AN EMPIRICAL STUDY:

The Delivery Phase of Large-Scale Information Systems Development in the Irish Public Sector.

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AN EMPIRICAL STUDY:

The Delivery Phase of Large-Scale Information Systems Development in the Irish Public Sector.

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The author hereby declares that, except where duly acknowledged, this thesis is entirely her own work and has not been submitted for any degree in any other institute.

DEDICATIONS

This thesis is dedicated to my husband Martin and my children Evan, Anna and Conor, and to the memory of my loving parents.

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ABSTRACT

The study of information systems development and implementation in the Irish Public Sector is abundant with both empirical and anecdotal evidence of failures. In recent years the Irish Credit Unions failed to introduce the standardised Information System ISIS. The Government failed to introduce the proposed electronic voting system. The implementation of an enterprise information system is laden with dangers and prone to failure. Even technically elegant systems, can fail, when critical human and organisational factors are not identified and expediently managed.

The purpose of this research was to examine the factors and strategies that impacted the failure or success of a large-scale enterprise information system implementation. The primary objective was to identify implementation related causes of information systems failures, and to prescribe best practices for minimising the risk of failure.

The focus of this study is on the delivery phase of the implementation of Enterprise Resource Planning Systems in two public sector organisations. In-depth studies of the Health Service Executive PPARS System and the Galway Mayo Institute of Technology, Banner System were conducted.

The research recommends that end-user involvement in all stages of the information systems development process is paramount and decisive. The study finds that, in order to ensure a successful outcome of the implementation, committed managers from all levels of management must efficiently manage the change and effectively communicate with

stakeholders. Appropriate educating and training the users, reengineering business processes to gain the most from the new system, and, planning, monitoring and controlling the project, are all vital factors to be considered during each stage of the process.

CHAPTER 1 INTRODUCTION

1.1 Objective of the Study

This study is generally concerned with the delivery phase of large-scale systems development in the Irish Public Sector. It is specifically concerned with identifying and examining, the impact of information system delivery factors and issues, on information systems failures or successes. The objective of the research therefore, is to identify delivery phase related causes of information systems failures and to prescribe best practice for minimising the risk of failure. This research does however, recognise the complexity of social phenomena difficult to quantify, which impacts on the implementation environment. Hence, the research, qualitative by nature follows the enlightenment model (Gewirtz 2003) and is aimed at informing practice by provoking and fuelling debate, which in turn will impact, however modestly, on strategy makers.

The study examines the various approaches and methodologies for Information Systems Development and pays particular attention to the delivery phase strategies of the Systems Development Life Cycle. The study aims to identify the issues and factors that impact the success or failure of the delivery and implementation of large-scale information systems, in particular Enterprise Resource Planning Systems, in Irish Public Sector Organisations.

1.1.1 Primary Objectives

The primary objective of this research is to identify the major factors conducive to the success or failure of the Delivery Stage of large-scale information systems implementation in the context of a number of selected public sector organisations in Ireland.

1.1.2 Secondary Objectives

The research proposes to achieve the primary objectives by achieving the secondary objectives as outlined below:

- To identify and qualify the major strategies used within the Delivery Stage of the implementation phase of a large-scale information system in the Irish Public Sector.
- To outline Individual Variables, Organisational Variables, Situational Variables and Technological Variables within the Delivery Stage that affects the outcome of large-scale information system implementation in the Irish Public Sector.
- To identify and quality the critical role of users in the Delivery Stage of large-scale information systems implementation in the Irish Public Sector.
- To identify and qualify the critical role of management in the Delivery Stage of large-scale information systems implementation in the Irish Public Sector.
- To derive an insight into best 'Delivery Stage Practices' and to prescribe for successful Large-Scale Information Systems Implementation in the Irish Public Sector.
- To identify areas for further research

As few Irish studies have been conducted in this area, the research is purposed to develop an understanding of the problems, issues and pitfalls associated with information systems implementation, with large-scale information systems, in particular Enterprise Resource Planning Systems in the Irish Public Sector.

The remainder of this chapter presents the research plan by outlining the objectives of subsequent chapters and the strategy employed for achieving those objectives.

1.2 The Research Plan

The layout of the thesis is as follow. Chapter two introduces and expands on the concept of Enterprise Resource Planning Systems (ERP). The literature is reviewed for insight into the nature and content of ERP systems. The components of an ERP system are examined. The 'Information' component is examined in detail because the desired output of an information system is quality information to be presented to its purpose. The characteristics and qualities of information are outlined and the purpose of information in the context of management needs is examined.

Chapter three focuses on the process of Information Systems Development (ISD). Several approaches to systems development are introduced and the traditional approach known as the Systems Development Life Cycle is reviewed in detail.

The literature review in Chapter four, examines the Implementation Phase of the Systems Development Life Cycle, with particular focus on large-scale ERP systems. The purpose of the literature review is to identify and qualify the critical issues associated with systems implementation, an innovative process fraught with uncertainty.

Chapter five focuses specifically on the issues and problems encountered during the implementation of an ERP systems in the Irish Public Sector.

Chapter six outlines the research methodology used in the course of the research. The research methodology was planned with due consideration to cost and time constraints. As the research is qualitative and interpretive by nature, case studies were chosen as the research approach.

Chapter seven presents the research findings and prescription for better practices. A synthesis of the results is aimed at fuelling debate, and consequently informing strategy makers better.

Chapter eight provides general conclusions and outlines areas that require further research.

1.3 The Research Question

The research question is: What are the major issues impacting on the success or failure of the implementation of large-scale enterprise systems in the public sector?

1.4 Summary of Findings

In-depth case studies of the implementation of Enterprise Resource Planning Systems in the Health Service Executive and in the Galway Mayo Institute of Technology were conducted.

Based on the findings of this research it is recommended that customisation of a system is kept to a minimum as the complexity of customisation causes problems. The study suggests that attention should be focused on streamlining and reengineering business processes to suit the technical solution.

The research suggests that involvement of 'real end-users' is critical to a successful implementation, and that increased involvement helps as follows: (i) to reduce resistance and increase employee buy-in, (ii) to increase the probability of establishing complete and clear requirements, (iii) to improve business process reengineering, (iv) to ensure users had a better understanding of capabilities, benefits and limitations of the system, (v) to ensure end users understood the business objective of the implementation, (vi) to facilitate invaluable feedback at early stages, and (vii) to improve user morale and motivation.

The research highlights the importance of getting users 'on board'. In order to achieve this, the change process must be consultative, open, and informative. The findings recommend addressing cultural issues, user resistance, conflict and unanticipated events through, planning, information, communication, consultation, demonstration and example, participation, and incentive.

The respondents advocate appropriate management commitment to be critical to successful implementation. Clarity of roles, organisational structure and project structure are vital in large and complex ERP projects.

The research suggests the need to have senior management visibly and vocally committed to the project. Senior management must take responsibility for the project and have the authority to make crucial decisions.

The findings suggest that project management is particularly important to large complex enterprise system implementation. Clear goals, objectives and plans must be communicated and understood and the project dimensions of time, budget and specification require planning, monitoring and controlling.

The research findings clearly recommend that training be timely, effective, on going, tailored to the individual and to the various skill levels in the organisation, and preferably provided by super users.

The findings suggest that an improved communication structure, where valuable feedback is encouraged and considered, will contribute to the success of the implementation of an enterprise resource system. Organisations must strive for 'more effective' communications rather than just 'more' communication.

CHAPTER 2 ENTERPRISE INFORMATION SYSTEMS

2.1 Introduction

Information systems have become strategically important in most if not all organisations. Quality Information Systems improve the efficiency and the effectiveness of processes and decision-making, and as a result, improve competitive advantage. Organisational effectiveness can be enhanced by the use of an information system which provides useful and timely information to decision makers.

According to Laudon & Laudon (2000), Information Systems have become essential for creating competitive firms, for managing global organisations and for providing useful products and services to customers. Information systems are designed to provide crucial information to users for decision-making. Information needs to be obtainable at the correct time, and at the appropriate level of detail to be of use to the recipient (Avison et al. 1998). O' Brien 2005 states that Enterprise Information Systems also known as Enterprise Resource Planning Systems (ERP System) integrate and automate many business processes and information systems, and in effect are the cross-functional enterprise backbone of the organisation.

ERP systems are large-scale, highly configurable, relational database driven systems, which span the whole organisation. These systems span all management levels and can

include, Customer Relationship Management Systems, Supply Chain Management and Enterprise Application Integration Applications (Seddon 1997). ERP systems, built around packaged enterprise integration software, generally require configuration and customisation to align them with organisational business processes and information needs.

Bocij et al. (2003) define an Enterprise Resources Planning System as

> *"a system that provides a single solution from a single supplier with integrated functions for major business functions from across the value chain, such as production, distribution, sales, finance and human resource management."*

Whitten & Bentley (2007) offer the following definition:

> *"An Enterprise Resources Planning system is a software application that fully integrates information systems that span most or all of the basic, core business functions (including transaction processing and management information for those business function."*

Both definitions focus on systems integration and the span of business activities supported. Enterprise Resource Planning is a key concept in today's competitive business world. Before the advent of ERP systems, important business records were stored in many different departments, and each department used different techniques and legacy systems to manage this data. Information was probably duplicated many times and other information may have been difficult to access (Musaji 2002). Beheshti (2006) argues that because data is only entered once in an ERP system, there is a greater chance of accuracy.

During the 90's businesses had difficulty trying to integrate their legacy information systems. Each of these systems had its' own files and databases and awkward integration of all applications (Whitten & Bentley 2007). The software industry recognised that the integrated application needs of businesses were more similar than different, and, thus the advent of a solution in the form of ERP systems. ERP systems were developed originally to serve the needs of the manufacturing environment, but over time they have grown to serve may other types of industries (Musaji 2002). Historically ERP systems evolved from Manufacturing Requirements Planning systems, which were designed to assist production processes (Markus et al. 2002).

An increasing number of organisations are choosing complete software solutions, consisting of integrated modules, to support their operations and business processes (Hoffer et al. 2002). ERP systems are comprised of an integrated set of modules, each supporting an individual traditional business function, with the focus on business processes rather than on business functional areas, as was the focus of legacy systems. All aspects of a single transaction happen seamlessly within a single integrated information system. ERP systems promise improved productivity and alleviate managers from incompatible information systems and inconsistent operating processes through its seamless integration of all information flow throughout the organisation (Dong 2001). The implementation of an ERP system requires organisations to examine their business processes in order to optimise the benefits of increased business efficiency and profitability (Beheshti 2006).

The major advantages offered by ERP systems, gleaned from a broad section of the literature e.g. Whitten & Bentley (2005) & Hoffer et al. (2002) are as follows:

- They provide a single repository for all aspects of a business process.
- They provide module flexibility.
- They provide consistent and accurate information.
- They reduced maintenance.
- Modules are easily added and integrated.
- They provide increased customer value as a result of business process integration.
- They facilitate better sharing of information, due to compatible modules.
- Cost is reduced because they are purchased from a single vendor.
- They generally provide a 'Use of best practice solution'.

It is because of such major advantages that Davenport (1998) describes ERP systems as '*a dream come true*'. However, there are also major disadvantages associated with them. These gleaned from a broad section of the literature e.g. Whitten & Bentley (2005) & Hoffer et al. (2002) are as follows:

- They are costly to implement.
- They force organisational change.
- Because they are off-the-shelf solutions they generally require established business processes to be adapted to fit.
- The current high demand for ERP systems has resulted in skill shortages in this field.
- ERP system implementation is generally complex and lengthy.

While recognising the advantages and disadvantages of ERP systems, Trehan (2005) suggests that if implemented successfully ERP systems provide the following benefits to their host organisations:

- Easier access to reliable information.
- Elimination of redundant data and operations.
- Reduction of cycle times.
- Imitation of the best practices of the organisation.
- Allowance for a flatter organisation.
- Standardisation of information.
- Capacity to meet growth needs of the organisation.

Because of these substantial benefits, ERP systems are perceived as indispensable for large and medium organisation to run their businesses and gain competitive advantage. ERP systems can contain elements of different types of information systems; they have an added complexity not found in other types of information systems that make the implementation of ERP systems prone to failure. Outsourcing has become an attractive option for senior management, in particular in the area of ERP system implementation (Basu & Lederer 2002). The main vendors for ERP systems are SAP, Oracle, Peoplesoft, Baan and SSA (Hoffer et al. 2002; Whitten & Bentley 2007).

2.2 Components of an Information System

The following constitutes ERP systems, as all information systems: *hardware*, *software*, *procedures*, *network resources*, *people* and *data and information*. These are needed to perform input, processing, output and storage, and to control activities that transform data resources into information products. This following section will outline the component parts of information systems.

2.2.1 Procedures

Procedures are the policies and rules that govern the operations of a computer system. Procedures describe actions in a step by step manner and describe how the end user interacts with the information system. Processes are often regulated by procedures. The greater the number and complexity of processes and procedures, the greater the probability of difficulties and the greater the risk of failure with systems implementation.

2.2.2 People / Users

Parker (1993) defines the end user as:

> *"a person who needs the output produced by application software to perform his or her job."*

Users are a vital component in the development of information systems as they are involved in the identification and establishment of the requirements for the new system. The implementation of a new information system is prone to failure if end users are not involved from conception to completion (O' Brien 2005).

Parker (1993) identified three categories of end-users:

- **Non- skilled end-users**

  Non-skilled users are users who are not computer literate and perform tasks that are low in computer knowledge content.

- **Semiskilled end-users**

  Semiskilled users are users who can work with nonprocedural oriented software tools that require a minimum level of computer knowledge.

- **Skilled end-users**

  Skilled users are users who have the ability to write their own programs.

All categorises of end users should be represented appropriately in the implementation process. Satzinger et al. (2002) list the following as typical end user activities: creating records or transactions, modifying database content; generating reports, querying databases, importing or exporting data.

2.2.3 Data and Information

Data is valuable 'raw material' that is normally devoid of meaning until reordered and processed into a coherent pattern of information that has meaning added and is useful. Information is data that has been processed, organised and ordered into facts and figures. This is communicated and understood as an organised body of knowledge, which reduces

uncertainty, ambiguity and confusion. Information is a valuable resource, the possession of which empowers the end user.

Haag et al. (2004), argue that in order to survive in today's economic environment, organisations must know their competition, know their customers, know their business partners and know their organisation. Knowledge comes from having timely access to information and knowing what to do with that information. Quality information is crucial to the survival of the organisation; it is therefore critical that information and knowledge is managed as a key organisational asset.

Haag et al. (2004) describe information as having three dimensions.

- **Time**. The information is available when needed and it is relevant to the time period under consideration.
- **Location**. Information must be accessible to the end user regardless of the location of the end user.
- **Form**. Information must be useable, understandable and free from errors.

According to Marnewick (2005), ERP systems consists of four components:

- The software component – the ERP product.
- The process flow – the way in which the information flows among the different modules of the system.
- The customer mindset – if the system is to succeed, the customers must buy-in.
- Change management – the management of the change at several levels.

It is vital to recognise ERP systems as the sum of their components, and avoid perceiving such systems as just the software component.

2.2.3.1 Qualities of Information

Information is produced for various purposes. In order for information to satisfy the purpose for which it is intended it must be 'good' information. The qualities of 'good' information, as identified across a broad section of the literature, e.g. Haag et al. (2004) & Bocij et al. (2003), are as follows:

Relevance: Information must be appropriate for the purpose for which it is being produced, i.e. it must be decision-relevant.

Timeliness: Information is used primarily for decision-making, which in turn generally leads to actions. Therefore, it is imperative that information is available on time to influence that decision making process.

Accuracy and Verifiability: Information should be free from errors and bias and be as accurate as its purpose dictates.

Completeness and Sufficiency: Information must be complete. This removes the need for the end user to engage in guesswork or create inappropriate closure.

Conciseness and Level of Detail: The level of detail required depends on the level of management and the purpose for which the information is intended

Presentation and Format: Information must be understandable, simple, practical, and suited to the cognitive requirements of the recipient.

Cost Effective/ Of Value: The value gained from the use of information must be greater than the cost of producing information.

2.2.3.2 Information, Management and Decision Making

Management use information to plan, control, measure, record, and primarily to enable decision-making. The type of information required by managers is directly related to their management level in the organisation, and the amount of structure in the decision situations they face (Gory and Scott Morton 1971) see Table 2.1.

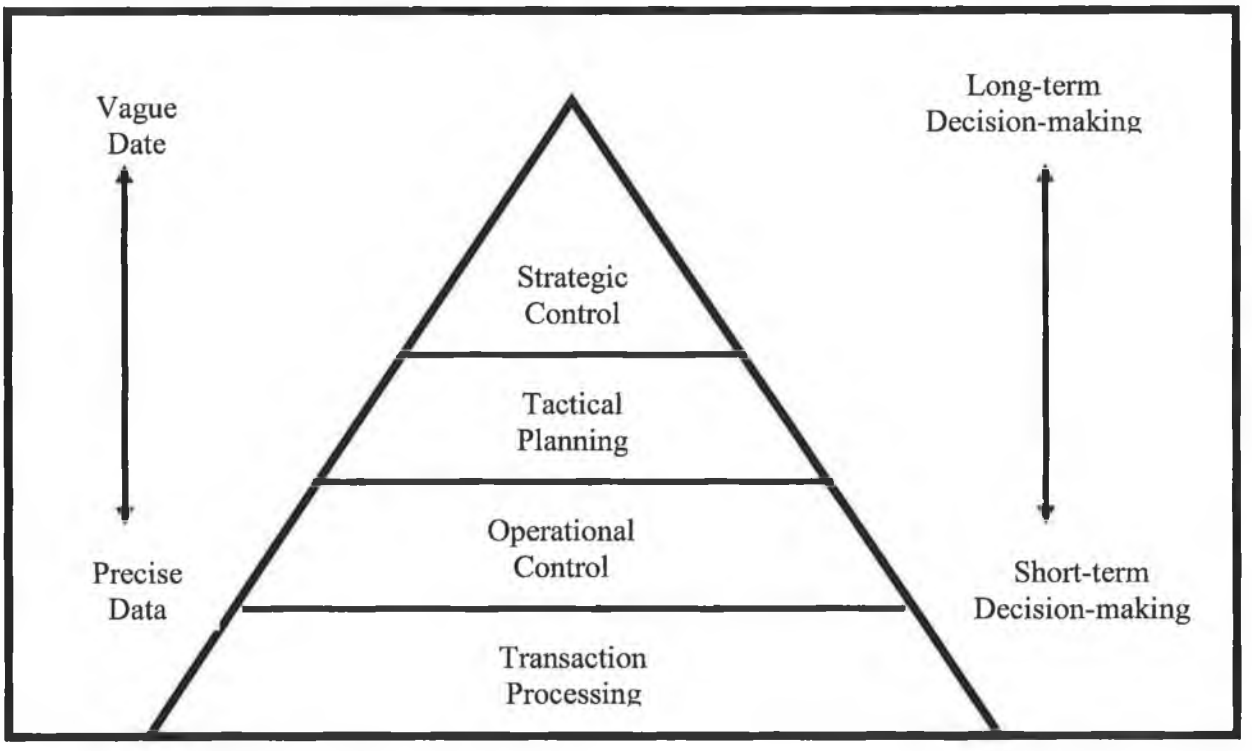
Table 2.1: Information and Decision Making

Table 2.1: Adapted from Lucey (1991)

Management Level	Decision Characteristics	Information Characteristics
Strategic	Long time horizons, large scale resources, much creativity and judgement, usually unstructured, problems difficult to define, infrequent, much uncertainty.	Largely external, informal, resource important, forward looking, qualitative information important, precision unimportant. Instant access not vital, wide-ranging, incomplete.
Tactical	↕	↕
Operational	Repetitive, short time scale, small scale resources, usually structured, clear objectives and decision rules, little or no discretion.	Largely internal, mainly historical, detailed, often quantitative, high precision, instant availability often critical, narrow in scope, comprehensive

Accurate information is vital for management decision-making. The characteristics of information required by managers differ at each management level and vary by source, scope, range, degree of detail, and time frame. Anthony's (1965), three-layer model of the organisation, consisting of operation control, tactical planning, and strategic planning, provides the basis for the most commonly used taxonomy of information system. See Figure 2.1.

Fig 2.1: Layers of Information Systems. Adapted from Burn et al. (1990)



Operational control decisions made by frontline managers are generally informed by historic information generated within the organisation. Results are normally expected. Relevant information will normally be presented in a structured fashion and with a high level of detail. Because operational control requires the day-to-day monitoring of operations, information is required as close to real time as possible.

Middle management uses tactical information to ensure the efficient use of resources in achieving organisational objectives. This type of information is presented frequently, reports performance measurements and highlights deviations and variations.

The characteristics of information required by strategic management is likely to be long range and predictive in nature. Unanticipated information, often from external sources and relating to changes in the market place, can be of substantial strategic importance.

The level of impact on the organisation and the characteristics of information it produces substantially moderate the design and implementation of large-scale information systems.

