user interface caused problems for the user, which had a knock-on affect that affected not just the user interface, but also the work practices. This ultimately led to under-utilisation of the system.

5.4.3   The Conceptualisation Framework Revised

The revised framework presented in Figure 6-3 illustrates the six different components required to enhance user satisfaction with the large-scale IS.

Figure 5.8: Revised PIUS framework
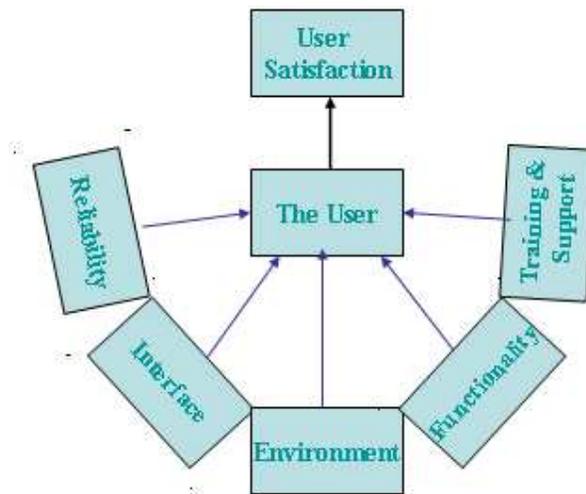
These six different components are broken up into three categories, the system, the user and user satisfaction. The system category includes: Environment, User Interface, Work Practices/Functionality, System Reliability, and Support and Training. To

create user satisfaction towards the system it is imperative that each of these pieces is presented well in the system. The interface must be easy on the eye, the system must have the correct functionality for the user to work correctly with, the system reliability must be high and the training must be adequate. For this theoretical framework each component is represented as a domino.

The user category is made up of one domino this is the user. The User is the key to ensuring user satisfaction, these are the individuals who are working directly with the system and can identify whether the system is satisfying them as they work.

Finally the last category is the user satisfaction domino. The findings revealed that the success of an IS depends on how high user satisfaction is when users are working with the system. User satisfaction depends exclusively on the user and how satisfied they are. If for instance the interface is poor, this can have a domino effect that results in user satisfaction to be low. A domino effect refers to a small change, which will cause a knock-on affect nearby. Using the same example above, a problematic interface causes problems with the system therefore causes problems for the user, which in turn creates user dissatisfaction. By repairing the user interface for the needs of the user, the domino effect will not occur and the user satisfaction will remain high.

5.5 Conclusion

The focus of this research was to identify the elements that have most impact on user satisfaction when a large-scale information system is introduced to the workplace. An in-depth investigation using semi-structured interviews was used to discover what elements users felt were critical to the success of a new system.

The findings expose that user satisfaction can only be achieved when the system is reliable, functional, easy to learn (through training or support), easy to use (interface) and encapsulated in an environment that can sustain a pleasant working atmosphere. The findings reveal that each element has a huge bearing on the satisfaction of the system. If one of these elements is causing irritation amongst the users of the system, user satisfaction will be low. When a system is been utilised by people who are frustrated with it, productivity can be hampered. The findings uncovered certain users who found the system 'difficult' to use, failed to fulfil the organisational procedures by not validating users inputs. The findings also shed light on the lack basic working conditions in Company A, each interviewee expressed dissatisfaction toward the noise

levels, space and safety conditions. A user who feels unsafe or uncomfortable in their environment will be unproductive, regardless of how well the system is to use. By ignoring these issues the system is becoming unreliable and futile. Addressing the concerns users are having can lead to an increase in productivity and satisfaction.

The next chapter explores possible enhancements to the PIUS framework and future work that can be achieved with this framework. The next chapter also concludes the research study.

CHAPTER 6   CONCLUSION

This chapter initially provides an overview of the research, highlighting the main problem area investigated in this thesis through the research question. A summary of the theoretical and practical contributions of this research that arise from the research question is presented, followed by the limitations and suggestions for future research.

6.1 Introduction

Chapter five presented and interpreted the results of the field research. This chapter discusses the significance of the findings and evaluates the usefulness of the proposed theoretical framework. The main findings of the study are reviewed and a number of limitations are discussed before recommending various avenues to perfect the framework, whilst improving the knowledge of user satisfaction with an IS.

6.2 Theoretical Framework and its Use

The theoretical framework introduced in chapter three was a six-piece synergy that visually appeared as a jigsaw puzzle. There was one external piece that surrounded the jigsaw-this was the *Working Environment*. Inside that there were four inner pieces, which included *User Interface*, *Work Practices/Functionality*, *Working Environment, System Reliability*, and *Support and Training*. These pieces surrounded one internal piece, which was the *End-User*. The exploratory research validated a large proportion of the framework. However, according to the findings, the theoretical framework overlooked the consequences each piece had on user satisfaction. To reflect this the theoretical framework was revised in chapter five.

The theoretical framework brought together six major aspects that create user satisfaction with a new large-scale IS. The framework was represented as a domino set that worked as a synergy. By knocking one domino, the user was directly affected and the user satisfaction of the system. The framework displayed five dominos lined up in a semi-circle, this included *Working Environment*, *User Interface*, *Work Practices/Functionality*, *Working Environment, System Reliability*, and *Support & Training*. Inside this semi-circle laid the *User* domino. The user domino was directly in front of each of the five pieces and had user satisfaction directly behind it. If one of the dominos were knocked it would have a knock-on affect which would result in user dissatisfaction. However, it is envisaged that the framework will require several

revisions. Further exploratory testing is necessary before the framework approaches a final stage, possibly by means of a PhD study.

6.3 Review of the Findings

The findings that emerged from this research study indicate that usability comprised of a number of factors that work in collaboration to create user satisfaction with a large-scale IS. Users want an easy-to-use, easy-to-learn, quick, and reliable system that assists them to do their job. The literature identifies these entities and establishes that these entities are often a deciding factor between success and failure (Benjamin, 2001). To coincide with the literature and the findings, this research study developed a revised theoretical framework that identifies the usability threats available to an implemented information system. This framework was called the Post-Implementation Usability Synergy (PIUS). The PIUS framework consisted of six different elements, which included: Reliability, Work Practices/Functionality, Support and Training, User Interface, Working Environment and the End-User. Each of these elements had its own individual importance to the success of an information system; however, a combination of each element would work like a synergy and creates user satisfaction. The literature corresponds with the findings and states that usability can be measured upon how Effective, Efficient, Flexible, and Robust the system is. Also how satisfying and easy to learn the system is from the users point of view (John, 1996); (Shneiderman, 1998); (ISO-9241, 1998).

The study focused upon three different categories of use, primary – those who used the system often, secondary – those who used the system frequently and finally tertiary – those who rarely used the system. These categories were measured through the time frame of one month.

The findings revealed primary users had various problems with the system. Users stated the system had "a few little flaws that are causing some users problems" (system administrator). However, the majority of these problems were based on "functionality not been switched on" which would have increased training costs (system administrator). Company A felt the system was superior enough to leave this functionality out. The primary user also found the working environment unworkable; one interviewee stated, "It's always really warm…if it wasn't so noisy you could fall asleep". Users need a well ventilate, quiet environment to carry out their work. The

study also identified this type of user had no issues with the systems interface, reliability or the training administrated.

The secondary user uncovered a very different set of results. This type user felt the systems functionality was "poor", "difficult" and "irritating". One interviewee reported: the system created more work, rather than minimising it. Users would have to "use additional software to create a report on a project". The CATS system cannot handle this, which "defeats the point of the system" (Line manager). The interface was "very unintuitive", "a nightmare" and "awful" secondary interviewees reported. Users felt that the system was designed for a database administrator as it was based solely on numbers and not names or images. The training provided was not comprehensive enough. Refresher-training courses are needed because at the moment "we end up calling system support" for basic system difficulties. The research uncovered the users who found the system problematic, are causing the system to become unreliable by not carrying out their work properly. Line managers and supervisors are validating staff hours before they verify if the hours have been completed. One interviewee stated "often I don't even look at what they (staff) wrote…I just verify it…its not because I am lazy, it is because the system is so annoying and so difficult to work with. I just don't want to know" (supervisor).

The tertiary user found the issues with the functionality and working environment. One interviewee revealed the system was not linked with the internal absent system. This meant users who were taking time off would have to enter in their hours twice. Users felt "double entry was annoying". Users also felt the working environment was "unsafe" and made feel uncomfortable working.

The study identified that users who felt that the Support and Training, User Interface, Working Environment, Work Practices/Functionality, or Reliability was inadequate failed to carry out their work practices correctly, led to their overall dissatisfaction with the system. This led to employee frustration toward the company, for not providing them an adequate means to do their job properly. This validated the PIUS framework and identified that each element was individually important nevertheless by overlooking one piece user dissatisfaction was inevitable. For user satisfaction to be achieved each piece of the PIUS framework must be perfect for the synergy to be complete.

The research examined the post-implementation evaluations that occurred in a large multinational company. This was a major discovery, which was not documented in the literature. Company A did not conduct *structural* post-implementation evaluations on their new system; however the findings indicated that Company A conducted *unstructured* post-implementation evaluations. This procedure involved empowering each individual user of that CATS system (may consist of 50,000 people) and encouraged them to find problems with the system and report them to Company A Headquarters. This process initially occurred throughout user training, where users were asked to 'mess around with the system'. The findings revealed that allowing users to explore the new system identified a multitude of problems. After the training process, users are working directly with the new system, without the helping hand of a qualified trainer. Here users can become frustrated if the system is not providing them with the functions or access, which they require. It was discovered that Company A asked users to write up reports documenting any problems they faced while using the system and send them anonymously to Company A Headquarters. Changes occurred depending on how urgent Company A Headquarters believed the problem(s) were.

6.4 Research Limitation

The main limitation of this study was that there was only one large multinational organisation involved in the research, and thus it was hard to establish whether post-implementation activities such as those reported in the findings actually occur in all organisations that have implemented large-scale IS.

6.5 Further Research Directions

The revised framework presented in Figure 5.8 needs to be tested and validated to become commercially viable. A further in-depth exploratory study could establish how the PIUS framework could be used to evaluate how satisfied users are with the new information system. The literature suggests that the following techniques may help address each issue of the PIUS framework. These include:
- Commercial Questionnaire
- Cognitive Walkthrough
- Formal Usability Testing

- Consistency Inspection

Commercial Questionnaire

The commercial questionnaire provides a useful approach to discover users' attitudes and opinions towards the new large-scale information system. The commercial questionnaire can be augmented by interviewers to gain further understanding about particular points addressed by the end-user ((Smith, Avison et al. 1997); (Sutcliff 1988)). This also allows the evaluator or interviewer understand how the end-users feels about the system on a one-to-one basis, without any managerial or supervisory interference. The commercial questionnaire can uncover problems that a multitude of end-users are having difficulties with, such as system support and training issues. The evaluator or interviewer notes any problems.

Cognitive Walkthrough

The cognitive walkthrough process involves the end-user and the evaluator, walking through the large-scale information system in the context of core tasks a typical end-user will need to accomplish. Discrepancies between end-user's expectations and the actual system are noted ((Shneiderman 1998); (Jeffries, Miller et al. 1991); (Smith, Avison et al. 1997); (Fruhling, Vreede et al. 2005)).

Formal Usability Testing

Formal Usability Testing is where the large-scale information system is observed under real-world or controlled conditions, with evaluators gathering data on problems that arise during its use. This type of inspection offers excellent opportunities to observe how well the information system supports the users' working environment, as experienced expert reviewers have great difficulty knowing how typical users will behave ((Jeffries, Miller et al. 1991); (Keirnan, Anschuetz et al. 2002); (Shneiderman 1998)). Formal usability testing determines whether the system meets a pre-determined, quantifiable level of usability for specific types of user carrying out specific tasks (Preece, Rogers et al. 1994). Problem areas are identified and noted by the evaluator.

Consistency Inspection

Evaluators and end-users work together to verify consistency across a family of interfaces, checking for consistency of terminology, colour, layout, input and output formats and so on within the interface as well as in the training materials and online help (Shneiderman 1998). Any issues with the user interface will be identified and noted

Figure 6-1: PIUS Inspection and Testing Methods

Players	Methods	Uncover Problems
End-User and Interviewer	Commercial Questionnaire	Support and Training, and Working Environment
End-User and Evaluator	Formal Usability Testing	Functionality and Reliability
End-User and Observer	Cognitive Walkthrough	Functionality and Reliability
End-User and Evaluator	Consistency Inspection	User Interfaces

These inspection and testing methods could identify problems or issues that end-users may have with the new large-scale information system. Such research may lead to a further revision of the PIUS framework; this revised framework would essentially integrate the organisational response mechanisms to address user satisfaction issues in the post-implementation phase of ISD project.

6.6 Conclusion

This research study was intended to provide new theoretical and practical insights into user satisfaction in the post-implementation phase of large-scale ISD projects. It is hoped that the theory and research findings presented in this thesis can assist practitioners dealing with critical post-implementation usability issues as well as identify the significant components that are required to create user satisfaction with a large-scale IS. This is crucial if we are to address the current problems associated with usability in the post-implementation phase of ISD projects.

REFERENCES

Abbot, R. J. (1990). Resourceful Systems for Fault Tolerance, Reliability, and Safety. ACM Computing Surveys. ACM Publishers.

Amaratunga, D.; Baldry, D.; Sarshar, D. & Newton, R. (2002). 'Quantitative and Qualitative Research in the Built Environment: Application of'Mixed' Research Approach', Work Study, Vol 15,.pp 17-31.

Apple-Computer (1985). Inside Macintosh. Cupertino, CA, Apple Computer.

Ardito, C.; DeMarsico, M.; Lanzilotti, R.; Levialdi, S.; Roselli, T.; Rossano, V. & Tersigni., M. (2004). 'Usability of E-Learning Tools', Proceedings of the working conference on Advanced visual interfaces: Gallipoli, Italy, Vol AVI '04, pp.80 - 84.

Argyris, C. & Schon, D. A. (1975). Organisational & Learning: A Theory of Action, Reading, MA, Addison Wesley.