2.3 Constituents of an Enterprise System

According to Harizanova (2003) organisations need to gather, store, organise and distribute large amounts of data and information. The main purpose of information systems is to produce meaningful information from data. An information system is a means of processing data and is only successful if it provides management with the information it requires in a timely manner. Information Systems are needed to optimise the flow of information and knowledge within the organisation and to help management maximise the firm's knowledge resources (Laudon & Laudon 2000).

O'Brien (2005) outlines three major goals of information systems as applied to business, Information systems provide organisations with support for business processes at an operational, tactical and strategic level. They support the day-to-day routine transaction processing, the tactical decision making process, and, through the innovative use of technology, can provide competitive advantage. According to O' Brien (1995), there are as many ways to use Information Systems in business as there are business activities to be performed, business problems to be solved and business opportunities to be pursued.

Enterprise information systems include enterprise resource planning systems, mainframe transaction processing systems, relational database management systems, and other legacy information systems. This following section provides a taxonomy of the constituent parts of ERP systems by outlining the different types of Information Systems and their uses within the organisation at various levels.

2.3.1. Transaction Processing System (TPS)

Transaction Processing Systems (TPS) also known as Accounting Information Systems (AIS) or Operational-Level Systems, serve the operational level within an organisation. According to Laudon & Laudon (2000), a TPS is a computerised system that performs and records the daily, routine accounting and administrative transactions necessary to conduct the business. They process the more structured and relatively high volume business operations that tend to be predefined and comparatively simple in nature. TPS systems are the main producers of data and information for other information systems. The TPS component of an ERP system provides the information requirement. This category of information system carries out four basic tasks, data gathering, data manipulation, data storage, and document preparation.

Laudon and Laudon (2000) identified five functional categories of TPS systems; sales/marketing, manufacturing/production, finance/accounting, human resources and other types of TPS systems that are unique to a particular industry. These systems carry out the most elementary of day-to-day activities such as sales, receipts, cash deposits,

payroll, credit decisions, flow of materials, order processing, employee record keeping, material control, etc.

The traditional SDLC methodology of systems development and implementation is appropriate for this type of system as end user requirements are unlikely to change significantly and the system is generally stable.

2.3.2 Management Information Systems (MIS)

Management Information Systems (MISs) serve the functions of planning, controlling and operational decision-making by providing regular and routine summary and exception reporting (Laudon & Laudon 2005) Also known as Management Reporting Systems (MRS) and Operational Control Systems (OCS), they are normally used to carry out monitoring and exception processes resulting from the TPS. MISs typically focus on internal events and provide information for short term planning and decision-making. MISs are reporting and control oriented, have little analytical capability, are relatively inflexible and have internal orientation. MISs rely on existing corporate data (Laudon & Laudon 2000).

Examples of Management Information Systems include Human Resource Information Systems, Financial Information Systems, and Manufacturing Information Systems.

The main weakness of MISs as identified by McLeod (1995) is that they are not aimed at the specific needs of the individual problem solvers. The Decision Support System concept was created in response to this weakness.

2.3.3 Decision Support Systems

Decision Support Systems (DSSs) also known as Planning and Analysis Applications are systems designed to support managers in their role as decision makers. There are two types of DSS, model based DSS and knowledge based DSS.

DSS are defined by Bidgoli (1989) as:

> *"A computer-based information system consisting of hardware, software and the human element designed to assist any decision maker at any level. However, the emphasis is on semi-structured and unstructured tasks."*

Keen & Scott-Morton (1978) describe DSS as the application of computers to:

- Assist managers in the decision making process for unstructured tasks.
- Support (rather than replace) managerial activities.
- Improve the effectiveness (rather than the efficiency) of decision-making.

Examples of Decision Support Systems include model-oriented DSS, expert systems, multidimensional analysis, query and reporting tools, OLAP, Business Intelligence, Group DSS, and Group Systems Software.

2.3.3.1 Model Based Decision-Support Systems (DSS)

Model based DSSs assist management in making unstructured decisions, by constructing a conceptual model of the situation. A model created by a DSS can be manipulated to forecast and predict the outcome of possible courses of action. Exploring the possible simulated options highlights the potential risk and benefits associated with each.

2.3.3.2 Knowledge –Based DSS (Expert Systems)

Expert Systems, according to O'Brien (2003), are knowledge-based information systems that act as an expert consultant by simulating expert behaviour about a specific, complex application area. These systems make humanlike deductions about knowledge held in a specialised knowledge base, and explain the reasoning process and conclusions drawn. Such deductions and conclusions can assist decision making for end users.

2.3.4 Executive Information Systems

Executive Information Systems (EISs) are decision support systems aimed at executives. They provide information at a strategic level without the need for technical intermediaries. They are considered as a different type to the DSS because of the level of the organisation on which they impact. Kelly (1994) provides the following definition:

> *"An Executive Information System is a tool that provides direct on-line access to relevant information in a useful and navigable format".*

Kelly (1994) also suggest the EIS needs to be highly navigable, with state-of –the-art user interfaces because EISs are designed for high level managers with limited time, limited keyboard skills and little experience with computers. EISs should excel at identifying broad strategic issues and exploring various strategic directions. EISs address unstructured decisions, use external data and information from DSS and MIS, are not designed to solve specific problems and make less use of analytical models. EISs are designed to utilise integrated office technologies for planning, forecasting, and controlling managerial tasks (Bidgoli 1989). One of the primary objectives of EISs is to protect executives from information overload, hence they are purposed to deliver only information relevant to a decision maker (Rinaldi et al. 1986).

2.3.5 Strategic Information System

Strategic Information Systems (SISs) are the application of contingency management theories and competitive advantage models to information technology (Porter, 1980). According to Laudon & Laudon (2005) SISs change the goals, operations, products, services or environmental relationships of organisations to help them gain an edge over competition. SISs can be used at all levels of the organisation and are more far-reaching and deep-rooted than any of the other systems described above. They may profoundly alter the way a firm conducts its business or the very business of the firm itself, and are aimed at developing a competitive advantage in the market place.

Neumann (1994) summarises the essential purpose of SISs as follows:

> *"...(SIS) find ways to change the rules of the game . . . so that we can use our IS resources to win"*

SISs if properly aligned with business goals and strategies can impact organisational performance. While an ERP system should provide strategic advantage, it may or may not have an SIS as an explicit component.

2.4 Information Systems Quality

Information System quality is determined by whether or not the system meets the processing requirement in a technically efficient and cost-effective manner. Management's perception of information systems quality may vary depending on their individual needs. Generally, the characteristics of a quality information system, as accepted by many writers in the area e.g. Laudon & Laudon (2000) & O' Brien (1995), can be categorised in the following table:

Table 2.2: Qualities of Information Systems

Correctness	The extent to which the final system satisfies the functional requirements of the business.
Efficiency	The extent to which the system maximises effective resource usage
Extendibility	The ease with which new functionality can be added to the system
Adaptability	The ease with which the existing system can satisfy unforeseen requirements
Maintainability	The ease with which existing functionality can be corrected
Reliability	The frequency of failure involving the whole system or a component thereof
Manageability	The ease with which the operational system can be controlled
Understandability	The ease with which the business processes incorporated in the system can be understood.
Usability	The degree to which the system can be integrated into work practices
Integrity	A measure of internal consistency and security against accident
Verifiability	The extent to which outputs and performance can be verified
Reusability	The extent to which the components of the system can be reused.

The perceived quality of information by the system users plays a significant role in the ultimate success or failure of information systems implementation. Sabherwal et al. (2006) observe that system quality and perceived usefulness influence the extent to which an information system is used and consequently system developers and managers should concentrate on developing 'better' systems.

2.5 ERP Systems in the Public Sector - Failure

Enterprise Systems have become the standard for many large and mid-sized, private and public organisations, to run all their major functional and process operations. These large, complex systems may take many years to implement, require participation across many functional areas, and are fraught with difficulties. Kamal (2006) suggests that public sector organisations are striving to improve their productivity and effectiveness, by re-engineering processes, and by implementing information technology solutions. These IT solutions, including ERP systems, enable improved information processing, shared and more rapid responsiveness, resulting in better coordination of the economic activities across the divisions of an organisation. Although IT offers substantial benefits to public sector organisations, it also poses new management and policy challenges, and a high risk of failure. According to Berg (2001) evidence would suggest that the more comprehensive the technology or the wider the span of the implementation, the more difficult it is to achieve success.

Gauld (2006) suggests that by nature the public sector imposes organisational and political influences on projects that may not be present in the private sector. According to Kamal (2006), information systems may be implemented in the public sector in a reactionary rather than in a proactive way, and this may be attributed to bureaucracy and culture.

Large-scale information systems implementation failure is common among public sector organisations. Evidence of this in the Irish Public Sector includes the Irish E-Voting System, The Garda Pulse System, the Credit Union ISIS System, and the Health Board PPARS system. The report by the UK Commissioner of Public Accounts and Comptroller and Auditor General, outlines levels of failure with UK Public Sector IT Projects. Examples of these failures include the UK Passport Agency System, National Insurance Record System, and the Ministry of Defence Project.

A number of researchers have attempted to address the question: Why do these large-scale enterprise system implementations fail in the public sector? A case study by Gauld (2006) reveals the following reasons for failure:

- A failure to understand the potential wide-ranging risk of the implementation.
- Not ensuring that key project leaders were in place throughout the project.
- Lack of information provided to stakeholders with regard to understanding the potential benefits of the new system.

Berg (2001) suggests that one of the core reasons for failure is, overlooking the fact that the IS implementation will ultimately affect the organisations structure and processes. Further he warns against assuming that the implementation is an IT project. The implementation is a process of organisational development, in which users along with the project team is adequately involved.

Barriers to success and reasons for failure of large-scale enterprise information systems will be examined in more detail in the context of the implementation phase of the development process in Chapter 4.

2.6 Summary

Information systems including large-scale Enterprise Systems are composed of hardware, software, procedures, networked resources, people, and data and information. The information component is vital as this constitutes the product and its quality generally defines the quality of the information system itself.

Enterprise Resource Planning Systems (ERP systems) integrate and automate many business processes and types of information systems and in effect are the cross-functional enterprise backbone of the organisation. An increasing number of organisations are choosing complete software solutions, consisting of integrated modules, to support their operations and business processes (Hoffer et al. 2002). If implemented successfully ERP systems provide significant benefits to their host organisations.

There are several types of information systems, normally defined by their level of impact on the organisation, by their purpose and objectives, and by the characteristics of the information they produce. These types of information systems are constituent parts of a large-scale Enterprise System. Transaction Processing Systems process the day-to-day routine transaction of the organisation. Management Information Systems provide timely and accurate information for planning, control and operational decision making. Decision

Support Systems support tactical managers in their role as decision makers. Executive Information Systems provide information to help direct the strategic direction of the organisation. Enterprise Resource Planning Systems encompass all types of information systems and provide an integrated solution to the whole organisation.

2.7 Conclusions

All information systems are designed to increase organisational efficiency and effectiveness, and to control and manage the vital information resource. Organisations invest significant capital in information system and in the development process, and despite the benefits achieved by some information systems, research is abundant with evidence of significant problems encountered with many, in particular large, complex, integrated, enterprise systems. These problems concern systems quality, systems productivity, systems maintainability and system reliability. This study is concerned with identifying the factors that influence such issues, and in particular the implementation of Enterprise Resource Planning systems. The purpose of the systems development process is to provide a quality and cost-effective system that fulfils the needs of the organisation. Factors that influence system quality, system productivity, system maintainability and system reliability are the focus of this study, in particular in the context of the implementation of ERP systems.

CHAPTER 3 INFORMATION SYSTEMS DEVELOPMENT – THE SDLC

3.1 Introduction

Whitten et al. (2004) defined the information systems development process as:

> *"A set of activities, methods, best practices, deliverables, and automated tools, stakeholders use to develop and continuously improve information systems and software"*

Information System Development is the systematic development process applied to developing an information system. The objective of this process is to provide a solution to the business problem identified, and to have a positive organisational impact. Information systems are designed and developed in response to an identified business need or problem that involves processing data. To ensure that quality and cost-effective information systems are developed and that they fulfil the requirements of the organisation some form of systems development process needs to be engaged.

Fitzgerald (2000) poses the following reasons in favour of using a systems development methodology:

- A methodology prescribes steps for a complex process.
- A methodology renders each task visible and transparent, and standardises the development process.
- Methodologies allow skill specialisation and a structural framework for the acquisition of knowledge.

Systems development is a demanding, difficult and challenging task. Post and Anderson (2003) claim that large system development projects are particularly complex to control for a number of reasons, conflicting goals; difficult to ensure subsystems work together; changing needs during the development process; and turnover among MIS employees. Resistance to change and lack of management commitment also pose challenges to the control of the project.

Maguire (2000) points out that there is disillusionment with regard to system being developed because:

- Some information systems are developed over a number of years during which time requirements may have changed.
- Integrated systems are implemented without full understanding their impact on the organisation
- Some of the solutions implemented are only 'solutions looking for problems'.

Fitzgerald (2000) argues that most of the systems development methodologies used today originate in a set of concepts dating back to the 70's. Therefore, there is a need to move from the past to the future by deriving new methodologies more appropriate to the development environment of the 21st century.

Information systems designed to meet the challenges of today's businesses are critical to the success of business activities and initiatives. Successful information systems development is a necessary prerequisite for realising gains in organisational performance

and avoiding losses attributed to development and implementation failures (Raduescu & Heales 2004).

Many organisations employ a standard set of steps, processes and procedures in the development of information systems. Chester & Athwall (2002) identify these stages as follows:

1. Find out what needs to be done – discover what is required of the system.
2. Plan what needs to be done – plan the system.
3. Carry out the plan – build and test and use the system.
4. Evaluate what needs to be done – review the finished process.

The methodology applied to a systems development project will depend on the scale, scope and characteristics of the project (Osborn 1995). According to Boahene (1999) a methodology requires purpose, organisation, sequencing, incentive and agreement. An approach or methodology that is likely to be effective will address the concerns of IS developers in that environment, will manage the unpredictability of the elements and the impact of forces in the environment. Maguire (2000) argues that one constant with IS development is that the process will change the organisation in some way.

According to Whitten et al. (2004) there are many variations to the process of information systems development. Many organisations embrace a standardised process in order to optimize efficiencies in resourcing, to produces consistency in documentation, which will reduce maintenance costs and promote quality. According to Beheshti (2006)

the implementation of an ERP system is a popular approach to the development of an enterprise wide system.

Whitten et al. (2004) indicated that while these approaches vary from one organisation to another most follow a problem-solving approach, which typically involves the following steps:

- Identifying the problem.
- Analysing and comprehending the problem.
- Discovering requirement and expectations.
- Identifying possible solutions and selecting the most appropriate.
- Designing the solution.
- Implementing the solution.
- Maintaining the solution.

Hirschheim et al. (1995) outline the evolution of information systems development methodologies over seven overlapping generations:

First Generation	The emergence of formal life-cycle approaches
Second Generation	The emergence of structured approaches
Third Generation	The emergence of prototyping and evolutionary approaches
Fourth Generation	The emergence of socio-technical, participative approaches
Fifth Generation	The emergence of sense-making and problem formulation approaches.

Sixth Generation The emergence of trade union led approaches

Seventh Generation The emergence of emancipatory approaches

In this chapter the 'Traditional' Systems Development Life Cycle Approach will be examined in some detail. This examination will include an outline of the background and objectives of the SDLC; the generally accepted characteristics of successful systems development; the SDLC stakeholders; the generic stages of the life cycle; SDLC methodologies; and, the strengths and weaknesses of the SDLC. A number of alternative approaches to information systems development will be examined briefly.

3.2 Traditional Approach to Systems Development

The traditional approach to Systems Development involves competent practitioners applying their experience and knowledge of the business being considered and of the technical environment. Generally two questions are being asked, 'what is the system supposed to do?' and 'how might the system work?' (Yeates et al.1994).

3.3 Systems Development Life Cycle

The Systems Development Life Cycle (SDLC) is simply described by Hoffer (2002) as the traditional methodology used to develop, maintain and replace information systems. The SDLC is a model of the life stages of the information system development. It is the most basic methodology that has been applied to the majority of information system

development projects (Avison et al. 1998). The SDLC consists of a number of discrete stages, each with a number of distinct activities. The SDLC does not proceed from one stage to next stage without a management decision to do so.

3.3.1 Background

The SDLC dates back to the 1960's when Enthoven and Rowan developed a linear set of stages for project development. In the 1970's W. Royce was responsible for introducing the formal classic sequential SDLC Waterfall model. Cost over runs and lack of user involvement were consequential features of this model. The incremental model was first introduced in the 1980's. This allowed for a more flexible approach in which linear, sequential steps were staggered and overlapped. Using this model, the project does not proceed to the next stage without user acceptance following a review. In the 1990's newer SDLC models were developed to address the problems and failures associated with the traditional SDLC approach.

With improvements in technology and as a result of the experiences learnt from these failures, new techniques became available to develop computer systems. The most formal of these is the traditional Systems Development Life Cycle. Many organisations have customised this technique to satisfy their own specific criteria with respect to systems development. Despite this customisation the common goal is to build and develop an information system based on the requirements of the users as defined by the systems analysis stage. Advances and improvements in technology and tools, and the diverse features of commercial computer software have improved the software development process.

3.3.2 Objective of SDLC

According to Post & Anderson (2003), the Systems Development Life Cycle was designed to overcome the problems associated with large projects, involving many users and thousands of hours of development, which potentially became "runaway projects" (projects that came in late and over budget). The goal of the SDLC was to design a system to eliminate or control these problems. A key element of control is project management. Whitten & Bentley (1998) argue that the life cycle is essentially a project management tool, used to plan, execute, and control systems development projects. The SDLC according to Bender (2003) should ensure that it is possible to produce more functionality, with higher quality, in less time, with fewer resources and in a predictable manner.

The three primary objectives of a systems development lifecycle (SDLC) according to Bender (2003) is the delivery of high quality systems; the provision of strong management controls over the projects; and the maximising of the productivity of the systems staff. Developers of the original classical operational SDLC, first gathered, synthesised and analysed requirements, then created, tested, and integrated the programs into computer systems and finally implemented the operational system. These steps vary according to the methodologies used. Bender (2003) suggests that an SDLC approach is needed because the development process is composed of many complex tasks which if done in the right order will produce a successful result.

The SDLC specifies the stages, phases and tasks of the project required for the systems development. Each of these stages, phases and tasks is essential to the successful systems development. How this methodology is followed and utilised will ultimately determine the degree of success of the IS implementation.

3.3.3 Characteristics of an Effective Systems Development Life Cycle

According to Berardi & Stucki (2003), a solid SDLC can reduce the risks of an application failing after it is installed. An effective SDLC provides the following:

- Project structure.
- Control and coordination throughout the application life cycle.
- Improved communication to enable a shared understanding of alternative solutions, opportunities and risks.
- Efficiency in the use of business processes, technology and human capital, to ensure lower life cycle costs.
- Project tracking and assurance to senior management and project sponsors.

3.3.4 Stakeholders of the Systems Development Life Cycle

As information systems are becoming more and more widely used in organisations it is likely that everyone in today's workforce will at some stage participate as a stakeholder in the SDLC. Stakeholders are interest groups; those who will be affected by the

outcome, but cannot prevent it, or impact groups; those who can prevent you from achieving the outcomes.

As defined by Whitten et al. (2000)

> *"A stakeholder is any person, technical or non-technical, who has an interest in an existing or new information system".*

Stakeholders can be broadly categorised into the following six groups:

3.3.4.1 System owners

System owners, generally the management team, own the system and pay for it to be built and maintained. The management team are interested in the benefits and value of the systems and the resulting costs, and consequently have a vested interest in the success of an information system implementation.

3.3.4.2 System users

According to Whitten& Bentley (2007) a system user can be defined as:

> *"A 'customer' who will use or is affected by an information system on a regular basis – capturing, validating, entering, responding to, storing, and exchanging data and information."*

System users use the information system to perform or support their work. They define the requirements and the expectations of the systems. As the largest group of stakeholders, system users are interested in a system that will meet system requirements without having to consider costs. System users should be directly involved with information system development projects that affect them. Users can be clerical staff,

administrators, service workers, technical or professional staff, supervisors, middle and senior management. External system users according to Whitten et al. (2000) can include other businesses, trading partners, suppliers, customers and consumers.

According to Doherty et al. (2003) ensuring that users are actively involved in all stages of the systems development and implementation contributes to a high level of system implementation success.

3.3.4.3 System designers

System designers are the technical stakeholders who design systems to meet user requirements within information technology constraints. They are responsible for designing the inputs, outputs, interfaces, files, databases and programs of the system.

3.3.4.4 Systems builders

System builders construct, test and deliver the system, based on the specification received from the designer during the design phase. Effective communication is essential between system designers and systems builders.