Avison, D. & Fitzgerald, G. (2002). Information Systems Development: Methodologies, Techniques and Tools (Information Systems Series), McGraw Hill Higher Education.

Avison, D. E. (1996). Information Systems Development Methodologies: A Broader Perspective. Conference on Method Engineering. Atlanta, USA.

Avison, D. E. & Fitzgerald, G. (1988). Information Systems Development. Methodologies, Techniques & Tools, Blackwell Scientific Publications.

Avison, D. E.; Wood-Haper, A. T. & Vidfen, R. T. (1998). 'A Further Exploration into Information Systems Development: The Evolution of Multi-view', Information Technology and People, Vol 11, pp.124 - 139

Avison, D. E. & Wood-Harper, A. T. (1986). 'Multi-view - An Exploration in Information Systems Development', Australian Computer Society Inc, Vol 18,

Avison, D. E. & Wood-Harper, A. T. (1990). Multi-view: An Exploration in Information Systems Development, McGraw Hill Publishers.

Babar, M. A.; Zhu, L.; Verner, J. & Huo, M. (2004). Software Quality and Agile Methods. 28th Annual International Computer Software and Applications Conference. Hong Kong, IEEE Computer Society.

Baskerville, R. (1999). Action Research for Information Systems. Proceedings of the Amcis Meeting. Millwall.

Benbasat, I.; Goldstein, D. K. & Mead, M. (1987). 'The Case research Strategy in Studies of Information Systems', MIS Quarterly, Vol 11, pp. 369 - 385

Benjamin, D. (2001). Designing for Usability. TestFocus.

Bernard, H. R. (2000). Social Research Methods: Qualitative and Quantitative Approaches, Beverly Hills, Sage Publishing.

Bevan N. (2005. Measuring Usability as Quality of Use, Software quality Journal , Vol 4, pp 124.

Bickerton, M. J. & Siddiqi, J. (1993). The Classification of Requirements Engineering Methods. Proceedings of IEEE International Symposium Requirements Engineering. San Diego, CA, USA.

Blaxter, L.; Hughes, C. & Tight, M. (2001). How to Research, Buckingham, Open University Press.

Boehm, B. & Turner, R. (2003). 'Using Risk to Balance Agile and Plan-Driven Methods', Innovative Technology for Computing Professionals, Vol June, ACM Publishers.

Boland, R. (1985). Phenomenology: A Preferred Approach to Research on Information Systems. IN Mumford; Fitzgerald; Wood-Harper & Hirscheim (Eds.) Research Methods in Information Systems. Amsterdam, Elsevier Publishing.

Boland, R. J. & Day, W. (1982). The Process of System Design. A phenomenological Approach. IN Ginzberg (Ed.) Proceedings of the 3rd International Conference on Information Systems. MI. ACM Publishers.

Booch, G.; Rumbaugh, J. & Jacobson, I. (1999). The Unified Modelling Language Users uide, Addison Wesley.

Bradford, G. (2003). 'What's Old is New Again: Training is the Information Technology Constant', Special Interest Group on University and College Computing Services, Vol 14, pp.255 - 258.

Brannen, J. (2004). Working Qualitatively and Quantitatively. Qualitative Research Practice. Sage.

Brannick, T. & Roche, W. (1997). 'Business Research Methods: Strategies, Techniques and Sources', Oak Tree Press, Vol 7 Dublin, Ireland

Briand, L. & Wust, J. (2002). 'Empirical Studies of Quality Models in Object-Oriented Systems', Advances in Computers, Vol 59, pp.97 - 166

Bryman, A. (1988). Quantity and Quality in Social Research, London, Unwin Hyman.

Bryman, A. (2004). Social Research Methods, Oxford, Oxford University Press, 2004.

Bucken, M. W. (1993). Boston Edison improves software development. Software Magazine. Wiesner Publications.

Burrell, G. & Morgan, G. (1979). Sociological Paradigms and Organisational Analysis: Elements of the Sociology of Corporate Life, Ashgate Publishers.

Caldwell, B. & Stein, T. (1998). Beyond ERP: New IT Agenda. Information Week: News in Review.

Calisir, F. & Calisir, F. (2003). 'The relation of interface usability characteristics, perceived usefulness, and perceived ease of use to end user satisfaction with enterprise resource planning (ERP) systems', Elsevier, Vol 20, pp.505-515

Carroll, J. & Carrithers, C. (1984). 'Training Wheels in a User Interface', Human Aspects of Computing, Vol 27, pp.800 - 806

Carson, D.; Gilmore, A.; Cummins, D.; O'Donnell, A. & Grant, K. (1998). 'Price setting in SMEs: Some Empirical Findings', Journal of Product and Brand Management, Vol 7, pp.74-86

Chang, S. I. (2004). ERP Life Cycle Implementation, Management and Support: Implications for Practice and Research. 37th Hawaii International Conference on System Sciences. IEEE Computer Society.

Checkland, P. (1993). Systems Thinking, Systems Practice, John Wiley and Sons.

Checkland, P. & Holwell, S. (1996). Information management and organisational processes, Wiley Publishers.

Checkland, P. & Scholes, J. (1990). Soft Systems Methodology in Action, Wiley Publishers.

Chen, W. & Hirschheim, R. (2004). 'A Paradigmatic and Methodological Examination of Information Systems Research from 1991 to 2001', Information System Journal, Vol 14, pp.197 - 235.

Clark, R. C. & Mayer, R. E. (2003). E-Learning and the Science of Instruction, Pfeiffer.

Clifton, H. D. & Sutcliffe, A. G. (1994). Business Information Systems: The New Edition of Clifton's Business Data Systems, Prentices Hall.

Cranny, C. J.; Smith, P. C. & Stone, E. F. (1997). Job Satisfaction: How People Feel About Their Jobs and How it Affects Their Performance, New York, Lexington Books: An Imprint of Macmillan, Inc.

Curran, J. & Blackburn, R. A. (1994). Small Firms and Local Economic Networks: The death of the local economy? London, England, Paul Chapman Publishing Ltd.

Curtis, P. (1997). Mudding: Social Phenomena in Tech-Based Realities. IN Kiesler (Ed.) Culture of the Internet. Lawrence Earlbaum Associates, Publishers.

Davenport, T. (1998). 'Putting enterprise into the enterprise system', Harvard Business Review, Vol 76, pp.121 - 131.

Davis, F.; Bagozzi, R. & Warshaw, P. (1989). 'User acceptance of Information Technology: A Comparison of two theoretical models', Management Science, Vol 35, pp.982 - 1003.

Deloitte & Touche (1999). ERP's Second Wave: Maximising the Value of ERP-Enabled Processes. Atlanta, Deloitte Consulting.

Deloitte&Touche (2003). The Top 10 ERP Mistakes. ACTIV~ity. South Africa, Active Era.

Dennis, A. & Wixson, B. (2000). Systems Analysis and Design: An Applied Approach, New York, John Wiley & Sons, Inc.

Denzin, N. & Lincoln, Y. (1994). Handbook of Qualitative Research, London, England, Sage.

Denzin, N. & Lincoln, Y. (2003). Strategies of Qualitative Inquiry, California, USA, Thousand Oaks, Sage.

Denzin, N. K. & Lincoln, Y. S. (2000). Handbook of Qualitative Research, Sage Publishers.

DeRuyter, K. & Scholl, N. (1998). 'Positioning qualitative and market research: reflections from theory and practice', Qualitative Market Research: An International Journal, Vol 1, pp.7-14.

Devaraj, S. & Babu, S. (2004). 'How to Measure the Relationship between Training and Job Performance', Vol 47, pp.63 - 67.

Dicks, R. S. (2002). Mis-Usability: On the Uses and Misuses of Usability Testing. SIGDOC 2002. Toronto, Canada, Association for Computing Machinery, Inc.

Dix, A.; Beale, R.; Finlay, J. & Abowd, G. (1993). Human-Computer Interaction, Prentice Hall.

Dodgson, M. (1993). 'Organisational Learning: A Review of Some Literatures', Organisational Studies, Vol 14, pp.375 - 390.

Easterby-Smith, M. (1991). Management Research: An Introduction, London, Sage Publishers.

Easterby-Smith, T.; Thorpe, R. & Lowe, A. (2002). Management Research: An Introduction, London, England, Sage Publishing.

Ehlert, P. (2003). Intelligent User Interfaces. IN Ehlert (Ed.) Neverlands, Delft University of Technology, The Netherlands.

Eisenhardt, K. M. (1989). 'Building Theories from Case Study Research', Academy of Management Review, Vol 14, pp.532-550.

Fahy, M. (1995). Management Development Systems: An Empirical Study in Irish and UK Companies. PhD, National University of Ireland.

Falconer, D. J. & Mackay, D. R. (1999). Ontological Problems of Pluralist Research Methodologies. Proceedings of the 5th Americas Conference in Information Systems. Milwaukee, USA.

Fitzgerald, B. (1998b). Competing Dichotomies in IS Research and Possible Strategies for Resolution. Proceedings of the 19th International Conference on Information Systems. Helsinki, Finland.

Fitzgerald, G.; Avison, D. E. & Smith, A. (1997). Human Computer Factors: A Study of Users and Information Systems, Luton, McGraw-Hill Companies.

Fowler, M. (2003). UML Distilled Third Edition: A Brief Guide to the Standard Object Modelling Language, Addison Wesley.

Fruhling, A.; Vreede, G.-J. d. & Chakrapani, A. (2005). A repeatable Collaboration Process for Usability Testing. Proceedings of the 38th Hawaii International Conference on System Sciences. IEEE.

Garcia, L. & Quek, F. (1997). Qualitative Research in Information System: Time to be Subjective. Information systems and Qualitative Research. London, England, Chapman and Hall.

Gibson, C. F.; Holland, C. P. & Light, B. (1999). Enterprise Resource Planning: A Business Approach to Systems Development. Proceedings of the 32nd Hawaii International Conference on Systems Sciences. Maui, Hawaii, USA, IEEE computer Society Press.

Goodwin, N. C. (1987). 'Functionality and Usability', Computing Practices, Vol 30, pp.229 - 233

Goulding, C. (1999). 'Consumer Research, Interpretive Paradigms and Methodological and Ambiguities', European Journal of Marketing, Vol 33, pp.859 - 887

Grant, K.; Gilmore, A.; Carson, D.; Laney, R. & Pickett, B. (2001). ''Experimental' Research Methodology: An Integrated Academic-Practitioner 'Team' Approach', Qualitative Market Research: An International Journal, Vol 4, pp.66-75

Grimes-Farrow, D. (1983). 'Human Factors Training and Awareness', Association for Computing Machinery, Vol 1, pp.73 - 78

Guba, E. & Lincoln, Y. (1989). Naturalistic Inquiry, Beverly Hills, CA, USA, Sage Publishing.

Gubrium, J. & Holstein, J. (2002). Handbook of Interview Research: Context and Methods, California, USA, Sage Publishing.

Haas, R. K. (1998). Usability Techniques: User-Centred Design and Web Development. Usability Interface.

Haigh, A. (2001). Object-Oriented Analysis and Design, Osborne Publishing.

Halpin, L. (2003). Chaos and Complexity in the Post-Implementation Phase of ISD. Physical & Quantitative Science. Waterford, Waterford Institute of Technology (WIT).

Hamilton, S. & Ives, B. (1982). 'MIS Research Strategies', Information Systems Management, Vol 5, pp. 339 - 347.

Harry, M. (1994). Information Systems in Business, Pitman Publishing 128 Long Acre, London, England.

Hawking, P. & Stein, A. (2002). 'E-skills: The Next hurdle for ERP implementations', 36th Annual Hawaii International Conference on System Sciences (HICSS'03), Vol 8, pp.235

Hawkins, D. & Tull, D. (1993). Marketing Research, Measurements and Methods: A Test with Cases, London, England, Macmillan Publishing.

Hawling, P.; Stein, A. & Foster, S. (2004). Revisiting ERP Systems: Benefit Realisation. 37th Hawaii International Conference on System Sciences. Australia, IEEE.

Hirschheim, R.; Iivari, J. & Keine, H. (1998). 'A Comparison of Five Alternative Approaches To Information Systems Development', Australian Journal of Information Systems, Vol 5, pp. 57 - 70.

Hirschheim, R.; Klein, K. & Lyytinen, K. (1995). Information Systems Development and Data Modelling: Conceptual and Philosophical Foundations. Cambridge, Cambridge University Press.

Hirschheim, R. & Smithson, S. (1999). Evaluation of Information Systems: A Critical Assessment, John Wiley & Sons Ltd.

Hix, D. & Hartson, H. R. (1993). Developing User Interfaces: Ensuring Usability Through Product and Process, Wiley Professional Computing.

Holland, C. P. & Light, B. (1999). A Critical Success Factors Model For ERP Implementation. From the Trenches: IEEE Software.

Hoyland, A. & Rausand, M. (1994). System Reliability Theory: Models and Statistical Methods, Canada, Wiley Inter-Science.

Huber, G. P. (1991). 'The contributing Processes and the Literatures ', Organisational Science, Vol 2, pp.88 - 115.

Humphrey, W. (1995). The Complete PSP Book: A Discipline for Software Engineering. Addison-Wesley.

Iivari, J.; Hirschheim, R. & Klein, H. K. (2001). 'A Dynamic Framework for Classifying Information Systems Development Methodologies and Approaches', Management Information Systems, Vol 17.

Iivari, N. & Abrahamsson, P. (2002). The Interaction Between Organizational Subcultures and User-Centred Design: A Case Study of an Implementation Effort. 35th Hawaii International Conference on System Sciences. Big Island, HI, USA, IEEE Computer Society.

INBITE (2005). PPARS goes PEAR Shaped. INBITE Conference Series.

Irestig, M.; Eriksson, H. & Timpka, T. (2004). The Impact of Participation in Information System Design: A Comparison of Contextual Placements. Design Conference. Toronto, Canada, ACM.

Irish-Health (2005). PPARS system 'a nightmare'. IrishHealth.com. Dublin.