3.3.4.5 System analyst

To facilitate the development of the system, the systems analyst liaises between technical and non-technical stakeholders. The system analyst interacts with all stakeholder groups

and performs systems analysis and design. Ensuring a complete and comprehensive requirement analysis is critical to the ultimate success of an information system.

3.3.4.6 IT Vendors and Consultants

The vendors and consultants sell hardware, software and support as required. Increasingly IT vendors and consultants have become partners in the information systems development process to the businesses that purchase their technology, products and services.

3.3.5 Generic Steps in the SDLC

The SDLC approach to IS development is comprehensive and encompasses five basic steps, as outlines in the following section. Although most SDLC methodologies use these five steps, the approaches may differ in terms of time spent on each, who carries out each step or how formal or informal the approach to each step is.

3.3.5.1 Feasibility and Planning.

The objective of the feasibility and planning step is to determine the following: is it feasible to proceed with a proposed systems development project from an operational, economic and technical perspective? Will the solution improve operations? Is the project cost effective? Are the technology and the technical expertise available? The output from this step is a project plan and schedule, which outlines the scope and objectives of the

project. This step of the process is vital to the ultimate implementation success, as it ensures the scope and objectives are agreed and signed off by all interested stakeholders, and ensures that expectations are understood and not inflated.

3.3.5.2 Systems Analysis / Requirements Definition

A complete study and analysis of the current systems will be conducted during the systems analysis and requirements definition step. This will determine how the systems work and what and where are the problems. The system is divided into smaller easier to understand, documented pieces. The output from this stage is a complete documented description of the business requirements, in text and diagram formats. The ultimate success of the implementation is dependent on the quality of systems requirements analysis.

The quality of this analysis will improve by involving appropriate users. According to Ovaska (2006), the establishment of requirements is the most difficult step in the development process, and if not carried out properly will cripple the resulting system. 'Scope creep' is a common problem associated with the development and implementation of information systems. A thorough, comprehensive, complete, all-inclusive system analysis requirement will help minimise the level of 'scope creep'. Simon's theory suggests that we can never find an optimal solution, and often must settle for the most satisfying one (Ovaska 2006). Scope creep causes implementation delays, increased costs, and dissatisfied end-users.

Ovaska (2006) suggests that problems associated with requirements gathering during large-scale information systems development can be addressed by taking an iterative approach. This facilitates the unfolding of requirements during social interactions, communication and negotiation between involved stakeholders.

3.3.5.3 Systems Design

During the systems design stage the new systems is further divided into subsystems. This design description includes details of data inputs, outputs, processes, database designs, feedback and controls, and backup and recovery plans. Any changes to design should be made before signing off. Design takes place at the end of this stage. Any hardware and software required is purchased, programs are coded and tested, manuals and processes are documented.

In the context of commercial software – the 'buy' solution, the systems design stage involves the procurement and decision analysis phase, where technical alternatives are researched and proposals are solicited from vendors. The selected solution may require customisation based on business requirements.

3.3.5.4 Systems Implementation

The system should be implemented giving due consideration to users attitudes to change. Users should be encouraged to accept the change resulting from the system

implementation. Systems implementation incorporates two stages, construction and delivery. Construction involves, refining system standards; acquiring hardware, software and IS services; building and testing networks and databases; installing and testing the new system; and testing and validating the new program. Delivery involves conducting system testing; preparing the conversion plan; conducting acceptance testing; installing databases; documentation; training; and installation. The approach to implementation and the management of issues emerging will impact on the overall success or failure of the system implementation.

3.3.5.5 Maintenance

Maintenance is the process of correcting errors, adapting to changes in business procedures and enhancing the new functionality.

3.3.5.6 Evaluation

During the evaluation stage the effectiveness and success of the system implemented is measured along with the effectiveness of the development process used. Systems are evaluated on cost effectiveness, reliability, availability, and security. Systems are also evaluated on whether or not system goals and objectives were met, and on the resulting impact on the organisations revenue, productivity and competitive advantage. The users will ultimately determine whether or not the system is 'good'.

3.3.6 SDLC Methodologies

According to Whitten & Bentley (1998), a methodology is a physical implementation of the SDLC; a true methodology should encompass the entire SDLC. Most modern methodologies prescribe for the use of several development tools and techniques.

Avison & Fitzgerald (2003) suggest that over 1000 methodologies, methods and tools, collectively known as Information Systems Development Methodologies (ISDM), have been developed to manage the development and implementation of information systems. These methodologies range from a structured and linear "hard" approach to a more "soft" approach that focuses on more iterative, and action based perspective. Fitzgerald (2000) suggests that many methodologies are not applied rigorously nor are they applied in the same way to different development projects. Many organisations apply an in-house methodology or a variation of published methodologies.

Organisations generally adopt a particular methodology to all systems development projects in order to ensure consistency, traceability, reproducible documentation, quality and common standards across all SDLC projects. Fitzgerald (2000) suggests that methodologies contribute a framework for the use of the tools and techniques, and that developers are aware of the limited contribution of methodologies. The following section provides a description of a sample of information systems development methodologies.

3.3.6.1 Waterfall Model Methodology

In applying the Waterfall methodology the emphasis is on sequentially completing each phase of the development process before proceeding to the next (see figure 3.1). The development process is 'frozen' after each phase is complete. If a change is required during the development process a formal change process is followed.

The waterfall methodology uses top-down development, consisting of a set of independent phases completed sequentially, where one phase leads into the next. This methodology is best applied to a software development project where requirements and the implementation of it are clearly understood, such as transaction processing systems.

Figure 3.1 Waterfall Model

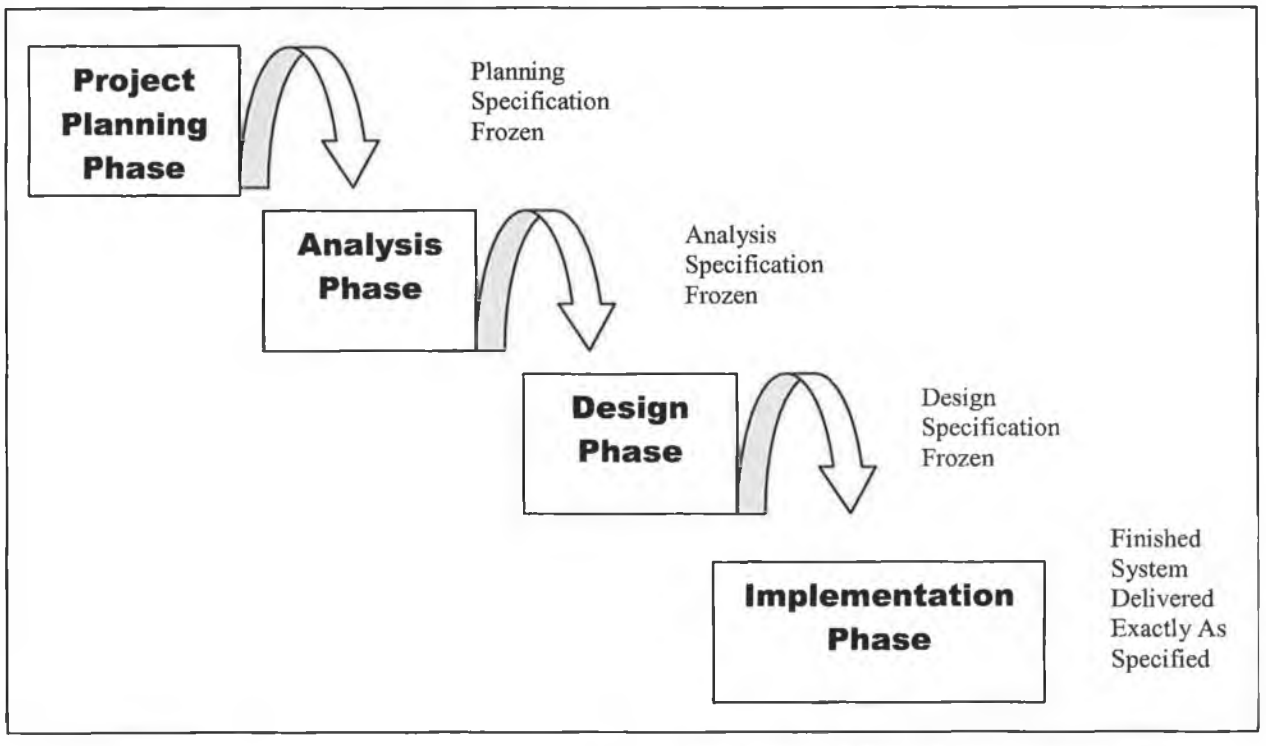


Figure 3.1: Adapted from Satzinger (2002)

3.3.6.2 Iterative Development or Incremental Strategy

The iterative approach, though firmly based on the life-cycle model, recognises that in reality development is seldom a purely linear process and iteration of phases of tasks is often desirable (see figure3.2). Flynn (1993) defines iterative development as:

> *"The process of performing a task within a phase more than once".*

As new information becomes available it may be necessary to repeat some of the phases or tasks. Each iteration refines previous results, and the assumption is that no one gets it right first time (Satzinger 2002). Each iteration is in itself a mini-project.

Figure 3.2: The Iterative Model or Incremental Strategy

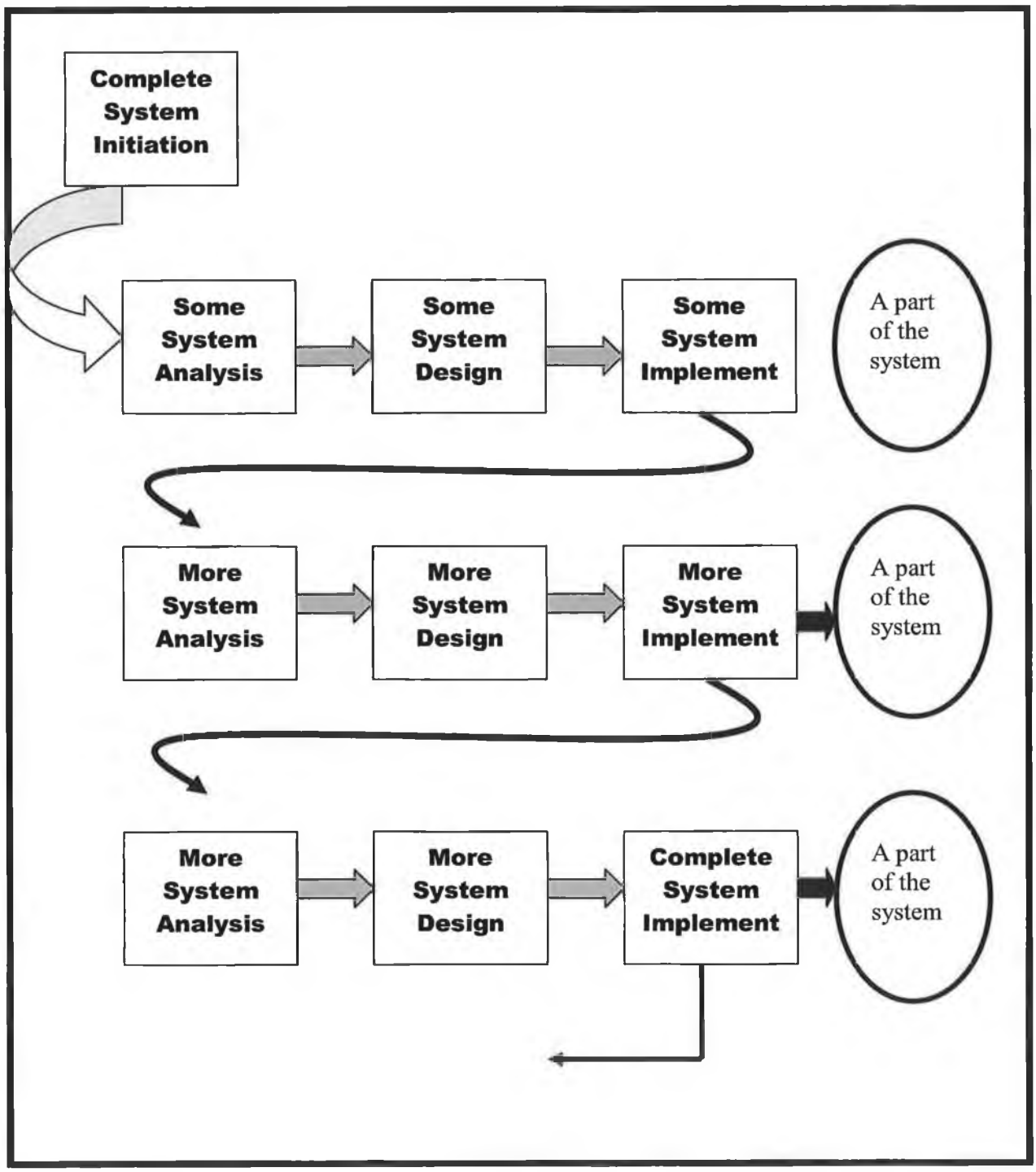


Figure 3.2: Adapted from Whitten et al. (2004)

3.3.7 Strengths of the Systems Development Life Cycle

As the SDLC operates in a linear model, each sequential phase is clear-cut with a beginning and an end (Flynn 1998). The SDLC approach ensures progress is reviewed before progressing to the next stage. Informed management decisions are facilitated at the feasibility phase. The use of documentation standards helps ensure systems documentation is complete and communication is facilitated (Walters et al. 1994).

The strengths of the SDLC, as presented by Avison & Fitzgerald (1995), are generally accepted by writers in the area. The SDLC provides a methodology that was tried and tested, in which a series of sequential phases, divided into tasks and activities are each spelt out in detail, with specific deliverables identified. The process only proceeds to the next phase when a review of the current phase is completed and signed off. The use of documentation standards help to ensure that documentation, including specification, is complete and communicated to all interested stakeholders.

3.3.8 Weaknesses of the Systems Development Life Cycle

According to Yeates et al. (1994) traditional methods have singly failed to deliver the goods in terms of developing information systems that are robust and flexible to meet users' needs.

The weaknesses of the SDLC, as presented by Avison & Fitzgerald (1995) and Laudon & Laudon (2005) are generally accepted by writers in the area. The process of development

is lengthy and prolonged and as a result is costly. The information needs of management are not being met and the methodology is not suitable to the development of a management decision system. The high level of documentation required leads to difficult version control. Bohaene M. (1999) suggests that any approach to IS development requires purpose, organisation, sequencing, incentive and agreement as well as encapsulating consciousness-generating knowledge and the latter is what is lacking in SDLC based methodologies.

3.4 Alternative Approaches to Systems Development

The SDLC approach is adequate for the system development needs of the 1970's, and is in some cases still being used successfully today, but there have been a significant number of developments and improvements with alternative approaches (Avison & Fitzgerald 1995). According to Fitzgerald (2000), experienced developers tend to use methodologies and these methodologies are likely to be customised for the particular development project. The following sections provide a description of a number of alternative approaches to information systems development.

3.4.1 Structured Systems Development

According to Yeates et al. (1994) the traditional approach to systems development involves the analysis of requirements, the specification of requirements and high-level design. This approach does not involve the system users to a large degree. This can be

seen as one of the problems that led to the failure of information systems; not providing the user with what they wanted or needed. As a result a structured approach was developed to overcome the problems with analysis and design. Structured methods focus on data structures, they use diagrams and structured English, and, they concentrate on business requirements by following a general structured sequence of design and analysis (Yeates et al. 1994).

Structured Systems Development refers to systems development using structured analysis, structured design and structured programming. According to Satzinger et al. (2002) structured programming was developed in the 1960s to provide guidelines to improve quality of computer programs, structured design was developed in the 1970s to enable combining separate programs into more complex programs, and structured analysis evolved in the 1980s to help clarify requirements before designing the programs. Samples of structured systems development approaches are described in the following sections.

3.4.1.1 Structured Analysis, Design and Implementation of IS (STRADIS)

The Structured Analysis, Design and Implementation of IS methodology proposed by Gane & Sarson (1979) which emphasises structure, uses process-oriented techniques, functional decomposition, data flow diagrams, decision trees, decision tables and structured English (Avison & Fitzgerald 1995). STRADIS is concerned principally with systems analysis, to a lesser degree with systems design and scarcely at all with implementation.

3.4.1.2 Structured Systems Analysis and Design Methodology (SSADM)

Described by Chester & Athwall (2002), SSADM is the standard UK government analysis and design methodology. SSADM covers data, processes and events views of the system. According to Bocji et al. (2003) SSADM is one of the most extensively used functionally rationalistic methodologies in use in the UK today. This methodology concentrates on the feasibility, analysis and design and little focus is on implementation and changeover. The methodology is highly structured, provides very detailed guidelines and rules, and documentation pervades all aspects of the project (Avison & Fitzgerald 1995). The techniques were purposed to alleviate problems in information systems development by imposing discipline on a previously undisciplined process. The term structured is applicable according to Hevner (1988) because they employ some system of hierarchical decomposition in managing size and complexity. Structured analysis draws on structured techniques attributed to Gane and Sarson (1979), while structured design is attributed to techniques developed by de Marco (1978), Yourdon and Constantine (1979), and Myers (1975).

Structured analysis is important, as incorrect systems specification will almost certainly jeopardise project success. It replaces 'old style functional specification' with a structured specification characterised as follows: it is graphic and concise; top-down partitioned; non-redundant; and emphasis is logical not physical (Yourdon 1980). The methodology presents a 'three-views' model of the system: (1) the data in the system; (2) the events the system must respond to; and (3) the functions as perceived by the users (Yeats et al. 1994).

3.4.1.3 Yourdon Systems Methods (YSM).

According to Hoffer et al. (2002) by making analysis and design more disciplined, through the use of data flow diagrams, transform analysis and other tools, Yourdon (1980) sought to emphasise and improve the analysis and design phases of the development process, with the objective to reduce maintenance time and effort.

Yourdons approach was to downplay the need to model the user's current system during the analysis work as it was believed that it was perceived to be a waste of time and effort and often unpopular with the users (Yeats 1994). Yourdon (1980) advocated building the essential model, which is a logical model of the required systems. This has two components, the environmental model and the behavioural model, together forming a complete and consistent picture of what the system is required to do.

Avison & Fitzgerald (1995) outlines the following as the three major phases of YSM:

1. Feasibility Study – the environment, the present system and the problems associated with it are studied during this phase.

2. Essential Modelling – having completed an overview of the current system an essential model, comprising an environmental model and a behavioural model, is constructed. The models should describe 'what the system will do?' with data flow diagrams; 'what happens when?' with event lists; and 'what data is used in the system?' with entity relationship diagrams.

3. Implementation Modelling – bridges the gap between specification and design.

3.4.2 Prototyping Approaches

3.4.2.1 Prototyping

Prototyping is defined by Hoffer et al. (2002) as:

> *"An iterative process of systems development in which requirements are converted to a working system that is continually revised through close work between an analyst and users."*

Using CASE tools a scaled-down version of the system, significant enough to highlight its value as a computerised solution, is designed and built. A prototype is quickly built based on initial basic requirements. Once built the user having used the scaled down version will provide feedback to the analyst on how it can be improved. The next version is built based on this feedback. This process is repeated until the user is satisfied with the system.

According to Kendal & Kendal (1999) the analyst is looking for reaction and feedback from the users and management on suggestions for change, possible innovations and ideas, and plans with regard to the sequence of development and revision plans.

Avison & Fitzgerald (1995) argue that prototyping addresses some of the shortfalls of the traditional approaches to systems development in that, users only see their information system at the implementation stage. This is often too late for changes; the first version is the last and therefore at a high risk of failure.

According to Whitten et al. (2004) the prototyping approach encourages and requires user participation; it can accommodate changing requirements and increases creativity; it's an active model that allows for early detection of errors; and, the approach can speed up the phases of the lifecycle. Despite these advantages the approach has a number of shortcomings. Due to the lack of analysis it can solve the 'wrong problem'. Due to its flexibility it can be difficult to control changing requirements. If the project is under time pressures there may be premature commitment to design and the prototype may become the finished product; and, the vital task of quality documentation is neglected.

3.4.2.2 RAD

Bocij et al. (2003) defines RAD as:

> *"A method of developing information systems which uses prototyping to achieve user involvement and faster development compared to traditional methodologies such as SSADM"*

Rapidly changing business needs and the ever increasing competitive nature of the business environment has driven the need to develop information systems faster (Avison & Fitzgerald 1995). This need together with the availability of high-powered computer tools to support systems development led to the popularity of the RAD approach.

Hoffer et al. (2002) argues that the RAD approach to systems development promises quicker deployment of improved systems at lower cost, by having system developers and users working together in real-time to develop systems. RAD compresses the phases of

the development process into intensive work delivered by small, cross-functional teams. Prototyping receives the most emphasis within this methodology (Osborn 1995).

The strength of RAD, as presented by Osborn (1995), is that it can build interfaces and roll prototypes into production code at speed and under acceptable control, and it is suited to developing information systems to support high-level, unstructured processes.

3.4.2.3 Agile Development

According to Whitten et al. (2004), agile development is a strategy whereby flexibility is given to the system developers to select appropriate tools and techniques, from a variety of methodologies, to best accomplish the development task at hand. By adapting this approach, it is believed the best balance between quality and productivity will be reached. The agile methodology evolved as a reaction to the traditional bureaucratic, slow, heavily regulated and regimental methodology of the Waterfall approach. Fowler (2005) suggests that the Agile approach is a compromise between too much process and no process, it is less document-oriented and more code-oriented. The approach is adaptive not predictive; it is people oriented, not process oriented.

3.4.3 Object-Oriented Development

Whitten & Bentley (2007) defined object-oriented development as:

> *"An approach used to specify the software solution in terms of collaborating objects, their attributes, and their methods."*

Object-oriented development has it roots in engineering and electronics. Its evolution proceeded bottom up, from programming to design to requirement's analysis. According to Balmelli et al. (2006) object-oriented software development led to the development of systems models to characterise complex behaviours. Object-oriented development is suited to replicating real world objects as software objects, due to its potential in modelling semantic relationships and associations among objects. The object-oriented development life cycle involves progressively developing an object representation through the phases of analysis, design and implementation (Hoffer et al. 2002). Object-oriented programming emerged as a term associated with the development of 'Smalltalk', the original object-oriented language, often regarded as pure object-oriented language (Loy 1989). The programming language C++ has featured prominently in the history of object-orientation. C++ offers a traditional language and eases the transition to an object-oriented environment. Object-oriented development continues its appeal with the upsurge of interest in user system interface (USI). As object-oriented programming matured an interest developed in object-oriented analysis and design. It was recognised that a higher level of reuse as provided by object-oriented design would bring great benefits (Coad et al. 1991).

Object-oriented design is a technique that involves the design of the software being based on real-world objects (customers, suppliers, employees, products data and procedures), rather than on traditional design where procedures operate on separate data (Bocij et al. 2003)

The main advantages of object oriented approaches as outlined by Bocij et al. (2003) include:

- More rapid development.
- Lower costs as a result of reuse of code.
- End-users understand objects as they are based on real-world objects.
- Generic concepts can easily be incorporated into the code.

SAP uses object-oriented structure in its R/3 ERP product. Here several hundred standard business process modules are provided that can assist in rapid implementation of the system for new users. These business processes are defined as objects (Bocij et al. 2003).

3.4.4 Socio-Technical Design Approach (STS)

Socio-technical design advocates the direct participation of end users in the systems development process. The system includes the users, developers, the information technology and the environment in which the information system is to be used (Scacchi (2003). The Tavistock Institute for Human Relations, widely credited with developing the concept of STS design, suggests a need for a fit between the technical subsystem and the social subsystem of the organisation (Badham et al. 2000). STS emerged in order to improve relations with people who were 'dehumanised' by modern industrial society.

The goal of the socio-technical approach, according to Hirschheim et al. (2000) is to:

> *"provide an approach for IS development that enables future users to play a major part in the design of the system, to cater to job satisfaction objectives in addition to more technical and operational objectives"*

In order to achieve this goal the following key principles of the approach, as outlined by Badham (2000) must be considered:

- Systems are made up of interdependent parts.
- The systems must adapt to and pursue the goals of the external environment in which it operates.
- A socio technical system is made up of separate yet interdependent technical and social subsystems.
- Goals can be achieved by different means.
- Performance depends on jointly-optimising the technical and social sub-systems, i.e., where neither the technical nor social sub-systems are optimised at the expense of the other

Examples of STS approaches that apply these principles are Pava's (1983) Methodology and ETHICS (Effective Technical and Human Implementation of Computer-based Systems) Methodology.

3.4.5 Soft Systems Methodology (SSM)

Developed by Peter Checkland, Soft Systems Methodology emphasises the need for human involvement in the systems development process and the need to recognise non-

technical experts as a part of that system (Bocij et al. 2006). This methodology deals with the unpredictability of human activity systems, as people may have conflicting attitudes and objectives.

Soft problems have a large social and political component difficult to define. Other methodologies were inadequate for the purpose of dealing with extremely complex problems that have a large social component (Couprie et al.). According to Hirschheim et al. (2000) the goal of the SSM approach is to provide a learning methodology to support debate on desirable and feasible changes.

Bocij et al. (2006) outlines the seven stages of Soft Systems Methodology as follows:

1. Problem situation unstructured – finding out as much as possible about the problem from as many different stakeholders as possible
2. Problem situation expressed – gathering an informal picture of the problem.
3. Formulate a concise description of the human activity system.
4. Formulate a conceptual model of the key activities and processes.
5. Compare the conceptual model with reality.
6. Assess the feasible and desirable changes.
7. Take action to improve the problem situation.

Examples of SSM include SSM81 Checkland's 1980 Methodology, Wilson's 1984 Methodology and Checkland and Scholes' 1990 Methodology.

3.5 Principles of Successful Systems Development

Whitten & Bentley (1998) outline a number of underlying principles for the management of the systems development process that apply to any methodology used; these are outlined in the following section.

3.5.1 Get The Owners And Users Involved

End-users are defined by O' Brien (2005) as:

> *"...people who use an information system or the information it produces. They can be customers, salespersons, engineers, clerks, accountants, or managers."*

End-users have a vital role in the ultimate success or failure of a new information system. End-user participation will help to ensure that not only technical needs, but also social needs will be met. To help win the acceptance of new ideas, it is recommended to seek agreement from users on decisions that may affect them. This research will study in particular the issue of end-user involvement and its influence on the ultimate success or failure of the system implementation.

3.5.2 Use A Problem-Solving Approach

A methodology is a problem solving approach to developing systems. The classic problem solving approach of studying and understanding the problem, defining requirements, selecting 'best' solution, implementing the solution and evaluating the impact, is suggested by Whitten & Bentley (2001).

3.5.3 Establish Phases and Activities

Generally projects are quite large, and include analysis, design, implementation and maintenance, and therefore need to be broken down into manageable activities and tasks. The methods, tools and techniques can then be applied to each activity.

3.5.4 Establish Standards for Consistent Development and Documentation

Establish development and documentation standards to ensure consistency in information systems development. These standards will describe activities, responsibilities, documentation guidelines, and quality checks. Documentation is a critical by-product of the systems development effort.

3.5.5 Justify Systems As Capital Investments

Investment in an information system is a significant capital investment for most organisations. For that reason it is important to identify several alternate possible solutions, evaluate them each in terms of cost-effectiveness and select the best solution.

3.5.6 Don't Be Afraid To Cancel Or Revise The Project Scope.

The phased approach to systems development provides an opportunity to re-evaluate the feasibility study. Building multiple feasibility checkpoints into the systems development methodology provides this opportunity. A cancelled project is less costly than a failed implementation.

3.5.7 Divide And Conquer.

Divide a system into subsystems to make it more possible to conquer the problem and bring it to a successful conclusion.

3.5.8 Design Systems for Growth and Change.

Frequently systems that are designed to meet current requirements are difficult to modify in response to new or changing needs. It is important for organisations to develop a system that will not only meet the systems requirements today but will satisfy anticipated future requirements.

3.6 Summary

Information System Development is the systematic development process applied to developing an information system. Information systems designed to meet the challenges of today's businesses are critical to the success of business activities and initiatives. Many organisations employ a standard set of steps, processes and procedures in the development of information systems.

The traditional Systems Development Life Cycle approach to systems development is a model of the stages of the information system development. It is the most basic methodology that has been applied to the majority of information system development

programs. Alternative methodologies have been developed in light of the shortcomings of the SDLC, of changing requirements, and, of demands for speedier systems development.

Whatever methodology or approach adopted by the organisation for developing or acquiring an information system there are a number of underlying principles that should be applied to ensure the successful development and implementation. These principles advocate, justifying the capital investment of the system development, involving the user, breaking the process down into phases and tasks, establishing quality standards, reviewing often and cancelling if necessary, and, designing an expandable and flexible system.

3.7 Conclusion

Systems development and implementation involves the substantial investment of human, financial, technical and time resources. An organisation will choose the most appropriate methodology to apply to a particular information systems development project. This study is concerned with the factors that influence the success or failure of the implementation phase of that methodology in the context of large-scale systems implementation. The basic principles discussed in this chapter apply to all software development and implementation projects regardless of the chosen methodology.

CHAPTER 4 IMPLEMENTATION

4.1 Introduction

Implementation is simply defined by Satzinger et al. (2002) as:

> *"...the activities that occur before the information system is turned over to its users."*

Kendal & Kendal (1999) describe implementation as the process of assuring that the information system is effectively functioning, and then allowing users to take over its day-to-day operation for use and evaluation. It is important to recognise the factors that have the most influence on the implementation success, regardless of the type of information systems being implemented (Soja 2006). Managers must recognise and understand the impact of the ERP system implementation on the organisation (Marnewick 2005).

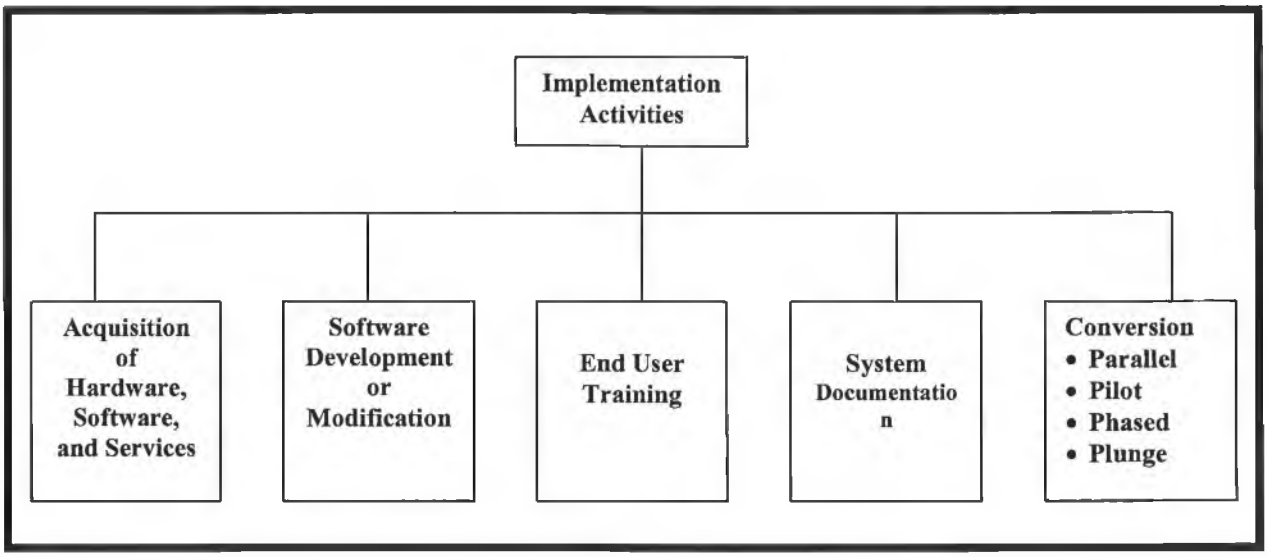
The implementation phase, in the main, consumes more time and resources that any of the prior phases of the Systems Development Life Cycle. Huge numbers of resources are involved in testing and construction. The process of implementation is very complex as many independent actions must be coordinated. In order to manage the coordination of these activities a project team led by a project manager is usually appointed and an implementation methodology is generally followed. Snell (2001) argues that a good implementation methodology should be modular, scalable, sequential, comprehensive and flexible. The methodology should address cultural, technical and business related

factors that may affect the implementation. According to O' Brien (1999) the implementation phase can be difficult, challenging and time consuming. A successful implementation phase is vital in order to ensure the success of a newly developed system, as even a well-designed system is likely to fail if not correctly implemented.

Hoffer (2002) argues that the process of implementing a new system into an organisation is not a mechanical one. The context of the organisation is defined and shaped by those who work there. The work habits, beliefs, interrelationships, culture, traditions, and the personal goals of the workers, and the policies and goals of the organisation, affect the implementation. The implementation is also influenced by the organisational context and environmental factors, and due attention must be given to these influences during the implementation. As a result there is no one best process or methodology for a system implementation. An effective implementation can result in many benefits, including enterprise management and information flow enhancement (Soja 2006).

O' Brien (1999) identifies in Figure 4.1 the activities within the implementation process, which are required to convert a newly developed information system into a functioning system for end-users.

Figure 4.1: Implementation Process Adapted from O' Brien (1999)



Hoffer et al. (2002) summarise the purpose of the implementation phase as follows:

> *"...to build a properly working system, install it in the organisation, replace old systems and work methods, finalise system and user documentation, train users, and prepare support systems to assist users."*

The Implementation Phase is further divided into a number of stages. Bocji et al. (2003), Whitten & Bentley (2007) identify these as the Construction Stage and the Delivery Stage. The following sections describe these stages, and provide a detailed description of the activities of the delivery phase, which is the focus of this study.

4.2 Construction Stage

The purpose of the construction phase, also know as the systems build stage, is to build and test a functional system that meets business and design requirements. During the construction phase programmers create the software and programmers and end-users test the release versions of the software (Bocji et al. 2003). Programming is considered a major part of the construction phase. Documentation is written and training takes place during this stage.

According to Whitten & Bentley (2007), as there is a significant trend towards acquiring or purchasing software packages as a system solution, the implementation and integration of software components is becoming a more common aspect of the construction phase.

The purpose of the construction stage is to develop and test a functional information system that meets business and design requirements, and to implement the interfaces between the new system and the existing systems (Whitten and Bentley 2007). Where the software is developed in-house, programming is a major aspect of this stage. Where the software has been acquired, as is becoming more common, the stage primarily involves the implementation and integration of the software components.

The New York State, Project Management Guide describes the Construction Phase as:

> *"all the activities to be completed, to build and validate the system so that it is ready to be turned over for to end-users for System Acceptance".*

The construction of all components of the systems, including utilities required to satisfactorily prepare and load the data, takes place during the construction phase.

4.2.1 Prepare for System Construction

The purpose of system construction preparation is to get the technical environment and the involved stakeholders ready for the successful completion of construction. According to the *NYS Project Management Guide*, the pressure of meeting deadlines generally increases at this stage, and therefore presents a growing need to stick to defined procedures. It is vital at this preparation point, that all stakeholders involved are clear about the purpose of the new system, understand the testing required, and the processes to be followed.

A development environment and a quality assurance environment may be required to carry out the tasks of the construction and implementation phases. During this preparation these environments will be planned, installed and configured.

4.2.2 Refine System Standards

As a result of day-to-day informal interaction among project team members, situations naturally arise where development standards, release management standards and configuration management standards need to be reviewed. The *NYS Project Management*

Guide advocates reviewing standards and processes periodically to reduce project risks and to re-evaluate existing standards.

4.2.3 Acquiring Hardware, Software and Services

The acquisition of hardware, software, and services is, according to O' Brien (1999) a key implementation activity. Hardware, software and services can be acquired from many sources in the computer industry, therefore their evaluation and selection is critical at this stage of the implementation. O' Brien (1999) advocates the use of a formal evaluation process which will reduce the likelihood of buying inadequate, unnecessary or inappropriate hardware or software.

4.2.3.1 Hardware Acquisition and Evaluation

The physical and performance characteristics of hardware must be evaluated and measured. The following table includes a list of Hardware Evaluation factors, as presented by O' Brien (1999).

Table 4.1: Hardware Evaluation Factors Adapted from O' Brien (1999)

Performance	What are the speed, capacity, and throughput?
Cost	What is its lease or purchase price?
Reliability	What are the risks of malfunction and its maintenance requirements? What are its error control and diagnostic features?
Availability	When is the firm delivery date?

Compatibility	Is it compatible with existing hardware and software? Is it compatible with hardware and software provided by competing suppliers?
Modularity	Can it be expanded and upgraded by acquiring modular "add-on" units?
Technology	In what year of its product lifecycle is it? Does it use a new untested technology or does it run the risk of obsolescence?
Ergonomics	Has it been "human-factor engineered" with the user in mind? Is it user-friendly, designed to be safe, comfortable and easy to use?
Connectivity	Can it be easily connected to wide area and local area networks of different types of computers and peripherals?
Scalability	Can it handle the processing demands of a wide range of end users, transactions, queries, and other information processing requirements?
Software	Is system and application software available that can best use this hardware?
Support	Are the services required to support and maintain it available?

There is more to acquiring and evaluating hardware than merely finding the cheapest and the fastest device available. The hardware selected must be appropriate for the system being implemented, the organisation, the technology available, and the users.

4.2.3.2 Software Acquisition and Evaluation

O' Brien (1999) summarises a list of selected software evaluation factors. Along with evaluating the software against the factors under which the hardware is evaluated, the following factors should also be considered.

Table 4.2: Software Evaluation Factors Adapted from O' Brien (1999)

Efficiency	Is the software a well-developed system of computer instructions or objects that does not use much memory capacity or CPU time?
Flexibility	Can it handle its processing assignments easily without major modifications?

Security	Does it provide control procedures for errors, malfunctions, and improper user?
Connectivity	Is it network-enabled so it can easily access the Internet, intranets, extranets, and other networks on its own, or by working with network browsers or other network software?
Language	Is it written in a programming language that is used by the organisations own computer programmers?
Documentation	Is the software well documented? Does it include helpful user instructions?
Hardware	Does existing hardware have the features required to best use this software?

As with hardware, evaluating and acquiring software is not simply about cost. Software, which does not meet the criteria as specified at requirements definition, even if acquired at a low cost, is unlikely to satisfy the requirements of the organisation.

4.2.3.3 IS Services Acquisition and Evaluation

Information Systems services in the form of, assistance during installation of hardware or software, user training and hardware maintenance, may be required during the implementation phase. O' Brien (1999) suggests the following evaluation criteria for selecting these services.

Table 4.3: Services Evaluation Factors Adapted from O' Brien (1999)

Performance	What has been their past performance in view of their past promises?
Systems Development	Are systems analysis and programming consultants available? What are their quality and cost?
Maintenance	Is equipment maintenance provided? What are its quality and cost?
Conversion	What systems development, programming, and hardware installation services will they provide during the conversion period?

Training	Is the necessary training of personnel provided? What is its quality and cost?
Backup	Are several similar computer facilities available for emergency backup purposes?
Accessibility	Does the vendor have a local or regional office that offers sales, systems development, and hardware maintenance services? Is a customer hotline provided?

As more organisations are acquiring the services of consultants and vendors for support during the stages of the IS development life cycle, it is critical that the services are evaluated against the recommended criteria.

4.2.4 Build and Test New Networks

Where network requirements have been identified, the implementation of the network is a prerequisite for the remainder of the construction phase. The network is implemented using the technical design specification prepared during earlier phases of the systems development life cycle. According to Whitten & Bentley (2007) this activity is principally the responsibility of the network designer and network administrator.

4.2.5 Build and Test Databases

If new or modified databases are required the building and testing of the databases must directly precede all other programming activities, as databases are the resources shared by the computer programs to be installed (Whitten & Bentley 2007). The database designer has primary responsibility for this activity. The task may also involve the

participation of systems users, analysts, designers and systems builders. The database schema specification is the input to this activity and the database structure is the output.

4.2.6 Install and test New Software Packages

If new software has been acquired as a systems solution, it will be installed during the installation and testing of new software stage. Whitten & Bentley (2007) identify the following stakeholders involved during this stage: systems analyst, designers, builders, vendors and consultants. The systems analyst will clarify requirements and test the software package. The system designer clarifies integration requirements; the network administrator installs the software application on the network; the software vendor and consultants assists in the installation and testing. The new software and documentation is the input for this task and the output is the installed and tested software.

4.2.7 Write, Code and Build New Programs

Writing, coding and building are the processes required to produce a complete set of software modules or in-house programs for the new system. It is during this process that the programmer converts specifications created during the analysis phase into working computer code (Hoffer et al. 2002). Prototypes which may have been constructed in the design phase may need to be modified or refined (Whitten & Bentley 2007).

Systems analysts, designers and system builders are involved during this stage. The analyst clarifies the business requirements to be implemented; the designer clarifies the program design, integration requirements, and program documentation; the system builder has primary responsibility for this activity and will write and test in-house software (Whitten & Bentley 2007). With the assistance of technical specifications, development work can be logically partitioned and progress can be measured and controlled (*NYS Project Management Guidebook).* The main inputs into this activity will be the technical design statement, the technical specification and the programming plan.

4.2.8 Test New Programs

The purpose of testing is to confirm that the system satisfies requirements (Hoffer et al. 2002). Testing is not a haphazard process, and attention must be paid to many different aspects of the system. Various test plans that were used during the analysis and design phases will be used when the actual testing is performed during the conversion stage. These test plans improve communications, specify individuals' roles and act as a checklist (Hoffer et al. 2002).

The testing can take place in parallel with the coding and building; and as each system is produced it can first be tested as a stand-alone unit and then as part of a larger system (Hoffer et al. 2002). Testing should not be postponed until after the complete program has been built. Whitten & Bentley (2007) identify three levels of testing:

Sub-testing is the testing of an isolated subset of a program.