ISO-9241 (1998). Ergonomics requirements for office work with visual display terminals., Part 11 - Guidance on Usability.

Janesick, V. (1994). The Dance of Qualitative Research Design: Metaphor, Methodology and Meaning, The Handbook of Qualitative Research, Sage Publications.

John, B. E. (1996). 'Evaluating Usability Evaluation Techniques', ACM Computing Surveys (CSUR), Vol 28.

Jokela, T. (2002). Making User-Centred Design Common Sense: Striving for An Unambiguous and Communicative UCD Process Model. Second Nordic Conference on Human-Computer Interaction. Aarhus, Denmark, ACM Press.

Káhkónen, T. (2004). Agile Methods for Large Organisations - Building communities of Practice. Proceedings of the Agile Development Conference. Salt Lake City, Utah., IEEE Computer Society.

Kaplan, B. & Maxwell, J. A. (1994). Qualitative Research Methods for Evaluating Computer Information Systems. Computers in Health Care: Research and Evaluation. Sage Publishing.

Karat, J. (1997). 'Evolving the Scope of User-Centred Design', Communications of the ACM, Vol 40, pp.33 - 38

Katzenbach, J. R. (1999). The Work of Teams, A Harvard Business Review.

Keirnan, T.; Anschuetz, L. & Rosenbaum, S. (2002). Combining Usability Research with Documentation Development for Improved User Support. SIGDOC 2002. Toronto, Canada, Association for Computing Machinery, Inc.

Kendall, E. & Kendall, J. (1999). Systems Analysis and Design Fourth: Edition, Prentice Hall.

Kennedy, J. (2004). Fear, uncertainty and doubt stalk IT projects. Irish Independent. Thursday ed.

Kennedy, J. (2005). Plan or be damned, warns expert on PPARS. SiliconRepublic.com.

Kilambi, A.; Johnson, C. S. & Wilson, D. N. (1998). Australian Experience with Post-Implementation Reviews. 9th Australasian Conference in Information Systems.

Kim, Y.; Lee, Z. & Gosain, S. (2005). 'Impediments to successful ERP implementation process', Business Process Management, Vol 11, pp.158 - 170

Klein, H. & Hirschheim, R. (1991). 'Rationality Concepts in Information Systems Development Methodologies', Accounting, Management and Information Technology, Vol 1, pp.157-187

Kopetz, H. (1976). Software Reliability, Berlin, Macmillan Computer Science Series.

Krasner, H. (2004). Ensuring E-Business Success by Learning from ERP Failures. IT Pro. IEEE.

Krieger, S. (1979). 'Research and the construction of a Text', Studies in Symbolic Interaction, Vol Vol 2, pp. 167 - 187.

Kruse, K. (2003). Effective User Interface Design. American Society for Training & Development. Alexandria, Virginia, 22313-2043, USA, Learning Circuits.

Kueng, P. (2002). Impact of Workflow Systems on People, Task and Structure: a post-implementation evaluation. Fifth European Conference on the Evaluation of Information Technology. Browne & Remenyi.

Kujala, S. & Kauppinen, M. (2004). Identifying and Selecting Users for User-Centred Design. Third Nordic conference on Human-Computer Interaction. Tampere, Finland, ACM Press, New York.

Landauer, T. (1995). The Trouble with Computers. MIT Press. Cambridge.

Langenwalter, G. (2000). Enterprise Resources Planning And Beyond: Integrating Your Entire Organisation, APICS: The Educational Society for Resource Management.

Larman, C. (1998). Applying UML and Patterns: An Introduction to Object-Oriented Analysis and Design, Prentice Hall.

Laudon, K. C. & Laudon, J. P. (1998). Management Information Systems: New Approaches to Organization & Technology, Prentice Hall.

Lauesen, S. (2005). User Interface Design: A Software Engineering Perspective, Essex, Great Britain, Assison Wesley.

Lee, T. W. (1999). Using Qualitative Methods in Organisational Research, London, Sage Publishing.

Lehaney, B. & Paul, R. J. (1996). Soft Systems Methodology and Simulation Modelling. Proceedings of the 1996 winter Simulation Conference. Coronado, CA, USA, ACM Press New York, USA.

Leitch, R. D. (1995). Reliability Analysis for Engineers: An Introduction, Oxford Science Publications.

Lejk, M. & Deeks, D. (1998). An introduction to Systems Analysis Techniques, Prentice Hall.

Lofland, J. (1971). Analyzing Social Settings, Belmount, California, USA, Wadsworth Publishing Company Inc.

Lopes, M. E. (2001). Soft Systems Methodology: An Application to a Community Based Association. Proceedings Field Graduate Institute Action Research Symposium. Alexandria, Virginia, USA.

Lucas, H. C. (2005). Information Technology: Strategic Decision Making for Managers, John Wiley & Sons. Inc.

Lyytinen, K. & Klein, H. (1985). The Critical theory of jurgen habermas as a basis for a theory of information systems. WG8.2 Conference: Research Methods in Information Systems. Manchester UK, Elsevier Science Publishing B.V.

Mahadevan, B. (2001). 'The ERP Conundrum', IIMB Management Review, Vol 13, pp.96

Mao, J.-Y.; Vredenburg, K.; Carey, T. & Smith, P. (2005). 'The State of User-Centred Design Practice', Communications of the ACM, Vol 48, pp.105 - 109.

Marshall, C. & Rossman, G. B. (1989). Designing Qualitative Research, Sage Publishing.

Martin, E. W.; DeHayes, D. W.; Hoffer, J. A. & Perkins, W. C. (1994). Managing Information Technology: What Managers Need to Know, Prentice Hall.

Martin, J. & Odell, J. (1998). Object-Oriented Methods: A Foundation, Prentice Hall.

Mason, J. (1996). Qualitative Researching, London, Sage Publishing.

Massey, A. (1998). The way we do things around here: the culture of ethnography. Ethnography and Education Conference. Oxford University Department of Educational Studies (OUDES).

Melnik, G. & Maurer, F. (2004). Introducing Agile Methods: Three Years of Experience. 30th EUROMICRO conference. Rennes - France, IEEE Computer Society.

Miles, M. (1979). 'Qualitative Data as an Attractive Nuisance: The Problem of Analysis', Administrative Science Quarterly, Vol 24, pp.590 - 601.

Miles, M. & Huberman, A. (1984). Qualitative Data Analysis: A Source Book of New Methods, London, England, Sage Publishing.

Miller, D. (1991). Handbook of Research Design and Social Measurement, California, USA, Sage Publications.

Mingers, J. (2003). 'The Paucity of Multi-method Research: A Review of the Information Systems Literature', Information Systems Journal, Vol 13, pp. 233 - 249

Mitleton-Kelly, E. (2000). Complexity: Partial Support for BPR. IN Henderson (Ed.) Systems Engineering for Business Process Change. Springer-Verlag.

Mohamed, M. & Fadlalla, A. (2005). 'ERP II: Harnessing ERP Systems with Knowledge Management Capabilities ', Journal of Knowledge Management Practice, Vol June, ACM Publishers.

Mumford, E. (1983). Designing Human Systems for New Technology: The ETHICS Method, Manchester Business School.