Program testing is the integrated testing of all events and modules coded for a program.

Systems' testing is the testing together of the isolated units as a whole system.

The programmer for each module usually carries out the unit testing. Although this is a subjective process, the possibility of carrying out independent testing is not generally practical. It is imperative that testing is thorough and that results are recorded for future reference. A test specification is used to ensure that testing is carried out in a structured way. The test script identifies the functions to be tested in a systematic manner (Bocij et al. 2003). Test plans are used for large implementations. Detailing the tests to be performed, and identifying who is to perform them is part of the project plan.

4.2.8.1 Types of Tests during Construction Phase

Bocij et al. (2003) identify the types of test as outlined in Table 4.4. These are referred to as "Developers Tests" that may be carried out during this stage:

Table 4.4: "Developers Test" Source: Bocji et al. (2003)

Module Tests	Performed on individual modules, where the tester is checking if the expected outputs are generated for given inputs.
Integration or Module Integration Testing	Messaging and data exchange between a limited number of modules are assessed.
New Function Testing	Testing the operation of a new function. The tester must be aware that the operation of a new function may cause bugs in other parts of the system.

System Testing	At this point links between the modules are assessed. System testing may highlight different errors to module testing, possibly due to unexpected data dependencies.
Database Connectivity Testing	This test is completed to ensure that there is connectivity between the application and the database.
Database Volume Testing	The purpose is to test how the system will react to different levels of usage as anticipated from the requirements and design specification.
Performance Testing	This involves timing how long different transactions or functions take to occur. These will need to be compared with maximum waiting times that may have been agreed.
Confidence Test Scripts	These are short scripts which tests all the main functions of the software.
Automated Tests	Automated tools that simulate user input. Scripts can run repetitive tests.
Regression Testing	These are performed before a release to ensure the software performance is consistent with previous test results. Fixing a bug may introduce a new error; regression testing may identify this.

Only the tests deemed necessary and appropriate will be conducted for a particular systems development and implementation project. Time spent testing as required may prevent major problems being encountered at a later stage.

4.2.8.2 Test Environment

Depending on the stage of the project, testing will take place in different environments. The prototype is tested on a standalone machine, during the build phase the test is carried out in a development environment (Bocij et al. 2003). A test environment may be

This preparation includes making sure the hardware and network infrastructure is in place; ensuring system testing and user acceptance testing has taken place; and, ensuring the selection, preparation and carrying out of training for the end users is in order. The way in which these activities are coordinated and managed is critical to the overall success of the new system (Whitten & Bentley 2007).

4.3.1 Implementation / Delivery Plan

The implementation plan is the final preparation before the system is delivered into operation. The final steps of the implementation are determined and commitment of resources is established. This plan ensures that everyone understands their roles and responsibilities during the system delivery (Biggs et al. 1980). The original implementation plans, along with current schedules and project status, are reviewed to produce the final overall implementation plan. The implementation plan includes details of user training, system test, site preparation and conversion (Biggs et al. 1980). The implementation plan will indicate when system acceptance is required and the criteria for acceptance.

4.3.2 Conduct System Test

Once the software application has been installed and tested a final system test must be performed. The purpose of this activity is to carry out an efficient, accurate, and complete test of all components of the system (Biggs et al. 1980). It is very risky not to

test, or to apply poor testing to the system at this stage. If errors remain undetected they may prove too costly to correct later (Awad 1988). At this point existing software, databases, custom-built programs, and software packages are tested to ensure they all work together. The system test is the ultimate integration test as it incorporates all modules into a single system. The systems test validates the operation of the systems as it performs against the boundaries, volume and peak load conditions anticipated (*NYC Project Management Guidebook*).

The tests that occurred during the design and development stages are not sufficient to guarantee that the system will work properly. Operational considerations are key to the systems test, as these tests place the system under operational and technical stresses that are normally experienced during business operations. The ultimate objective is to test for anticipated risks and to ensure that the systems can recover from failure (Briggs et al. 1980). The system owners and users who carry out the systems testing ultimately decide if the system is operating correctly. The system analyst reports any test problems encountered to the project team (Whitten & Bentley 2007).

System testing should focus on rigorous testing of the system to determine its real limits and its ability to fail in an orderly manner and to recover from such a failure. This involves the following major tasks as set out in Table 4.5 (Briggs et al. 1980):

Table 4.5: System Testing Tasks (Briggs et al., 1980 and Bocij et al. 2003)

Planned "Fail" Testing	The test group must predict how anticipated failures will occur and how to keep data loss to a minimum as a result of such failure.
Capacity Testing	This testing ensures that the system can meet required demand levels at peak load times.
Stress Testing	This involves an increasingly severe progression of tests incorporating different combinations of events, for example, hardware malfunctions, huge data volumes etc.
Backup and Recovery Procedures	A complete exhaustive test of backup and recovery procedures.
Scenario Testing	Processing examples of typical operational processes.
Functional Testing	Users test specific modules in detail and repeatedly following a test script.
General Testing	Users do not follow a test specification but test randomly as they chose.
Multi-user Testing	These tests ensure that two users cannot modify data at the same time. This test will also test for user permissions and user rules for different groups of users.
Inexperienced User Testing	Inexperienced users will make good testers as they may choose illogical combinations of options that the developers may not think to test. This is an effective method of testing.

If the system test results in modifications and requires the return to the construction phase, the systems test is repeated until a satisfactory and acceptable result is obtained.

4.3.3 Prepare Conversion Plan

On completion of a successful system test, a detailed conversion plan is developed using the design specifications for the new system. At this point the organisation is ready to put the new system into operation. The conversion plan will identify databases to be installed, training and documentation required, and a conversion strategy (Whitten &

Bentley 2007). The conversion plan may also include a systems acceptance test plan and an installation strategy plan. The project manager may be required to seek approval of the conversion plan from the steering committee.

4.3.4 System Acceptance

The purpose of the system acceptance test is to test the system using real data over an extended period of time, in an attempt to make the systems fail (Awad 1988). During this step in the SDLC every aspect of the system is thoroughly validated by the users or customers prior to proceeding with system implementation (*NYC Project Management Guide*). In order to proceed to the implementation with the highest degree of confidence, there must be evidence of the systems accuracy and functionality.

It has been argued that acceptance testing is possibly the most critical step of a software development process. During this formal phase the performance, appearance, and usability of the software are measured and compared to criteria agreed upon by the developer and the user/client. The purpose of acceptance testing is to confirm that the software system and its components meet the specifications formulated as part of the development process.

Acceptance testing is carried out to avoid the following risks: (Whitten & Bentley 2007)

Loss of Reputation:	The reputation of the organisation may be at risk if customers, suppliers or users perceive that there is a problem with the information system.
Legal Implications:	Testing must ensure that the system complies with all relevant current legislation.
Time Risks:	The system may not be capable of meeting business deadlines.
Resource Risks:	If the system is not properly integrated there may be more time and effort spent getting around the problem.

Acceptance testing may take some time in order to ensure that the system is fit for purpose before it goes live and before it is signed off as fit (Bocij et al. 2003).

Whitten & Bentley (2003) identify three levels of acceptance testing.

Verification Testing

Verification testing often referred to as *alpha testing* is carried out in a simulated environment using simulated data.

Validation Testing

Validation testing also known as *beta testing* is run in a live environment using live data. During this test the following is being tested:

- Systems Performance
- Peak workload processing performance

- Human engineering test
- Methods and procedures test
- Backup and recovery testing

Audit Testing

Audit testing certifies that the system is error free and ready to be placed into operation. Some organisations require an audit, often conducted by an independent auditor or quality assurance staff.

Problems encountered during alpha testing or beta testing must be corrected before the user can accept the system (Hoffer et al. 2002). It is at this point that considerable delays can occur due to modification and correction required as a result of system bugs.

The *NYS Project Management Guidebook* outlines four steps in the System Acceptance activity. These are briefly outlined below.

4.3.4.1 Prepare for System Acceptance

A system acceptance environment is created and it is within this environment that the test team is instructed to use the tools and procedures for this activity. This is the final opportunity for testing before going live; therefore preparation of both the user and the environment is crucial.

4.3.4.2 Validate Data Initialisation and Conversion

During the validation and conversion activity the processes and utilities used to populate the database are tested to ensure that processing of the new systems can start. The purpose of this step is to ensure that the quality of the data load process, and the resulting data, are acceptable before proceeding with the implementation. Data problems that may potentially endanger the eventual success of the system are identified.

4.3.4.3 Test, Identify, Evaluate, React (TIER)

Although the responsibility for performing tests at this stage is with the user / customer, the principles that applied to earlier testing also apply here. Any problems identified during acceptance testing must be recorded and tracked to closure. Some organisations may chose to perform parallel operations during acceptance testing, however the TIER approach is still recommended for testing of applications.

Test results and resulting defects are communicated to the project manager or design team in a timely manner. The reported errors and defects are analysed to determine if adjustments are required. Some errors or defects may only be as a result of the tester's misunderstanding.

If adjustments or modifications are required, the project team has responsibility for determining the priority of such corrective action. It may be possible to continue implementation despite the existence of modification and adjustments. The project team

may decide that implementation is not possible due to the systems inability to perform essential business operations, and therefore implementation does not proceed without the modification. Once the corrections and modifications have been identified and prioritised they are implemented. The system will then be re-tested and released if satisfactory at this point.

According to the *NYS Project Management Guidebook*

> *"The key to successful completion of System Acceptance is the clear definition of go/no-go criteria that can be used to define the set of circumstances that would preclude placing the application in production"*

The real users of the system decide whether or not the system should be accepted. These users should be involved in determining the criteria for such acceptance.

4.3.4.4 Refining Supporting Materials

All materials relating to the new system must be updated with any changes that resulted from the system acceptance activity. These materials include user training materials and technical documentation. The system acceptance activity can be deemed a success when the user has accepted the system and agreed that the system can move into production.

4.3.5 Install Databases

The previously built and tested databases can now be installed and fully loaded for operation. The new systems database is populated with data from the old system. Each

record must be entered, edited and confirmed before the database is 'ready'. Special programs are compiled to facilitate this activity. The outcome from this activity is the new system database populated with the restructured existing data (Whitten & Bentley 2007).

4.3.6 Documentation

Documentation is produced throughout all phases of information systems development, see Table 4.6, but it becomes vitally important during implementation and maintenance (Bocij et al. 2003).

Table 4.6: SDLC and Generic Documentation Corresponding to Each Phase
Adapted from Hoffer et al. (2002)

Generic Life-cycle Phase	Generic Document
Requirements Specification	System requirements specification Resource requirements specification
Project control structuring	Management Plan Engineering Change proposal
Systems Development Architectural Design Prototype Design Detailed design and implementation Test Specification Test Implementation	 Architecture design document Prototype design document Detailed design document Test Specifications Test Reports
Systems Delivery	User's Guide Release description System administrator's guide Reference guide Acceptance sign-off

Every systems development and implementation project will have its own unique suite of documentation requirements. Documentation format and contents vary depending on the

systems development methodology being followed. The documentation requirements may also be specified by the organisations' quality standards (Hoffer et al. 2002).

Documentation enables good communication among developers, those implementing the system and those maintaining the system. It is vital for diagnosing errors and making changes, especially if personnel involved in the development of the system are no longer in the organisation (O' Brien 1999). As the writing of software is seen as less interesting than developing the software, it is often neglected. A software quality plan and strong project management skills are required to ensure time is spent on the production of vital documentation (Bocij et al. 2003).

Hoffer et al. (2002) divides documentation into two basic types:

4.3.6.1 System Documentation

System documentation records detailed information about the design specifications, the internal workings and functionality of the system. System documentation is intended for maintenance programmers. Organisations will often have quite explicit, definitive standards to be complied with when producing system documentation. Applying these standards can contribute to the quality of the development process.

4.3.6.2 User Documentation

Described by Hoffer et al. (2002) user documentation consists of written or other visual information about the information system, how it works and how to use it. User documentation may include any of the following:

Reference Guide

Reference guides include an exhaustive list of the systems functions and commands. A reference guide is useful for very specific information but not useful for describing the overall picture or how the steps of a task are performed.

User's Guide

The user's guide is a complete description of how the user uses the system to perform specific tasks. The guide is generally written in the order in which the tasks are most commonly performed and according to their complexity. According to Bocij et al. (2002) user guides are becoming less important due to the advent of on-line help facilities with more applications.

Release Description

The release description contains information about a new system release, and will include details of new features, enhancements, known problems, and information about installation. As each new version of the software is released a release description is produced to identify information specific to the latest release.

System Administrators Guide

The system administrator's guide, used by those who install and administer the system, includes information about compatibility with networks and peripherals, printing, troubleshooting and user account information.

Acceptance Sign-off

The users, having completed the systems acceptance test, signify their acceptance by signing the acceptance documentation.

4.3.7 Training

Training of end-users is vital to the overall success of the system implementation as end-users play a key role in extracting the maximum value from the new information system. Effective end user training reduces the number of errors made and the support required by the user, and potentially increases user productivity. The implementation requires appropriate education and training. According to Bocij et al. (2003) this might include, along with practical and operational training, an explanation of why the new system is being implemented and the impact on users jobs and working environment.

Converting to a new system can be made easier if the users are effectively trained and provided with quality user documentation. Effective training requires a learning environment that includes proficient trainers, enough time to train adequately and a

training programme based on well defined training objectives (Yeates et al. 1994). The type of training required depends on the type of system and the expertise of the users. Training may be as simple as data entry or may involve complex instructions on the use of the system.

Users need to be ready, conceptually and psychologically, to use the new system. It is vital that management and system owners support training by releasing users for training. Fortunately, according to Whitten & Bentley (2007) the involvement of users in training is rarely overlooked. Training can be one-to-one but group training is generally preferred as it makes efficient use of resources and encourages group learning (Whitten & Bentley 2007).

Training can be provided in a variety of formats and methods as outlined by Hoffer et al. (2002) in Table 4.7 below:

Table 4.7: Methods and Formats of Training Adapted from Hoffer et al. (2002)

Tutorial / One-to-one Training	One person taught at a time.
Instructor-Led Training Course	Presentations that provide an overview and details of how to use the functionality of the system and hands on practical exercises.
Computer-aided Instruction	Instruction delivered with the assistance of a computer. The student interacts with the computer and proceeds at his or her own speed.
Interactive Training manuals	Includes a combination of tutorials and computer-aided instruction.

Live eLearning Sessions	Enables a widely dispersed audience to interact with the instructor, the application and other trainees. This provides a dynamic platform for training.
On-demand Sessions	Training sessions available on demand from the organisations intranet. This can accommodate large audiences and reduce costs.
Resident expert	A dedicated member of staff, providing training and support on a needs basis.
Software Help Components	As part of the system, users can access the Applications help feature for user guide and support.
External sources	The vendor provides the training on installation of the system.

Despite the critical nature and value of training, most of these methods and formats are under-utilised in many organisations (Hoffer et al. 2002). He further concludes that an effective method of training is to train a few key users as 'superusers' who will subsequently deliver the training to the end-users within the organisation.

The following groups can provide training (Yeates et al. 1994):

The System Developers

Systems Developers possibly understand the system best but may have a technical bias and therefore focus training on the technical operations of the system. Training must include the following: an understanding of the system and how it operates; an understanding of the business processes which form part of the system; and, an understanding of the impact the system will have on the individual, their roles and the organisation.

Experienced Staff

Experienced staff, unlike the systems developers, may have a better knowledge of the business but may not appreciate the end-users abilities or competencies. The end-user is not likely to admit their difficulties for fear of being perceived as a failure by their peers. Trained trainers will allow for varying levels of skill and competence when delivering training.

Professional Training Companies

Employing professional trainers is an expensive option. The professional trainers, with no previous knowledge of end-users, make no assumptions about the users abilities. Once the professional trainer learns the system they can impart that knowledge to the users in a helpful way. Professional training is seen as value for money as it is important that users get a positive introduction to the new system.

Superusers

A selected number of end-users who are involved in the implementation may be trained to become trainers. The advantage of using users in training is that, not only will they understand the system as a result of training, but they will have a deep understanding of users needs and the business in which they operate.

It is as important to time the training correctly as it is to have appropriate training content. Conducting the training after the system has been rolled out may form poor

perceptions of the systems. Users may have forgotten how to use the system effectively if the training takes place too far in advance of the rollout (*NYS Project Management Guidebook*).

4.3.8 Installation / Conversion / Going Live

Installation is the process of moving from the current information system to the new one. The initial operation of the new system can be complicated; it involves a conversion process during which personnel, procedures, equipment, input-output media and databases of the old system are converted to the requirements of the new system (O' Brien et al. 2003). The approach the organisation decides upon depends on the scope and complexity of the change (Hoffer et al. 2002). The following factors, as outlined by Bocij et al. (2003), need to be considered when evaluating the different approaches:

Cost: Organisations expect value for money and a return on their investment when implementing an information system. It is vital when considering the cost of the installation that the quality of the information system is not compromised.

Time: When planning the installation of the information system, a balance must be struck between the time available for installation and the desired quality of the system. Installation is one of the final stages on the implementation and the temptation to rush the installation is to be avoided. Not allowing sufficient time may contribute to the failure of the implementation.

Impact on Customers: The installation, regardless of the approach employed, will impact the organisations customers to some degree. How system bugs, possible delays and overruns will impact the customers must be considered.

Impact on Employees: The installation, regardless of the approach employed, will impact the employees to some degree. This impact may cause changes in workload, changes in roles and changes in the organisations structure.

Technical Issues: The technical design of the system may rule out some of the approaches, particularly if the system is not modular.

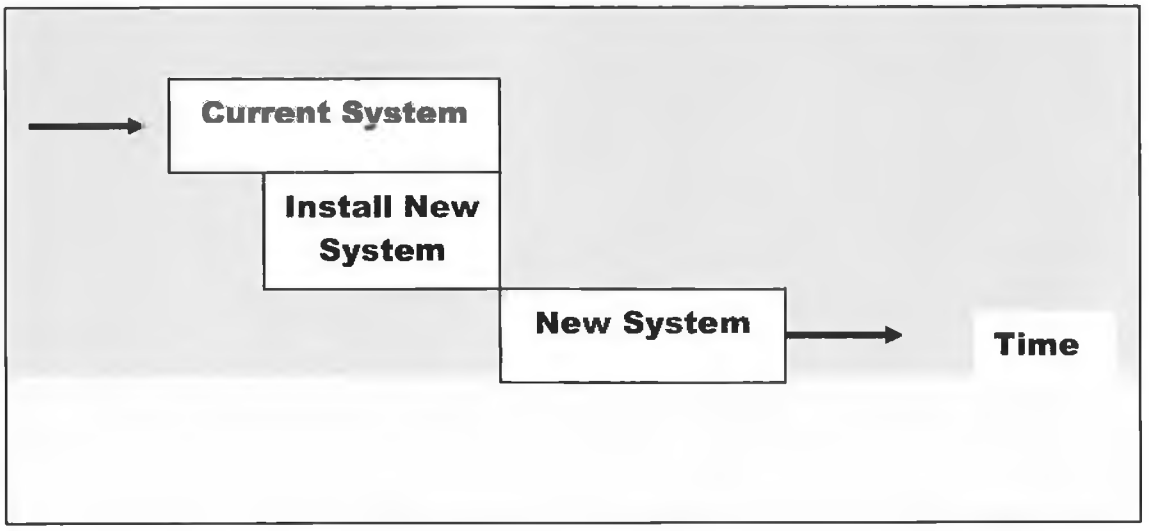
Authors in this field generally accept the following approaches to the installation of an information system:

4.3.8.1 Direct Cutover

Direct Cutover, also known as abrupt installation, plunge, or the 'big bang approach', involves the old system being dropped and the new system started, see figure 4.2. This can be a very dangerous approach to take, as there is a high risk of losing valuable data if the new system fails. With direct cutover the user is at the mercy of the system, because if it fails or runs into difficulty it will have a direct impact on their workload and how the organisation performs its business (Hoffer et al. 2002) This is a high-risk approach; if there is failure or considerable fault there will be no fallback position (Bocij et al. 2003).

Despite these risks, some organisation would find it too costly to run the old system in parallel with the new and therefore opt with the direct cutover approach.

Figure 4.2: Direct Cutover



The advantages of using Direct Cutover installation are:

- Quicker and less costly approach.
- Suitable for the implementation of commercial applications.