Mumford, E. (1991). Information Systems Research-Leaking Craft or Visionary Vehicle. IN Nissen; Klein & Hirschheim (Eds.) Information Systems Research: Contemporary Approaches and Emergent Traditions. Amsterdam, Holland.

Mumford, E. (2000). 'A Socio-Technical Approach to Systems Design', Vol 1. McGraw Hill Companies.

Musa, J. D.; Iannino, A. & Okumoto, K. (1987). Software Reliability: Measurement, Prediction, Application, McGraw-Hill International Editions.

Myers, M. (1997). 'Qualitative Research in Information System', MIS Quarterly, Vol 2, pp.241 - 242.

Myers, M. & Avison, D. (2002). Qualitative Research in Information Systems, London, England, Sage.

Nah, F. F.-H. & Lau, J. L.-S. (2001). 'Critical factors for successful implementation of enterprise systems', Business Process Management, Vol 7, pp.285 - 295.

Nandhakumar, J. & Avison, D. (1996). Information Systems Development In Use: An Empirical Study. Proceedings of the 4th Conference on Information System Methodologies. British Computer Society.

Nandhakumar, J. & Avison, D. (1999). 'The Fiction of Methodological Development: A Field Study of Information Systems Development', Information Technology and People, Vol 12, pp.176 - 191.

Ndlela, L. T. & duToit, A. S. A. (2001). Establishing a knowledge management programme for competitive advantage in an enterprise. International Journal of Information Management. Elsevier.

Nicolaou, A. (2003). Quality of Post Implementation Review for Enterprise Resource Planning.

Nicolaou, A. I. (2004). 'ERP Systems Implementation: Drivers of Post-Implementation Success', DSS 2004 Conference Proceedings, Vol 1, pp.589-597

Nielsen, J. (1993). Usability Engineering, Florida, Morgan Kaufmann.

Nielsen, J. (2000). Designing Web Usability, New Riders Publishing.

Nielsen, J. & Coyle, K. P. (2001). Emerging Technology. CIO Magazine. CIO Magazine.

Nielsen, J.; Coyne, K. P. & Tahir, M. (2001). Make it Usable. PC Magazine. PC Magazine.

O'Brien, J. A. (1999). Management Information Systems: Managing Information Technology in the Internet-worked Enterprise, McGraw Hill Companies.

Ohlson, D. W. (1999). Exploring The Application of Adaptive Management and Decision Analysis To Integrated Watershed Management: A Soft Systems Approach. http://www.scarp.ubc.ca/thesis/ohlson/iwmss.htm.

Orlikowski, W. J. & Baroudi, J. J. (1991). 'Studying Information Technology in Organizations: Research Approaches and Assumptions', Systems Research, Vol 2, pp.1 - 28.

Paetsch, F.; Eberlein, A. & Maurer, F. (2003). Requirements Engineering and Agile Software Development. Twelfth International Workshops on Enabling Technologies: Infrastructure for Collaborative Enterprises. Lenz, Austria, IEEE Computer Society.

Palvia, S.; Sharma, R. & Conrath, D. (2001). 'A Socio-Technical Framework for Quality Assessment of Computer Information Systems', Industrial Management and Data Systems, Vol 101, pp.237 - 251.

Parasuraman, A. (1991). Marketing Research, Reading, MA, USA, Addison-Wesley Publishing.

Petrelli, D.; Hansn, P.; Beaulieu, M.; Sanderson, M.; Demetriou, G. & Herring, P. (2004). 'Observing Users - Designing Clarity: A Case Study on the User-Centred Design of a Cross-Language Information Retrieval System', Journal of the American Society for Information Science and Technology, Vol 55, pp.923 - 934

Pierce, R. (2003). Optimizing Your Documentation with the Help of Technical Support. SIGDOC. ACM Publishers.

Plummer, A. (2001). 'Information Systems Methodology for Building Theory in Health Informatics: The Argument for a Structured Approach to Case Study Research', Proceedings of the 34th Hawaii International Conference on Systems Sciences - 2001, Vol 9.

PPARS (2005). Personnel, Payroll and Related Systems. IN Health (Ed.), http://www.ppars.ie/Public/public_home.htm.

Preece, J.; Rogers, Y.; Sharp, H.; Benyon, D.; Holland, S. & Carey, T. (1994). Human-Computer Interaction, Oxford, Addison Wesley.

Preece, J.; Rogers, Y.; Sharp, H. (2002). Interaction design: beyond human-computer interaction. New York, NY: J Wiley and Sons.

Raskin, J. (2000). The Human Interface: New Directions for Designing Interactive Systems, Addison Wesley.

Reaves, C. (1992). Quantitative Research for Behavioural Science, Singapore, Wiley.

Redish, J. (2005). Six Steps to Ensure a Successful Usability Test. User Interface Engineering.

Remenyi, D. (1998). Doing Research in Business and Management: An Introduction to Process and Method, London, Sage Publishing.

Ritchie, J. & Lewis, J. (2003). Qualitative Research Practice, London, England, Sage Publishing.

Robson, C. (2002). Real World Research: A Resource for Social Scientists and Practitioner-Researchers, Oxford, England, Blackwell Publishers.

Rolland, C. & Prakash, N. (2001). 'Matching ERP System Functionality to Customer Requirements', Proceedings. Fifth IEEE International Symposium on Requirements Engineering, 2001, Vol pp.xiii - 321

Rosenbaum, S.; Hinderer, D. & Scarborough, P. (1999). 'How Usability Engineering Can Improve Clinical Information Systems', Usability Professionals Association, http://www.teced.com/PDFs/upa99sr.pdf.

Rudolf, A. & Pirker, R. (2000). E-Business Testing: User Perceptions and Performance Issues. 1st Asia-Pacific Conference on Quality Software.

Sarantakos, S. (1998). Social Research, Hong Kong, Macmillan Publishers.

Saunders, M.; Lewis, P. & Thornhill, P. (1997). Research Methods for Business Students, London, England, Pitman Publishing.

Schultze, U. (2001). Reflexive Ethnography in Information Systems Research. IN Truth (Ed.) Qualitative Research in IS: Issues and Trends. London, Idea Group Publishing.

Seddon, A. (1997). System Design Methodologies. Staffordshire University.

Seffah, A. & Andreevskaia, A. (2003). Empowering Software Engineers in Human-Centred Design. 25th International Conference on Software Engineering. Portland, Oregon, IEEE Computer Society.

Sekaran, U. (1992). Research Methods for Business, New York, Wiley Publications.

Shackel B. (1986. People and computers: Designing for Usability, Proceedings of the Conference of British Computer Society: Human-Computer Interaction Specialist Group, University of York, U.K September 23-26)

Shang, S. & Seddon, P. (2000). A Comprehensive Framework for Classifying the Benefits of ERP Systems. Americas Conference on Information Systems. Long Beach, California.

Shneiderman, B. (1998). Designing the User Interface: Strategies for Effective Human-Computer Interaction, Addison Wesley Longman, Inc.

Siewiorek, D.; Smailagic, A. & Salber, D. (2001). Rapid Prototyping of Computer Systems: Experiences and Lessons. 12th International Workshop on Rapid System Prototyping. Monterey, California, USA, IEEE Computer Society.

Simonson, M. & Sein, M. (2004). Conceptual Frameworks in Practice: Evaluating End-User Training Strategy in an Organisation. SIGMIS. Tucson, Arizona, USA, ACM.

Singh, V.; Twidale, M. B. & Rathi, D. (2006). 'Open Source Technical Support: A Look at Peer Help-Giving', 39th Hawaii International Conference on System Sciences, Vol 4, pp.1 - 10

Smith, A.; Avison, D. E. & Fitzgerald, G. (1997). Human Computer Factors: A Study of Users and Information Systems, Luton, McGraw-Hill Companies.

Snene, M.; Pardellas, J. & Leonard, M. (2004). Information System Architecture: Where are we? Information and Communication Technologies: From Theory to Applications.

Somers, T. M. & Nelson, K. (2001). 'The Impact of Critical Success Factors across the Stages Enterprise Resource Planning Implementations', 34th Annual Hawaii International Conference on System Sciences (HICSS-34), Vol 8.

Spathis, C. & Constantinides, S. (2003). 'The Usefulness of ERP systems for effective management', Industrial Management and Data Systems, Vol 103, pp.677 - 685

Spool, J. M. (2005). Seven Common Usability Testing Mistakes. http://www.uie.com/articles, User Interface Engineering.

Stair, R. M. (1996). Principles of Information Systems: A Managerial Approach, Boston, Boyd and Fraser Publishing Company.

Stapleton, L. (2000a). Form Information Systems In Social Settings To Information Systems As Social Settings: A Study of Large Information Systems in

Manufacturing Firms. Proceedings of the 7th IFAC Symposium on Automation Based on Human Skill. North Holland, Elsevier Publishing.

Stapleton, L. (2000b). 'From Information Systems in Social Settings to Information Systems as Social Settings: A Study of Large Information Systems in Manufacturing Firms', Proceedings of the 7th IFAC Symposium on Automation Based on Human Skill.

Stapleton, L. (2001). From Information Systems in Social Settings To Information Systems as Social Settings: A Study of Large Information Systems in Manufacturing Firms. Faculty of Commerce. Cork, University College Cork.

Steenis, H. V. (1990). How To Plan, Develop & Use Information System: A Guide to Human Qualities and Productivity, Dorset House Publishing, New York, USA.

Stern, P. (1980). 'Grounded Theory Methodology: Its Uses and Processes', Image, Vol 12, pp.20 - 23.

Strauss, A. & Corbin, J. (1994). Grounded Theory Methodology: An Overview. IN Denzin & Lincoln (Eds.) Handbook of Qualitative Research. Thousand Oaks, Sage.

Tallon, P.; Kraemer, K. L. & Gurbaxani, V. (2001). 'Executives' Perceptions of the Business Value of Information Technology: A Process-Oriented Approach', Journal of MIS, Vol 12.

Todd, K.; Mardis, L. & Wyatt, P. (2005). Synergy in Action: When Information Systems and Library Services Collaborate to Create Successful Client-Centred Computing Labs. Proceedings of the 33rd annual ACM SIGUCCS conference on User services. Monterey, CA, USA, ACM Press, New York, NY, USA.

Turban, E.; McLean, E. & Wetherbe, J. (1999). Information Technology for Management - Making Connections for Strategic Advantage, New York, John Wiley & Sons. Inc.

Underwood, J. (1996). Models for Change: Soft Systems Methodology. Business Process Transformation.

Usability.Net (2003). ISO 13407 <http://www.usabilitynet.org/tools/13407stds.htm>.

Van-Maanen, J. (1979). Reclaiming Qualitative Methods for Organizational Research: A Preface. Administrative Science Quarterly.

Vidich, A. & Lyman, S. (1994). Qualitative Methods: Their History in Sociology and Anthropology. IN Denzin & Lincoln (Eds.) Handbook of Qualitative Research. London, Sage Publications.

Virzi, R.A. (1997). User-centred software evaluation methodologies. In Helander (ed.) Handbook of Human-Computer Interaction. Second completely revised edition, 689-704

Vredenburg, K.; Isensee, S. & Righi, C. (2001). User-Centred Design: An Integrated Approach (Software Quality Institute Series), Prentice Hall.

Vreede, G.-J. d.; Fruhling, A. & Chakrapani, A. (2005). A repeatable Collaboration Process for Usability Testing. Proceedings of the 38th Hawaii International Conference on System Sciences. IEEE.

Vrendenburg, K.; Mao, J.-Y.; Smith, P. & Carey, T. (2001). User-centred design methods in practice: a survey of the state of the art. Centre for Advanced Studies on Collaborative Research. Toronto, Canada, IBM Press.

Warren, C. (1988). Gender Issues in Field Research, London, England, Sage.

Wastell, D. G. (1996). 'The Fetish of Techniques: Methodology as a Social Defence', Information Systems Journal, Vol 6.

Weaver, P. L.; Lambrou, N. & Walkley, M. (1998). Practical SSADM: A Complete Tutorial Guide: Version 4+, FT Prentice Hall.

Webb, E.; Campbell, D. T. & al, e. (1966). Unobtrusive Measures: Non-Reactive Research in the Social Sciences, Chicago, Rand-McNally.

Whitten, J. (1998). Systems Analysis and Design Methods, Irwin/McGraw-Hill.

Whitten, J. & Bentley, L. (1998). Systems analysis & design Methods, McGraw Hill.

Willcocks, L.; Feeny, D. & Islei, G. (1997). Managing IT as a Strategic Resource, Shoppenhangers Road, Maidenhead, Berkshire, SL6 2QL, England, McGraw-Hill Book Company (Europe).

Wixon, D.; Holtzblatt, K. & Knox, S. (1990). Contextual design: an emergent view of system design. Human factors in computing systems: Empowering people. Seattle, Washington, United States, ACM Press.

Woodings, T. L. & Everett, J. E. (1999). A Methodology with Quality Tools to support Post Implementation Reviews. 10th Australasian Conference on Information Systems. New Zealand, ACIS.

Wynekoop, J. & Conger, D. (Eds.) (1991) A Review of Computer Aided Software Engineering Research Methods, North Holland, Elsevier Publishers.

Yeates, D.; Shields, M. & Helmy, D. (1994). Systems Analysis and Design, Pitman Publishing.

Yin, R. (1994). Case Study Research: Design Methods, United States of America, Sage Publications.

Yu, C.-S. (2005). Causes influencing the effectiveness of the post-implementation ERP system. Industrial Management & Data Systems. Emerald Group Publishing Limited.

Zwass, V. (1992). Management Information Systems, United States, Wm.C.Brown Publishers.

APPENDIXES

APPENDIX I: Questionnaire used in pilot case study

Pilot Interview Guide (Questionnaire)

Section A: (General Background Information)
1. Describe the Information System in place within your organisation?

2. Are you a key user of the system?

    a. Describe your role?

Section B: (Information Systems Characteristics)
3. Does the system do what it was intended to do?