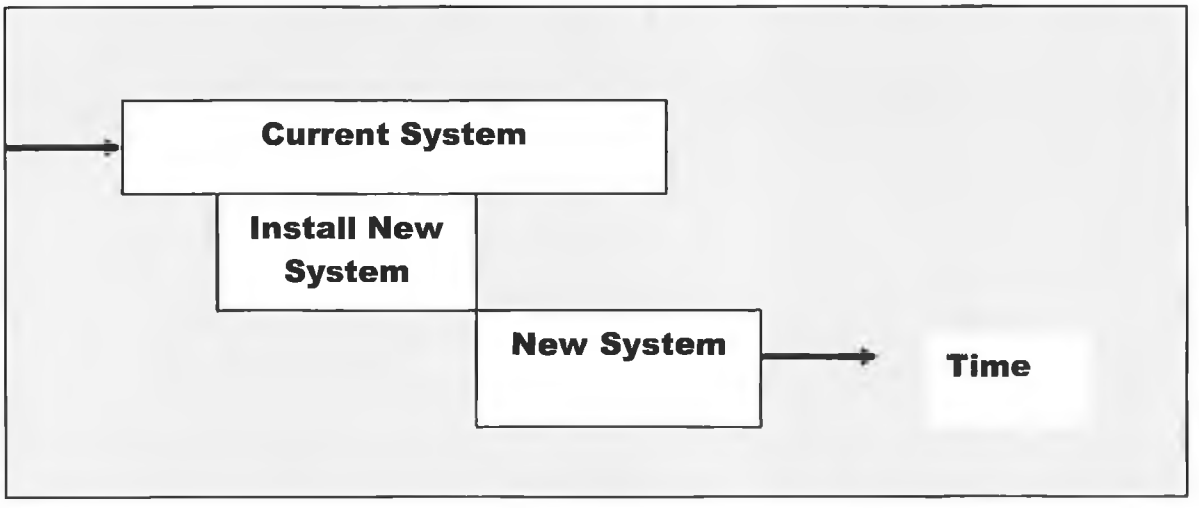
The disadvantages of using Direct Cutover installation are:

- High risk of losing data if the new system fails
- No contingency in place if implementation fails.

4.3.8.2 Parallel Installation

According to Hoffer et al. (2002) parallel installation is as safe as direct cutover is risky. The new system is installed alongside the old one. Both systems are operated in parallel until all problems with the new system have been solved and the users are sure the new system is acceptable, see figure 4.3. This can be very expensive as the users can be slow to accept the new system and discard the old system. The extra costs incurred result from running and maintaining two systems, and the human cost of repeating all operations on each system (Bocij et al. 2003). The parallel installation approach reduces the risk of major flaws in the new system, but the very high cost of running two systems is incurred (Whitten & Bentley 2007).

Figure 4.3: Parallel Installation



The advantages of using Parallel Installation are:

- Safe approach as the old system acts as a backup in the event of implementation problems.

- Easy to verify that the new system is working as comparisons can be made.

The disadvantages of using Parallel Installation are:

- Very expensive and lengthy process.
- Users may be reluctant to eventually cutover.
- Can be confusing for users operating two systems.
- Having two systems running is a heavy burden on network resources, IT staff and users.

4.3.8.3 Pilot Installation

Pilot Installation, also known as location or single location installation, is a middle-of-the road approach (Hoffer et al. 2002). The new system is rolled out in one of many sites and is only installed in subsequent sites when satisfactorily used in the first site. Instead of rolling out the system in the whole organisation, the system is rolled out in one unit or location at a time, see figure 4.4. The pilot approach limits potential damage and cost to a single site and is common in large multinational companies or national companies with several offices (Bocij et al. 2003).

The advantages of using pilot installation are:

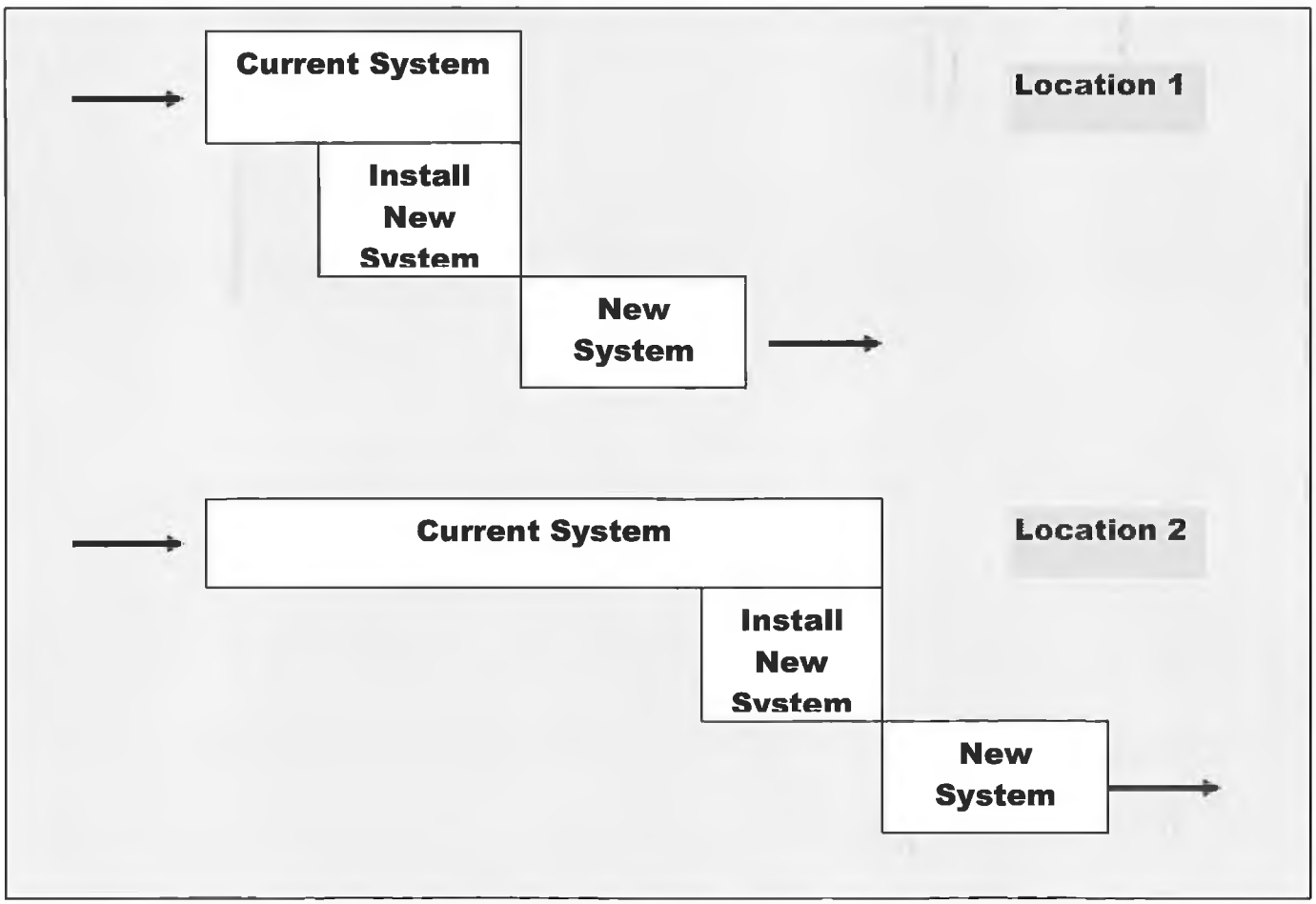
- The risk of failure is reduced to one site.
- The cost of failure or significant problems is reduced to those incurred on the pilot site.
- Lessons will be learnt from experiences gained during the pilot site installation.

- Reluctant users may be convinced of the benefits of the successful implementation on the pilot site.

The disadvantages to using pilot installation are:

- It places a heavy burden on IS staff to support the old system and the new systems in the pilot site.
- If data is shared, programs may need to be implemented to synchronise the systems (Hoffer et al. 2002).

Figure 4.4: Pilot Installation



4.3.8.4 Phased Installation

Phased installation, also known as 'staged installation' is a variation of the abrupt and parallel installation approaches. One module of the new systems is implemented and only when this module is operating satisfactorily will subsequent modules be implemented, see figure 4.5. According to Hoffer et al. (2002) the new system is brought on-line in functional components or modules. Different parts of the new and old systems are used simultaneously until the whole new system is installed in phases. The organisations exposure to risk is limited, both in terms of cost and business disruption. The phased approach requires strict version control; a long period of change that may be frustrating for users, but the benefit of this is that each phase of change is smaller and more manageable (Hoffer et al. 2002).

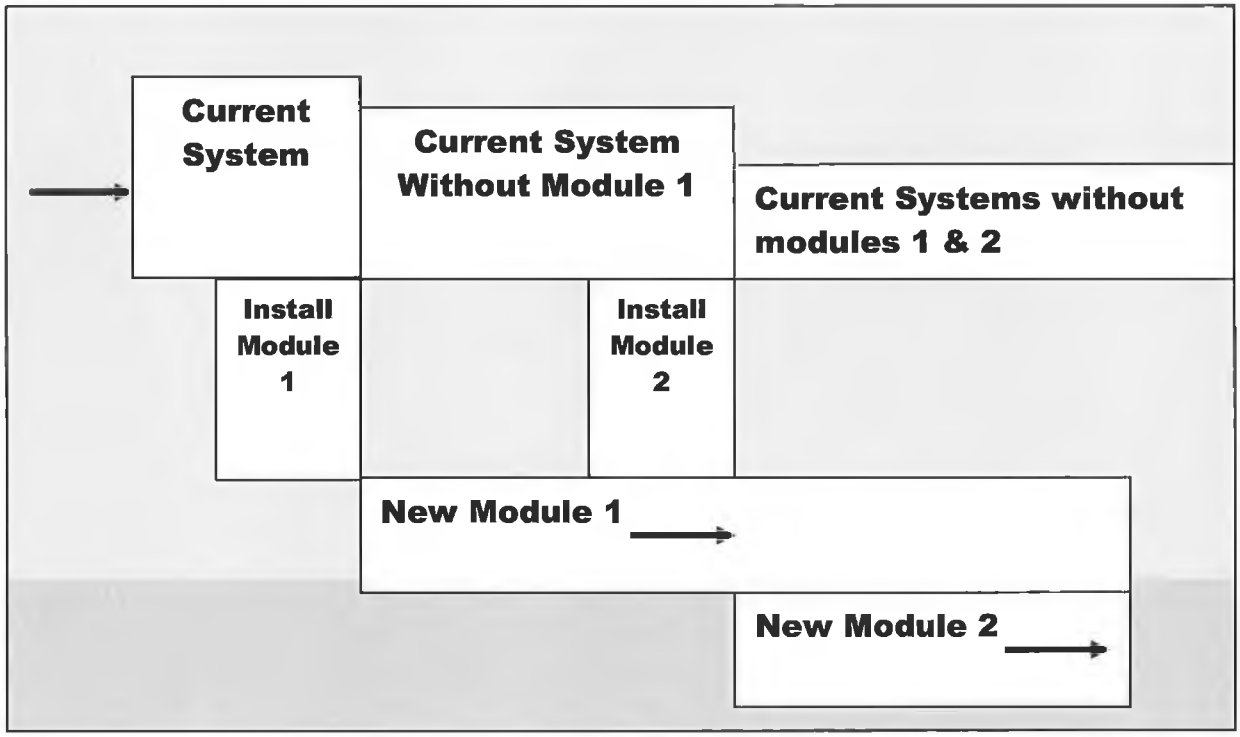
The advantages of using Phased Installation are:

- Less expensive than other approaches.
- The risk of failure is limited to one site.
- The implementation involves small manageable changes for users.

The disadvantages of using Phased Installation are:

- The lengthy process of this approach may be frustrating for users.

Figure 4.5: Phased Installation



The installation approach selected depends on the size of the organisation, the size and complexity of the system, the cost, the time available for the implementation, the expected impact on the organisation and its employees, and the technical implications of the installation.

Up to this point all activities have been performed in a safe, protected and secure environment, where any issues that arise have little effect on business operations. Once the system goes live, problems encountered will have direct impact on operations and may have a financial impact on the organisation (*NYC Project Management Guidebook*).

It is through the careful planning, execution and management of the implementation activities that these problems can be minimised.

Bocij et al. (2003) recommend a 'Deployment Plan" which defines all activities that are required to ensure a successful changeover. A deployment plan, which is critical for large-scale ERP implementations, includes an extensive list of all software, hardware and network requirements, and data conversion processes. Installation schedules, which form part of the deployment plan, should be communicated to all interested stakeholders, particularly if system outages or interruptions are expected (Hoffer et al. 2002).

4.4 ERP Implementation

Since the early 1990s, some organisations shifted their information technology (IT) strategy from developing information systems in-house to purchasing application software such as enterprise resource planning (ERP) systems (Hong & Kim 2002). As IS implementation is now more dependent on 3rd Party products than on IS development of bespoke products, a successful implementation faces challenges based on people, processes and work environments (Saleh & Alshawi 2005).

Implementing large, complex, integrated information systems such as ERP systems, involves difficult, unique, technical and managerial challenges. The planning for such an undertaking must begin at the strategic level of the organisation and then progress to the technical level (Markus et al. 2002).

According to Enterprise Ireland, 'E-Business Guide', if ERP systems are successfully implemented, the organisation is streamlined, responds to customers needs, and problem areas can be easily identified. How effectively an ERP system is implemented will determine the return on what is usually a considerable investment (Langenwalter 2000). Often organisation experience very long, expensive and resource-draining implementations, only to find that business performance is not improved as a result. Soja (2006) argues that the realisation of substantial benefits depends on the successful implementation of the ERP system.

Organisations that implement ERP system solutions undertake a very challenging task and must recognise that the way they do business and the way people do their jobs will have to change. Implementing an ERP system involves huge re-engineering and analysis of business processes, employee retraining and new works procedures (Musaji 2002). ERP system implementations are people projects, and in order for an implementation to succeed, the organisation, its departments and its employees must change and adapt as necessary (Langenwalter 2000).

Markus et al. (2002) suggest that if an organisation is simply structured and only operates in a few locations, ERP systems implementation can be straightforward. When the organisation is complex and geographically dispersed, with complex business processes, the implementation can pose substantial technical, managerial and organisational challenges.

4.4.1 Method of Deployment

There are three commonly used methods of installing ERP systems.

1. **The Big Bang Approach.**

The 'Business Performance Improvement Consultancy Webpage' offers the following definition of "The Big Bang Approach":

> *"An implementation strategy that cuts over all parts of a planning system at the same time in a company or division, as opposed to a phased implementation module by module. The challenge is to implement an enterprise wide system that everyone can use from the start"*

"The Big Bang Approach" is the most difficult and ambitious approach, where the whole organisation is required to mobilise and change at once. This approach is not recommended for large installations due to the high risk associated with it.

2. **Franchising Strategy**

The Franchising Strategy involves independent ERP systems being installed in individual units, and common processes being linked across the enterprise. This method suits large, complex organisations and is the most commonly adopted approach. The franchising strategy begins with a pilot implementation in a less complex business unit, where the risk of failure is reduced.

3. Slam Dunk Approach

The 'Slam Dunk' approach focuses on one key process at a time, in a modular format. The objective is to get ERP systems up and running as quickly as possible by installing module by module.

4.4.2 ERP Implementation Approaches

According to Parr (2000) ERP systems are "*comprehensive packaged software solutions which aim for a total integration of all business processes and functions*". He provides the following categories of implementation approaches.

4.4.2.1 Comprehensive

The comprehensive approach is a most ambitious implementation of the full functionality of all modules of an ERP system. The comprehensive approach suits multi-national organisations, on multiple sites, possibly in different geographical locations. There is a high level of business process reengineering required for this type of implementation, as each sites generally has its own independently engineered legacy system business processes being replaced. An example of a comprehensive implementation is the complete implementation of all modules of SAP R/3. This type of implementation would typically be a long-term project, 5-10 years.

4.4.2.2 Middle-road

The middle-road approach generally involves the implementation of a selected number of core ERP system modules in a multi site organisation. A significant element of business process reengineering is required, as this approach is generally suited to a multi-national organisation where business processes exist for the legacy system. Implementing a selected number of SAP R/3 modules is an example of a middle-road approach.

4.4.2.3 Vanilla

The vanilla approach is the least ambitious and least risky, and is generally limited to one site. The core functionality of an ERP system is adopted and a minimal amount of business process reengineering is required in order to take full advantage of the process model built into the system. The business processes are aligned to the ERP system. This approach is typically adopted in a single site with a small number of users.

4.5 Summary

The implementation of an information system can be difficult, challenging, costly and time consuming and it is vital that the methodology and approach taken, and the strategies employed, contribute to its success. There is no one best process or methodology for a system implementation.

Information systems implementation is not just a technical project. It is affected by the work habits, beliefs, interrelationships, culture, traditions, personal goals of the workers

and the organisation, the organisational context and environmental factors. The organisation must focus attention on these influences during the implementation.

The implementation phase is divided into individual activities within two stages. The construction stage involves acquiring hardware, software and IS services; building testing networks and databases; writing code and testing and validating programs. The delivery stage, which is the focus of this study, comprises system testing and acceptance testing, installation, documenting, training and going live.

4.6 Conclusion

Regardless of the implementation methodology or approach adopted, the successful implementation of the information system, in particular an ERP system is dependent upon various technical, organisational and individual factors. Soja (2006) suggests that three of these factors are of paramount importance; management support of the project team and the process, a project team with business and technical skills, and stakeholders who are committer to change. In the following sections the suggested reasons for common failure of system implementation will be examined.

CHAPTER 5 IMPLEMENTATION – REASONS FOR FAILURE

Block (1983) defines failure and the level of severity in the following table:

Table 5.1: Severity of Failure

Definition of Failure	
Project Event	**Severity**
Cancellation	High
Late Delivery	Medium to High
Over Budget	Medium to High
Low Quality	Medium to High
High Employee turnover	Low to Medium

Adapted from Block (1983)

The study of information systems development and implementation is abundant with both empirical and anecdotal evidence of a preponderance of information systems failures. As a result, the issue of implementation has been a discussion topic for sometime. Organisations have spent millions installing ERP systems and have abandoned them when it became clear that they were not going to meet expectations. Many organisations have ended up bankrupt and others had their reputation damaged or faced legal proceedings as a result of implementation failure (Parth & Gumz 2003).

According to Marple (2003) much research has been conducted into the low success rate of information systems implementation. Coca-Cola spent $10 million on a failed SAP implementation. Dell Computers aborted the implementation of SAP/R3 after two years on the grounds of incompatibility with business model (Beheshti 2006). Cleveland State University ran a cost overrun of $5 million when it could not process student applications on the newly implemented PeopleSoft System. The Irish Health Board Executive PPARS system is an example of Information Systems implementation failure that has featured prominently in the media and press, with the government accused of having wasted €160 million of public funds. The ISIS Tenemos System, a computer project that aimed to provide an integrated standard information system for all affiliated Credit Unions, is considered a huge failure. In excess of €40m of the Irish taxpayer's money was wasted on an unusable e-voting system

The Standish Group 1996 reported that 30% of government technology projects failed (Parth & Gumz 2003). The Standish Report 2003 indicates that 15% of IT projects failed in 2002, and a further 51% did not deliver the desired results on time or within budget. Only 34% of IT projects were considered a success (BearingPoint Web Site).

Parth & Gumz (2003) suggested the following as commonly cited reasons why ERP systems fail to meet project objectives: lack of visible executive level leadership, poor communications, poor adherence to Project Methodology, resistance to change, organisation not prepared for change, inadequate training, failure of individual departments to take ownership, lack of project team experience, and incomplete requirements definition.

Sabherwal et al. (2003) added "Escalation of Management Commitment" to the common reasons for an implementation failure. Despite clear indications and reports of poor progress, and major difficulties encountered during the implementation, some IS projects persist as a failing venture long after a decision to abandon should have been made. These types of projects are generally referred to as "Runaway Projects", often additional resources are committed to an already failing course of action to address the problems encountered. The investment in the project to date may be so considerable that to abandon it might be seen as a waste and therefore more is invested in an attempt to address the problems. According to Keil et al. (2000), one of the most difficult decisions that a manager faces is whether or not to abandon a project that is failing.

Research into information systems implementation is abundant with factors and issues that are critical to the successful implementation of large complex ERP systems. Block (1983) presented the following twelve categories that most cause system failure:

Table 5.2: Factors Influencing Implementation Failure

Failure	Cause	Result
1. Resource failures	Conflict of people, time and project scope due to insufficient personnel.	Incorrect system with poor reliability, difficulty with maintenance, and dissatisfied users.
2. Requirements failures	Poor specification of requirements.	Leads to developing the wrong system with many changes in requirements downstream.

3. Goal failures	Inadequate statement of system goals by management.	Leads to developing the wrong system by leading to requirements failure.
4. Technique failures	Failure to use effective software development approaches, such as structured analysis and design.	Causes inadequate requirements specification, poor reliability, high maintenance costs, scheduling and budget problems.
5. User contact failures	Inability to communicate with the system user.	Causes inadequate requirements specification, and poor preparation for accepting and using the IS.
6. Organisational failures	Poor organisational structure, lack of leadership, or excessive span of control.	Leads to poor coordination of tasks, schedule delays, and inconsistent quality.
7. Technology failures	Failure of hardware/software to meet specifications, failure of the vendor to deliver on time, or unreliable products.	Causes schedule delays, poor reliability, maintenance problems and dissatisfied systems users.
8. Size failures	When projects are too large, their complexity pushes the organisations systems development capabilities beyond reasonable limits.	Caused by insufficient resources, inadequate requirements specification, simplistic project control, poor use of methodology, and poor organisational structure.
9. People management failures	Lack of effort, stifled creativity, and antagonistic attitudes cause failures.	Time delays and budget overruns occur, project specifications are poor, and the system is difficult to maintain.
10. Methodology failures	Failure to perform the activities needed, while unnecessary activities are performed.	This type of failure can lead to any of the consequences of system failure.
11. Planning and control failures	Caused by vague assignments, inadequate project management and tracking tools.	Work assignments may overlap, deliverables may be poorly defined, and poor communication may result.
12. Personality failures	These are caused by people clashes.	Passive cooperation and covert resistance, with possible acts of vengeance.

Table 5.2: Adapted from Block (1993)

5.1 Barriers to Successful Implementation

The main barriers or factors that influence the successful implementation of a complex information system are summarised in the following section and developed on in subsequent sections. According to Wu (2006), solving and addressing these problems requires information, business support and user involvement.

5.1.1 Organisational and Cultural Barriers

Defined by Tiernan et al. (2001),

> *"An organisations culture is concerned with the shared values, beliefs and assumptions held by members of the organisation and commonly communicated through symbolic means"*

The design and nature of the information system will be influenced by, the culture of the organisation, the management style within the organisation, and the infrastructure of the organisation. The cultural shared values and beliefs of the organisation will have an impact on the users' acceptance or rejection of the new information system. The participation and involvement of users, and the management of motivation and communication, is key to user acceptance.

5.1.2 Technical Barriers

The degree of expertise of the technical designers, and their understanding of information requirements and needs of users and executives, will impact the implementation. The new

information system may constrain how the organisation copes with diverse and changing business environment. Therefore, in order to benefit from the new technology the organisation may have to undergo significant changes to its business processes.

5.1.3 Human and Individual Barriers

Users' expectations of the system implementation will impact the degree of success or failure of the implementation. These expectations of benefits must be controlled to ensure users have realistic expectations. The significant changes brought about by the implementation of a new information system can have considerable effects on the stress levels of the workers in the organisation. These changes can have traumatic effects on the individual as with the change comes inevitable risk.

5.1.4 Environmental and Situational Barriers

External environmental influences in which the organisation is operating include political and legal influences, economic influences, social and cultural influences, technological influences and competitive influences. Each of these factors may influence the implementation, and therefore, each requires due consideration.

5.2 Implementation of ERP – Critical Factors for Success

Implementation strategies must address the following major implementation issues:

- Complexity of system and fit to business requirements.
- Changes required matching the business processes.
- Behavioural challenges and change management posed by the implementation.
- Cultural, technical and business related factors of the implementation.

O Brien (2005) suggests that the implementation of an information system requires managing the effects of change on business processes, organisational structure, managerial roles, employee work assignments, and stakeholder relationships. Successful implementation of ERP systems is dependent on the ERP Package Developers, the developers using the systems, and the ERP system users (Wu 2006).

Large, complex, multi-functional and multi-site information system implementations, including ERP systems, are typically costly, timely and burdened with problems, complications, and possibly failure. These problems and failures inevitably are as a result of the implementation approaches adopted. Umble et al. (2003) argues that as an ERP system implementation is not cheap or risk free, it pays-off to examine the factors that influence the success or failure to the project.

Ginzberg (1981) suggests that management support, user involvement, commitment to the project, commitment to change, user expectation, and project definition and planning are the key elements necessary for successful implementation. According to empirical research by Bakehouse & Doyle (2003) there are three broad conditions necessary to ensure IT implementation success; commitment, coordination and communication. They suggest that if any of these conditions are lacking the project will probably fail. These three conditions are critical in managing the strategic change and in 'closing the gap' between '*where we are*'- the old system, and '*where we want to be*'- the new system.

Al-Mudimigh et al. (2001) suggests a number of different strategies for the successfully implementation of ERP systems.

- **Organisational Strategies**

Employing an organisational strategy involves focusing on change strategy, change management techniques, project management, organisational structure, management style and ideology, communication and coordination and IS function characteristics.

- **Technical Strategies**

Employing a technical strategy involves focusing on, the technical aspects of the implementation, the complexities of the ERP system, the adequacy of in-house technical expertise, and the time and cost of the implementation.

- **People Strategies**

Employing a people strategy involves focusing on the attitudes of staff and management, end-user involvement and training.

Chrusciel & Field (2003), in the context of the Malcolm Baldrige National Quality "Criteria for Performance Excellence" outlines the critical success factors for systems implementation in Table 4.2 below. The author has further grouped these factors into the following categories: management commitment, education and training, project management, change management, communication, user involvement, and quality of information system. Based on the literature researched the author has added a further category particular to ERP systems implementation success, 'organisational fit and business process engineering'.

Table 5.3: Critical Success Factors Defined

Category	Factor Name	Importance	Definition
Management Commitment	Top Management Support	Critical	Active and visible support from the management of the organisation.
Education & Training	User Training	Critical	Clear demonstration as to how to use the system.
	Perceived Utility	Critical	Belief by users that the system is important to, and has an impact on the organisation.
	Perception of the Organisational Readiness	Critical	Perceptions in terms of whether the organisation and its users will undermine or facilitate the implementation.

	Perception of Personal Gain	Critical	Perception of personal gain as result of the users being associated with the change.
	Ability to Use the New System	Important	Overall ability of end users to use the new system
Project Management	Planning and Analysis	Critical	Evaluation of where the organisation is now and where it wants to be and the influencing variables.
Change Management	Assessment	Critical	Evaluation of the effectiveness of change
	Curriculum Dealing Specifically with Change	Critical	Instructions to educate staff about the important technical and human change issues.
Communication	Comprehensive Communication	Critical	Communication of the change message to all levels within the organisation.
User Involvement	User Involvement	Important	Ownership of the system is in the hands of users and participation during implementation.
Organisational Fit	Suitability Of Selected Technical Solution To The Business Needs	Critical	Degree to which the selected solution fits the functional requirements of the organisation.
Quality of the System	User Information Satisfaction	Important	User satisfaction and acceptability of new system.
	Relative use	Important	Level of use of new system.
	Goal realisation	Important	Degree to which expectation have been met.

Adapted from: Chrusciel & Field (2003)

In the following section the categories of issues that are critical to the successful implementation of an information system are examined in detail. Many of these factors are more particular to the implementation of an Enterprise Resource Planning System, as many of the significant failures recently published are ERP systems and thus significant research has been conducted into this phenomenon. The system implementations targeted in the case studies conducted as part of this research are ERP systems.

5.2.1 Management Commitment

> *"Unless commitment is made, there are only promises and hopes; but no plans."*
>
> Drucker, P.F.

Tyran & George (1993) state:

> *"Commitment to the project refers to the commitment of key players to do whatever is necessary to assure that the system requirements are defined and that the system meets its requirements".*

Management commitment, to an information system development and implementation project, is essential for system success (Sabherwal et al. 2003). According to Krasner (2000) management incompetence or lack of management involvement could result in implementation failure. A combination of frontline management and corporate management involvement is required throughout.

Commitment and support must be from top down and across all levels of management. Users perceive this commitment in terms of the allocation of people, time, money, information and technology (Bakehouse & Doyle 2003), and only with this commitment will users in turn commit to the project and get involved. Sumner (2000) advocated as a priority, getting the "business" areas to commit resources to the project. Unless the project is perceived as well administered and actively supported by management it may not be effective (Marble 2003).

A White Paper by BearingPoint (2001) listed, "actively building a base of support for the project", as one of its main success strategies. Someone at senior management level must have the vision, understand the benefits and get the message out. One of the major risk factors in the implementation of an enterprise system, argued Sumner (2000), is the importance of getting the support and commitment of senior management for accomplishing project goals and aligning them with organisational goals.

Kamath (1999), cited in Gunson & de Blasis (2001), recommended appointing a Project Sponsor, who has management clout, is responsible for the business unit concerned with the implementation, is forceful in his position and personality, is respected and liked, and is associated with the project permanently. Sarker & Lee (2003) found that strong and committed individuals, at top management level, at project management level and at IS function level, is a necessary condition for implementation success. Senior level sponsorship, and championship support and participation, are critical to success. Bingi et al. (1999) cited in Sarker and Lee (2003) stated, "*Implementation completely hinges on*

strong sustained commitment of top management." This commitment is required throughout all stages of the project and must be given significant priority throughout. The sponsor and project team need strong, maintained management commitment. The continued involvement, support, commitment and mobilisation of top management is vital. The successful implementation should be a priority personal objective for senior management (Gunson & deBlasis 2001). Aladwani (2001) stated that successful implementation could only be accomplished when senior management is totally committed to the initiative. Management commitment and support is the ultimate strategy to ensure that the required changes and improvements are brought about by the system implementation.

Umble et al. (2003) recommends appointing an executive management planning committee for the duration of the implementation. This team is committed to enterprise integration, understands the information system, fully supports the costs of the implementation, demands payback and champions the project. According to Manoeuvre (2001) the management team must have adequate knowledge of the business to be capable of challenging the status quo. They must be respected, trusted and have the authority and power to make decisions. They must have a clear vision of the goals of the project and understand the significance of the job. The project team should be key organisation players with the relevant skills and motivation.

Dong (2001) identifies two area of management commitment:

- Top Management Commitment to Resources – the extent to which management provide financial and technical resources to ensure the smooth completion of the implementation.
- Top Management Commitment to Change – the extent to which top management promote receptivity of IT implementations.

Figure 5.1: Conceptual model of top management influence on implementation effectiveness.

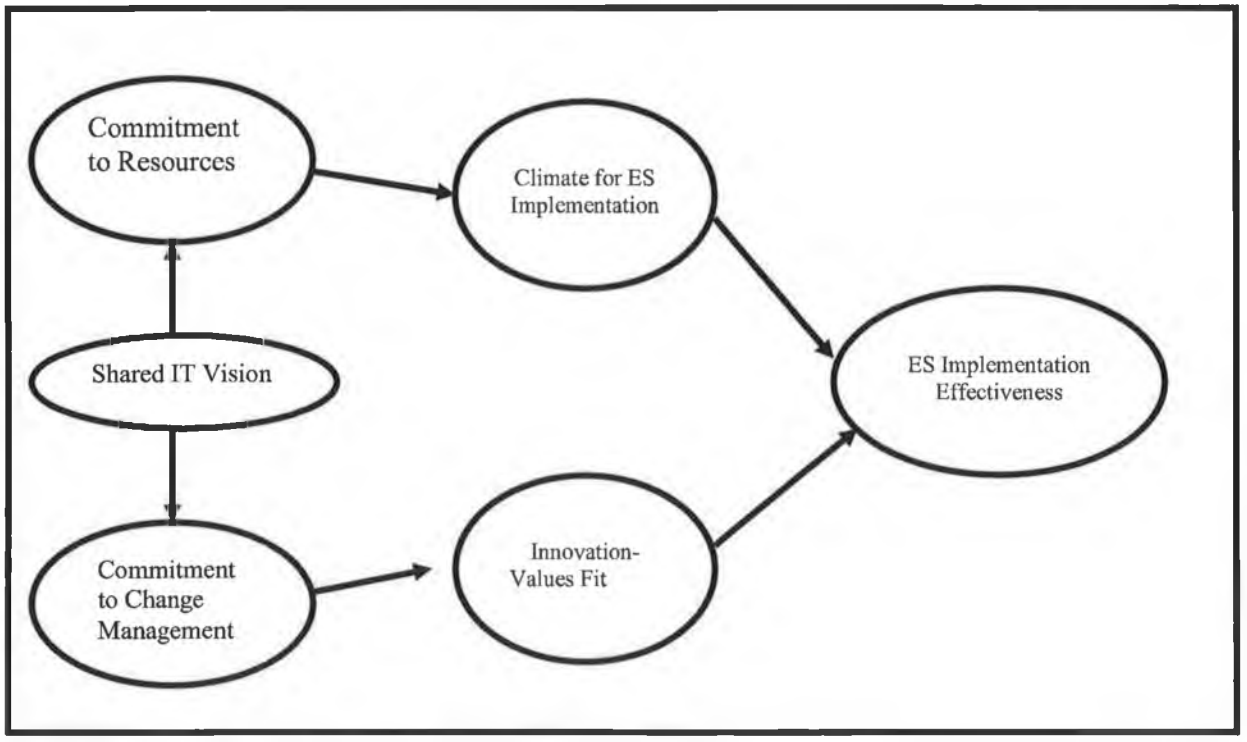


Figure 5.1: Adapted from Dong (2001)

5.2.2 Education and Training

> *"What we have to do, we learn by doing"*
>
> Aristotle

Users buy-in is critical to the success of the IS implementation. If users understand the system they are more likely to buy into it. Umble et al. (2002) suggest that to ensure buy-in, end-users education and training is critical. If users do not understand the system they will only use those functions that they are able to manipulate, thus inventing their own processes. According to Burch (2002) poorly trained users are never happy and this will detract from productivity. Superior training of personnel is imperative to the success of an enterprise system (Beheshti 2006).

Training presents an opportunity to enable users to adjust to the change caused by the implementation, and training can help build positive attitudes to the new systems (Aladwani 2002). Users get the opportunity to appreciate the potential benefits and the quality attributes of the system. The real benefits of the system will only be realised when the users use the system effectively. Training should begin early to ensure the users are ready for the implementation (Umble et al. 2002). To ensure adequate training, management must commit time and resources as required. The cost of training must be built into the implementation budget (Umble et al. 2002).

Employees should not be expected to effectively use the system based on education and training alone. Ongoing on-the-job and hands-on training post implementation is vital.

Project managers should monitor the use of the system and the problems encountered by the users (Umble et al. 2002). As the introduction of a new information system will often result in loss of productivity, substantial training will be required to improve users' productivity through the use of the system (Rocheleau 2006). Parth & Gumz (2003) stress the need to provide adequate training to both the contractors implementing the system and to the users who live with the system and support it. Inadequate training leads to users learning their own way, which may not make effective use of the new system. Brown (2004) advocated the use of super-users to train the users in their functional areas prior to the deployment of the IS.

Sumner (2000) found that most organisations researched, stressed the need to commit to re-skilling users in new technologies generally, and supplementing this with specific module training as appropriate to the business unit. Manoeuvre (2001) recommends that training incorporates an explanation of the business objectives of the project, the new business processes, people's new roles and all aspects of the system.

5.2.3 Excellent Project Management

> *"A carelessly planned project takes three times longer to complete than expected; a carefully planned project takes twice as long".*
>
> Famous Quote.

Whitten & Bentley (2007) offer the following definitions of a project, a project manager and project management.

> *"A project is a sequence of activities that must be completed on time, within budget, and according to specifications."*

> *A Project Manager is the person responsible for supervising a systems project from initiation to conclusion. Successful project managers process a wide range of technical, management, leadership, and communication skills."*

> *"Project Management is the process of scoping, planning, staffing, organising, directing, and controlling the development of an acceptable system at a minimum cost with a specified time frame."*

Creating and implementing an information system successfully requires, managing resources, activities, and tasks required to complete the project. The skills required by a project manager, to initiate, plan, execute and close a project, include management, leadership, conflict management, and customer relations (Hoffer 2002).

According to Post & Anderson (2003) a project with precise, well-defined goals is better focused, and as a result has a greater chance of succeeding. The focus of project management is to ensure that the information system implementation meets customer

expectations and is delivered within budget and on time (Hoffer 2002). These three key dimensions of a project, time, budget and specification, are the primary focus of the project manager and ones that require the project manager's influence, management and control.

Effective project management is necessary for the successful completion of any development or implementation of a large-scale enterprise system (Hoffer 2002). Project management includes a clear definition of the objectives, a work plan, a resource plan and careful tracking of the project process (Umble et al. 2003). The clear definition and plan can help avoid 'scope-creep'. Change in scope during a project is responsible for a considerable element of the time and cost slippages. Whitten & Bentley (2007) define scope-creep as,

> *"...a common phenomenon wherein the requirements and expectations of a project increase, often without regard to the impact on budget and schedule."*

Organisations need to be prepared before undertaking such a large project. A large-scale enterprise wide implementation project is costly and slow to run, and therefore needs skilful panning and the selection of a project manager with business and technical skills is vital (Beheshti 2006). Individual stakeholders must be aware of what is involved in the implementation, the volume of effort required and the ultimate effect on staff assigned to the project. The project manager must ensure commitment of key personnel is obtained and maintained. The project manager must build an effective team; define roles, responsibility and structure; communicate effectively with the team, management and users; and, monitor performance against expectations.

Gowan & Mathieu (2005) argue that the implementation large-scale enterprise projects require project managers to have project management skills and practices that are successful in a global, integrated and distributed environment. Adam et al. identify in table 5.3 below, elements of a project that require effective management, and argue that failure to effectively manage contributes to a degree of failure.

Table 5.4: Project Management Elements

1. Project Integration Management	2. Project Scope Management	3. Project Time Management
1.1 Project Plan Development	2.1 Initiation	3.1 Activity Definition
1.2 Project Plan Execution	2.1 Scope Planning	1.2 Activity Sequencing
1.3 Integrated Change Control	2.2 Scope Definition	1.3 Duration Estimating
	2.3 Scope Verification	1.4 Schedule Development
	2.4 Scope Change Control	1.5 Schedule Control
4. Project Cost Management	**5. Project Quality Management**	**6. Project HR Management**
4.1 Resource Planning	5.1 Quality Planning	6.1 Organisational Planning
4.2 Cost Estimating	5.2 Quality Assurance	6.2 Staff Acquisition
4.3 Cost Budgeting	5.3 Quality Control	6.3 Team Development
4.4 Cost Control		

7. Project Communications Mgt.	8. Project Risk Management	9. Project Procurement Mgt.
7.1 Communications Planning	8.1 Risk Identification	9.1 Procurement Planning
7.2 Information Distribution	8.2 Risk Analysis	9.2 Solicitation Planning
7.3 Performance Reporting	8.3 Risk Response Planning	9.3 Solicitation
7.4 Administrative	8.4 Risk Monitoring and Control	9.4 Source Selection
		9.5 Contract Administration

Table 4. : Adapted from Adam et al.

Brown (2004) recommends that the project manger is familiar with the organisation and has the ability to get things done, foster collaboration, make decisions and break impasses. The project manager keeps the implementation team on track for milestone deadlines, provides assistance to implementers with process change decisions, and makes resources available where required and appropriate. The project manager must believe in the value of the implementation to the organisation.

The management, scheduling, and carrying out of the project, and how the project has responded to stakeholders' requirements, reflects the organisation. Users' perception of the management of the project is an issue that can affect the implementation planning. Gowan & Mathieu (2005) advocate adopting a project management methodology to ensure project success, particularly in enterprise systems implementation.

5.2.4 Change Management

> *"It is not the strongest species that survive, nor the most intelligent, but the ones most responsive to change"*
>
> Charles Darwin

The implementation of a new information system inevitable causes disruption to staff as their work patterns change. This change, as a result of the new system, needs to be managed and controlled in order to ensure that staff motivation and productivity is not negatively impacted (Bocij et al. 2003). A successful implementation is brought about through effective change management.

Despite many attempts to identify change management strategies, many implementations still face resistance or failure (Aladwani 2001). The implementation of a complex information system may force the organisation to re-engineer key business processes or develop new business processes. These changes may pose major changes on the organisation structure, policies, procedures and employment (Umble et al. 2003).

The implementation of a new system is not just a technical challenge, and the ultimate goal should be to improve the business and not just the system (Umble et al. 2003). The larger and more complex the IS implementation the more changes that are required in existing business processes (Dong 2001). If employees and the organisation are not prepared for these profound changes, the result may be denial and resistance. Proper

change management ensures the organisation embraces the opportunity provided by the new system (Umble et al. 2003). Donovan (1999) suggests that organisations are often steeped in old bad habits and traditional way of doing things. These habits may be ineffective methods, but the organisation knows and relies on them to run the business. The organisation must leave these old habits behind and develop a new mindset.

Manoeuvre Pty. Ltd. (2001) listed "*Not managing change effectively*" as one of the six deadly sins of ERP systems implementation. An organisation should not underestimate the impact that the implementation has on people, their roles, skills and organisational structure. The organisation and personnel should be willing, ready and able to embrace the systems and the changes, and this must be communicated and influenced at various levels within the organisation. Beheshti (2006) recommends establishing an ERP system planning and implementation team, which will determine the impact of an ERP system on the organisation.