4. Are there any particular parts of the system you would change?

5. Describe the following, with regard to your information system:

    a. User-Interfaces

    b. Business Functionality

    c. System Reliability

    d. Training and Support

Section C: (Post-Implementation Evaluations)
6. What type of evaluation(s) has taken place since the system has gone 'live'?

    a. How did this process work?

    b. Who is involved? End-Users?

Section D: (Usability Activities)
7. Is creating a 'usable' system important to your organisation?

    a. Who ensures the system is easy to use? … Discuss.

APPENDIX II: Case study 1 interview guide (questionnaire)

Profile of Participation

Company Name: [_____]

Interviewee Name: [_____]

Interview ID: [_____]

Interviewee Job Title: [_____]

Date of Interview: [_____]

INTERVIEW GUIDE (QUESTIONNAIRE)

Section A: General Background Information

1. Describe the information system (IS) in place within your organisation.

2. Are you a key user of the IS?

    a. Describe your role.

Section B: Information Systems Characteristics

1. Does the IS do what it was intended to do?

    a. With regard to the IS in question, do you feel the business functionality is important to the systems success?

2. Are there any particular parts of the IS you would change to make it better?

3. Describe the following, with regard to the IS in question:

    a. *User Interface*

        i. How important is the systems interface to the success of an IS?

    b. *System Reliability*

        i. How imperative is system reliability to the success of an IS?

    c. *Training and Support*

        i. Are support and training materials important ingredients for the success of an IS?

Section C: Usability Activities

1. What are the components that create user frustration with a new large-scale IS?

2. What constitutes a '**usable**' IS?

    a. How does your company ensure the IS is usable?

Section C: Post-Implementation Evaluations

1. Has the organisation carried out post-implementation reviews on the IS to ensure user satisfaction?

    a. To what extent?

    b. How did this process work?

    c. Who is involved? End-users??

APPENDIX III: Case study 2 interview guide (questionnaire)

Profile of Participation (2)

Company Name: [   ]

Interviewee Name: [   ]

Interview ID: [   ]

Interviewee Job Title: [   ]

Date of Interview: [   ]

INTERVIEW GUIDE (QUESTIONNAIRE 2)

Section A: General Background Information

1. Describe the CATS system that is used for time keeping within your organisation.

2. How often would you use this information system?

Section B: Information Systems Characteristics

1. Describe how affective the CATS interface is.

2. Describe the type of support provided with the CATS system.

    a. Extra support was required with the introduction of CATS, why was this?

Section C: Usability Activities

1. What kind of issues affected the reliability of the CPAC system (internal and external issues were reported from case study one)

Section D: Post-Implementation Evaluation

1. Is the method of user empowerment an adequate method to ensure a usable system?

APPENDIX IV: Cover letter

Waterford Institute of Technology
Waterford, Ireland
TEL: +353-51-302000
WEB: www.wit.ie

<<Date >>

<<Full Name >>,
<<Job Title >>,
<<Address >>,
<<Address >>,
<<Address >>.
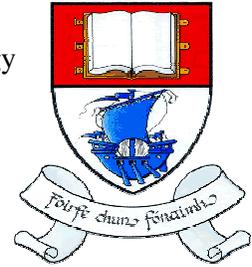
Dear <<First Name>>,

My name is Colman Gantley and I am currently doing my Masters in Science at Waterford Institute of Technology. The focus of my research is to identify various elements required to create user satisfaction within a working environment.

The results of this study will be extremely useful in trying to understand why information systems are so problematic and identify the main usability issues that surround the difficult post-implementation phase.

I would be immensely grateful if you would assist me in this matter by agreeing to meet with me for an interview.

The duration of the interview would be about one hour and at a time convenient to you. A copy of the executive summary will also be provided upon completion, if requested. I understand that this may be difficult to undertake, but I would appreciate it, if you could give me some of your time.

Any information supplied by you will be treated in strict confidence and will be used for academic purposes only. You have the right of first refusal: if you want to strike a line, a paragraph, a section, or the whole interview—I eliminate that line, paragraph, section, or the whole interview. I will record the interview myself.

If you have any questions with regard to this study, please do not hesitate to contact me.

Thanking you in advance,
Yours sincerely,

  Colman Gantley .

Colman Gantley, Masters by Research Student,
Waterford Institute of Technology,
Cork Road, Waterford.
Mobile: 087 9813907
Email: cgantley@wit.ie

APPENDIX V: Company profile

Company A:

Company A is a world-leading supplier of equipment for mobile and fixed line telecommunications networks and offers a wide range of telecom and datacom equipment such as end-to-end solutions and systems and services, which enables mobile and fixed line networks to transmit voice, data and multimedia effectively, fast and securely. Company A is one of the few companies that can offer complete solutions for all major mobile communication standards. With operations in 140 countries, Company A is a leading global player in the telecom industry and is an employer of over 56,055 worldwide.

APPENDIX VI: Informed consent form

INFORMED CONSENT FORM

Instructions: *To be read out by the researcher before the beginning of the interview.*
- *One copy of the form to be left with the interviewee;*
- *A second copy is to be signed by the interviewee and kept by the researcher.*

My name is Colman Gantley. I am doing research on a project entitled: "An exploratory study into achieving ultimate usability in the post-implementation phase of a systems development life cycle".

The attached overview describes what this study is about. I am a member of the Information Systems, Organisational and Learning (ISOL) Research Group within Waterford Institute of Technology, Waterford. This research is being conducted under the supervision of Dr. Larry Stapleton, and either of us can be contacted (see below) should you have any questions.

Colman Gantley   Larry Stapleton
Waterford Institute of Technology   Waterford Institute of Technology
Cork Road   Cork Road
Waterford   Waterford
Phone: 087 9813907   Phone: 051 302100
Email: cgantley@wit.ie   Email: lstapleton@wit.ie

Thank you for agreeing to take part in the project. Before we start I would like to emphasise that:
- Your participation is entirely voluntary;
- You are free to refuse to answer any question;
- You are free to withdraw at any time.

The interview will be kept strictly confidential and will be available only myself. Excerpts from the interview may be made part of the final research thesis, but these will be anonymous. The name of your company will be included in an appendix; but under no circumstances will your name or any identifying characteristics of you or the organization appear in the thesis.

Please sign and date this form to show that I have read these contents to you.

_____ *(Signed)*

_____ *(Printed)*

_____ *(Dated)*

Please send a report on the results of the research project:

YES   NO   *(Circle one)*

Address for those requesting a research report.

_____

_____

_____

_____

(Interviewer is to keep a signed copy and leave an unsigned copy with the interviewee).

OVERVIEW DETAILING RESEARCH STUDY

An Exploratory Study to Enhance User Satisfaction in the Post-Implementation Phase of a Systems Development Life Cycle

Researcher: Colman Gantley

Institute: Waterford Institute of Technology

Background on Research Project:

This research project is looking at the post-implementation and usability concerns that occur with the introduction of a new information system. This research is also looking at who are the key individuals involved during these critical stages of the systems development life cycle.

Focus of the Interview:

1. To identify and classify the post-implementation activities.
2. To identify appropriate usability elements that is required for a successful information system.