According to Scott & Vessey the implementation of a cross-functional enterprise system results in major organisational change. This change is influenced by many factors in the business environment. According to Hackney & McBride (1995), if the cultural and contextual factors of the organisation are given as much attention as the technical factors, the implementation is likely to be successful. Martinez (1994) identified "culture and value assessment" as critical for the success of larger implementation projects. This involves analysing the current persistent culture of potentially affected areas, and preparing an implementation change management plan to change the behaviour of the

organisation gradually. Aladwani (2001) suggest a process oriented conceptual framework for change management, which would include the following steps:

Step1. Identify and evaluate attitudes of individual users and influential groups in order to determine the sources of employee resistance to the new system. Employees may feel that they are years doing the job without the new system, that their job is threatened by the new system, and that they may not know how to do their job with the new system

Step 2. Base the change management strategy on the analysis conducted in step one. Communication is the key factor at this point. Inform and convince users of the benefits of the system and create awareness. Check for inflated expectations; if expectations are not met user resistance will be deepened.

Step 3. Get the endorsement and support of respected well-known leaders who will invoke group pressures. A new system is best introduced when attitudes are positive. If users perceive that management are committed then they in turn are more likely to participate in and support the project.

Step 4. Monitor and evaluate in order to keep anxiety and user resistance under control. Managing user resistance through communication is critical throughout the project.

Jay & Smith (1996) advise paying particular attention to planning for the change and ensuring appropriate leadership is in place to direct the change. They also advise creating a readiness for change, closely managing the transition and the resistance to change, and, evaluating the impact of the change. Salauroo & Burnes (1988) suggest that organisations that most successfully manage change pay attention to, and manage effectively, the environment in which the organisation operated; the state of the internal cohesion of the organisation; and, the management and their approach to change.

According to O' Brien (2005) change experts recommend involving as many stakeholders as possible in reengineering and change, and making that change a constant part of the culture of the organisation. It is vital to communicate all relevant information, with regard to all aspects of the project to all concerned. He advocates the use of incentives and recognition of employee's contribution in maintaining motivation. The change strategy adopted by any organisation depends on the amount and level of resistance, the magnitude and timeframe of the change, the risk associated with the change, and the expertise required to implement such a change (Beer & Noria 2000).

5.2.5 Communication

> *"The problem with communication is the illusion that it has occurred".*
>
> George Bernard Shaw

Sarker & Lee (2002) propose that implementation can only be a success if there is open and honest communication among the stakeholders. Bakehouse & Doyle (2003) argue

that communication is one of the main conditions necessary for the successful implementation of an information system. It is paramount that the right people communicate the right information at the right time in the right format, and that this communication is honest (Nah et al. cited in Sarker & Lee 2002). Sumner (2000) recommends telling stakeholders in advance what is happening with regard to the scope, objectives and activities of the project. It is imperative that management admit that there will be changes as a result of the implementation.

Scott and Vessey recommend fostering an open culture, encouraging open communication and responding to environmental and strategic changes at project level. Brown (2004) further advocate communication as a vital element of change management, in the following format: initial briefings, visits and briefings on site, regular meetings to employees, conference calls by leaders to super users, project new letters, Intranet, project meetings, presentations, minutes circulated, training material, and Frequently Answered Questions. Brown (2004) further recommended placing a senior employee in charge of communication and change management.

Davenport (1993) suggests that communication should be through the change program and that sensitive issues that may affect employee conditions must be addressed openly and honestly. Management must increase awareness of the benefits of the ERP system by communicating with the workers and by teaching the users how the ERP system works (Aladwani 2001).

As part of this critical element of communication, management must ensure that key people in the organisation communicate a clear and compelling vision of the organisations goals. This must include a clear definition of goals, expectations and deliverables of ERP system implementations; the reason for the implementation; and the critical business needs this system will address (Umble et al. 2002). Aladwani (2001) suggests that through effective communication an attempt should be made to affect the cognitive component of users' attitudes when trying to change the attitudes of potential users.

Watson et al. recommend that you should never 'assume anything' during a large-scale implementation project. Miscommunication has been the cause of many major errors. Everything must be formally agreed and documented. Manoeuvre (2001) suggests that blanket approaches to communication are ineffective and the communication needs to be varied and appropriate depending on the people's level of influence and ability to impact.

5.2.6 User Involvement

> *"Tell me and I'll forget, show me and I may remember, involve me and I'll understand".*
>
> *Chinese Proverb*

End user resistance to the implementation of the new system has often been cited as one of the major contributing factors to the ultimate demise of the implementation. A key to addressing the problem of end-user resistance is to promote end-user involvement in the

organisational change and in the development and implementation process (O' Brien 2005). User participation will increase user commitment and foster a sense of ownership for the new system. User participation will also enhance quality, as the assessment of requirements is more complete (Tyran & George 1993). Beheshti (2006) recommends cross-functional unit involvement in the implementation process, which he suggests will facilitate implementation activities and foster a sense of ownership, which will lead to further use of the system.

End-user involvement incorporates the need for user participation in the implementation, and the personal relevance of the information system to the individual user. Higher levels of systems' success is associated with treating a broad range of organisational factors throughout the development and implementation process and ensuring that users are actively involved (Doherty et al. 2003). Tait & Vessey (1988) categorise levels of user involvement as generally dependent on the users position and their role within the organisation. Involvement can range from no involvement or symbolic involvement, to involvement by advice or by weak control, to involvement by doing or by strong control.

Ives and Olson, (1984) cited in Hoffer et al. (2003) argue that the link between user involvement and success is not always strong, and as a result may not conclusively contribute to the success or failure of the implementation.

5.2.7 Organisational Fit and Business Process Reengineering

Information Systems, in particular ERP system implementations success, depends on the organisational fit of the information system (Hong & Kin (2001). The ERP system fit to the current business processes must be considered during the selection phase of the project. A major challenge of the implementation is the adaptation of the business processes and work practices to match the system, and the adaptation of the new information system to match the current business practice.

Sumner (2000) suggests that many organisations 'go to war' with the software solution and try to make it meet their business process requirements, which inevitably leads to delays and cost overruns. She recommended re-engineering processes to be consistent with the software and limiting the changes to the original software. Enterprise software is not easily customised and the business processes must adapt to the systems embedded processes (Stefanou & Revanoglou 2006). If customisation or modification is necessary an agreement between IT managers and user managers is required. According to Dong (2001) greater benefits will be experienced due to greater ERP system integration, if fewer changes are made to the system. The bigger the ERP system integration the greater the number of changes required in the existing processes, thus greater risks will be involved.

Hoffer et al. (2002) offers the following definition of Business Process Reengineering:

> *"The search for and implementation of radical change in business processes to achieve breakthrough improvements in products or services."*

Business Process Reengineering (BPR) recognises that business processes and management structures can be fundamentally transformed so that the definition, focus, organisation and running of a business are improved (Bocij et al. 2003). The new information systems can be the catalyst for this change. Consideration must be given to the organisational context when implementing this change (Stefanou & Revanoglou 2006). The technology may force organisations to reconsider their processes and find new ways of operating. Some IS implementations require a study of existing processes to identify problems, area for improvement, bureaucracy, and inefficiencies that need to be addressed by the new technology (Whitten & Bentley 2007).

As there is a considerable risk involved in BPR, Davenport (1993) offers the following staged approach as a guide to reengineering business processes:

- Identify the process for change with emphasis on major business processes.
- Identify the change levers
- Develop the process vision; how and why the process might be modified
- Design and prototype the new process.
- Handle the implementation of the process sensitively.

Dobriansky (2004) argues that business process reengineering is vital to ensure that the new enterprise information system will not just overlay the existing organisation and business processes. Reviewing and reengineering business process can result in reducing the level of customisation required on the selected software solution. He suggests at the outset performing a fit analysis, which identifies the current state and the desired future state. The output of this analysis is documented 'as-is' processes. This analysis identifies gaps in the business processes and potential process improvements. Based on the findings of the analysis conducted, newly engineered business processes are mapped and documented, and standard operating procedures are developed and issued in the form of a process/policy/procedure manual. Finally, training is developed and delivered to encompass the implementation.

5.3 Summary

An implementation of a large, complex Enterprise Resource Planning System is an enormous undertaking for organisation. Many factors and issues influence the success or failure of implementation. These factors must be considered and managed to minimise the probability of failure and to maximise the benefit of the implementation to the organisation. These critical factors include management commitment, education and training, project management, change management, communication, user involvement and organisational fit.

5.4 Conclusion

The study of large-scale information systems development and implementation is abundant with both empirical and anecdotal evidence of a preponderance of failures in the Irish Public Sector. In recent years the Irish Credit Unions failed to introduce the standardised Information Systems ISIS. The government failed to implement the proposed Electronic Voting System. The Health Service Executive PPARS system has cost the taxpayer in excess of €195 million and is considered a failed solution.

An organisation embarking on a large complex implementation project, regardless of the methodology employed or the approach taken, must consider many factors and issues that may influence the outcome of the implementation. Organisational, individual, technical and situational issues impact the level of success or failure of ERP system implementations. This study is primarily concerned with examining in detail, the factors and their potential influence on the implementation of large-scale information systems in the Irish public sector.

CHAPTER 6 RESEARCH METHODOLOGY

6.1 Introduction

Chapter two, three, four and five have placed this study on large-scale enterprise information systems implementation in its historical and associative perspective. Those who commission and those who implement information systems encounter significant problems, which have been highlighted. The research is designed to identify the major factors that impact the success or failure of the delivery stage of the implementation of an information system.

This chapter outlines the research methodology applied in the reported study of the systems development lifecycle implementation activities, at selected organisations in Ireland. The main objective for this chapter is to examine the theoretical and conceptual considerations affecting the research design adopted by the author to complete this study. The research approach is then examined; the research design is identified; and, case studies and interviews are analysed.

Having examined research methods, a case / field study is proposed and justified. This research draws upon case studies, semi-structured interviews and questionnaires as a means of collecting data.

6.2 Research Objective

The research is designed to investigate the major factors that impact on the success or failure of the implementation of a large-scale enterprise information system in the public sector. The research objectives are discerned as a primary objective, which answers the research question, and secondary objectives, which qualify the answer.

6.2.1 The Primary Objectives

The primary objective of this research is:

- To identify the major factors conducive to the success or failure of the Delivery Stage of large-scale information systems implementation in the context of a number of selected public sector organisations in Ireland.

It is planned to achieve this objective by identifying and applying critical analysis to the issues relevant to the delivery stage of the implementation of a large-scale enterprise information system, and by examining how these have impacted the overall success or failure of the information systems implementation.

6.2.2 Secondary Objectives

The secondary research objectives are as follows:

- To identify and qualify the major strategies used within the Delivery Stage of the implementation phase of a large-scale information system in the Irish Public Sector.
- To outline Individual Variables, Organisational Variables, Situational Variables and Technological Variables within the Delivery Stage that affects the outcome of large-scale information system implementation in the Irish Public Sector.
- To identify and quality the critical role of end-users in the Delivery Stage of large-scale information systems implementation in the Irish Public Sector.
- To identify and qualify the critical role of management in the Delivery Stage of large-scale information systems implementation in the Irish Public Sector.
- To derive an insight into best 'Delivery Stage Practices' and to prescribe for successful Large-Scale Information Systems Implementation in the Irish Public Sector.
- To identify areas for further research

Section 6.5.1 outlines in detail how each of the secondary objectives are to be addressed and in particular how they are linked to the Research Questionnaire, as detailed in Table 6.1.

The objectives will be achieved by:

- Conducting a literature review focusing on books, articles, scientific papers and the Internet.
- Analysing the responses received from interviewees during the field study.

6.3 Research Philosophy

6.3.1 Positivist Philosophy

Smith (1998) argues that the positivist approach to research assumes things can be studied as hard facts. With positivist research only observable and measurable data should be taken into account and only data provided by direct observation can be used to reach 'positive facts'. Positivism assumes an objective reality exists and it is independent of human behaviour.

6.3.2 Phenomenological Philosophy

The word 'Phenomenology' is derived from the two Greek words: phainomenon (an "appearance") and logos ("reason" or "word,") hence a "reasoned inquiry". This philosophy has been adapted to promote an understanding of the relationship between states of individual consciousness and social life (Natanson 1970). The phenomenological approach looks at the interpretation of individuals to the phenomena being studied.

6.4 The Research Method

Based on the overall goal of the study, an appropriate research method was chosen. Two paradigms in particular have earned widespread use, the Quantitative approach based on the positivist philosophy and the Qualitative approach based on the phenomenological philosophy.

The quantitative-qualitative classification is dependent on three criteria: (Kumar 1996)

1. *The purpose of the study*
2. *How the variables are measured*
3. *How the information is analysed*

Put simply by Punch (1998), both are empirical research methods, but quantitative research is applied to numerical data, and qualitative research is the analysis of descriptive data.

6.4.1 Quantitative Research Methods

Hoepfl (1997) describes quantitative methods as follows:

> *"Logical positivism, or quantitative research, uses experimental methods and quantitative measures to test hypothetical generalisations"*

Quantitative research attempts to quantify phenomena so that they can be transformed into numbers. This form of research is scientific and objective. The main method used to

collect quantitative data include, Interviews, Tests/Measures, Observation and Questionnaires.

6.4.2 Qualitative Research Methods

Cresswell (1994) defines a qualitative study as:

> *"An inquiry process of understanding a social or human problem, based on building a complex, holistic picture, formed with words, reporting detailed views of informants, and conducted in a natural setting*

Qualitative research is "*any kind of research that produces findings not arrived at by means of statistical procedures or other means of quantification*" (Strauss and Corbin 1990). Qualitative research involves the use of qualitative data, such as interviews, documents, and participant observation data, to understand and explain social phenomena.

In information systems research, there has been a general shift away from technological issues to managerial and organisational issues, hence an increasing interest in the application of qualitative research methods (Myers 1997).

According to Denzin & Lincoln (1994) qualitative research is multi-method, which involves an interpretive, naturalistic approach to its subject matter. Qualitative researchers study things in their natural settings. Qualitative research involves the use of a range of empirical materials, case study, personal experience, introspective, life story interview, observational, historical, interactional, and visual texts.

Oakley (1999) outlined the following differences between qualitative and quantitative research:

The quantitative paradigm objectively seeks the causes of social phenomena as the researcher is removed from the data and gains a perspective 'as an outsider'. This outcome-oriented approach is an obtrusive and controlled measurement of reliable, hard and applicable data. The paradigm assumes a stable reality where the findings are verification oriented, ungrounded and generalisable.

The qualitative paradigm is a subjective naturalistic and uncontrolled observation concerned with understanding behaviour from the actor's own frame of reference; from an 'insiders' perspective. The methodology is grounded, discovery-oriented, exploratory, descriptive and inductive. The process-oriented approach is based on valid, real, rich, holistic data in a dynamic reality, which produces ungeneralisable findings.

6.4.3 Sources of Data

A field research approach has been chosen as the most appropriate research method for this in-depth, exploratory study. The following is an examination of the most suitable techniques available and used for the purpose of this study.

6.4.3.1 Case Study

Yin (2002) describes a case study as an empirical inquiry that investigates a contemporary phenomenon within its real-life framework, especially when the boundaries between phenomenon and context are not clearly evident. Case study as a research method is appropriate for IS research, as the researcher is studying organisations, and according to Benbasat et al. (1987) interest has shifted to organisational rather than technical issues.

Cresswell (1994) offers the following rationale for choosing a qualitative case study approach:

1. The research question often starts with a '*how*' or a '*what*' so that initial forays into the topic describe what is going on.
2. The topic needs to be *explored.*
3. There is a need to present a detailed view of the topic.
4. There is a need to study individuals in their *natural setting.*
5. The author is interested in *writing* in a literary style.
6. *The target audiences for the research are receptive* to qualitative research.
7. To emphasise the researcher's role as an *active learner* who can tell the story from the participants' view.

Benbasat et al. (1987) offer the following as the key characteristics of case studies in the study of information systems.

- The phenomenon is examined in a natural setting.
- Data is collected by multiple means.
- One or few entities (person, group or organisation) are examined.
- The complexity of the unit is studied intensively.
- The investigator should have a receptive attitude towards exploration.
- No experimental controls or manipulation are involved.
- The investigator may not specify the set of dependent and independent variables in advance.
- The results derived depend heavily on the interegative powers of the investigator.
- Changes in site selection and data collection methods could take place as the investigator develops new hypotheses.
- Useful to study "how" and "why" questions.
- The focus is on contemporary events.

Case study has been selected as appropriate for this research based on time constraints, the timeline of the study, resources available and the nature of the research question. A case study approach is most appropriate to elicit the information relevant to the research. This approach is considered the most feasible because of the nature of the investigation.

6.4.3.2 Personal Interviews

Based on the time constraints, the nature of research question and the resources available semi-structured interviews were deemed an appropriate method for gathering data in this study. The personal interview was the major source of data collection. The organisations were cooperative and accepted this method. A semi-structured interview guide, appropriately supported by a detailed questionnaire was used for the collection of data. This conversational approach yields flexibility and may lead the interviewer to adjust the focus of the question or to probe deeper into an issue as appropriate. The interviewer adopted the use of interview probes (detail-oriented, elaboration and clarification) as key interviewing techniques.

A preliminary interview was conducted with a senior member of the implementation team in each of the organisations chosen. This was subsequently followed by detailed interviews with a number of stakeholders in each organisation. The use of a detailed questionnaire provided a guide to the interviewer, while also allowing flexibility for the interviewer to develop ideas and discussions.

To ensure that a depth of knowledge resulted from the study, it was agreed to interview a minimum of four users from each of the two participating organisations.

6.4.4 Selection Criteria

The organisations were selected for the study based on the following criteria:

- A large public sector organisation with substantial organisational complexities and diversities in business process.
- A public sector organisation that has undergone an implementation of a large, complex, fully integrated, Enterprise Resource Planning (ERP) System in the last three years.
- A public sector organisation that had experienced substantial failure in the implementation of an ERP system.
- A public sector organisation that had achieved moderate to significant success in the implementation of an ERP system.
- A public sector organisation reasonably accessible to facilitate time and financial constraints of the author.

For the purpose of the study it is assumed that ERP system implementations in large organisations are of a homogeneous nature, i.e. there is no substantial difference in the degrees of complexities in these throughout Ireland.

A list of 10 public sector organisations was prepared. Each was contacted by phone to conduct a preliminary interview to establish their suitability with reference to the criteria listed above. Of those contacted four had recent ERP system implementation and of them two agreed to participate.

6.4.5 Data Collection

Having decided on the research method, the next step in the process was the collection of data. Following the identification of a list of suitable candidate organisations by means of an initial phone interview, the organisations were initially contacted by e-mail and subsequently by phone. The potential respondents were assured of the importance of the research and the value of their cooperation. A preliminary interview was agreed upon, and the respondents understood that the meeting was intended to produce material that was to be used for the purpose of preparing for detailed interviews. Follow-on interviews were agreed upon, and the respondents understood that the meeting was intended to produce material to be used for research purposes. All respondents were offered a summary of the findings. The respondents were assured that their words could be treated as 'on the record' and 'for the record'. The venue for the interview was arranged and the method for recording the interview was agreed.

The purpose of the semi-structured interview as a means of collecting data was to question the views of a number of stakeholders affected by or involved in the implementation of an information system.

6.4.6 Size and Nature of Organisations Targeted

This research targeted Irish public sector organisations that had implemented complex, large, integrated information systems, irrespective of whether this implementation was a success or not. In order to formulate a study where findings could be generalised with a

level of confidence it was agreed that a minimum of four stakeholders would be interviewed from each organisation.

6.4.7 Profile of Stakeholders Interviewed

In order to gain an insight into the phenomenon being studied and to gain a perspective of the implementation from each stakeholder's viewpoint it was decided that a minimum of four stakeholders from each participating organisation would be interviewed. Due to the lack of availability of stakeholders other than users, participation in interviews was limited to end-users. Although the study targeted stakeholders from the system user group and the system superuser group only, the researcher was aware that each question posed would have different responses depending on the end-users position and role within the organisation.

The users interviewed, as part of the PPARS case study were all part of a user group that were actively involved in many stages of the development and implementation process, including training of other users. Due to the lack of availability of HSE employees, only four PPARS users were interviewed.

The users interviewed as part of the BANNER case study were either administrative users or academic users. The researcher was forced to limit the number interviewed to five due to the lack of availability of GMIT staff to participate in the study.

6.4.8 Information Systems Implementation Projects Targeted

The information systems implementation targeted were large, complex, fully integrated information systems that span most or all of the basic, core business functions. These systems were typically Enterprise Resource Planning Systems, consisting of integrated modules, which supported the operations and business process of the organisation.

6.5 The Research Instrument

The questionnaire was used as an exploratory research technique to guide the interview and allow for ideas to be developed and discussed. The questionnaire was designed to identify information with regard to the major organisational, individual, situational and technological factors that may influence the success or failure of the implementation of information systems. The questionnaire was designed in consideration of, and in strict line with the research objectives. Each question was designed in light of the relevant literature. The Questionnaire can be found in Appendix A.

6.5.1 The Questionnaire Content

The questionnaire content is summarised in Table 6.1

Table 6.1: Questionnaire Content

Question Number	Question Purpose
Q1 – 4	Identify interviewee profile
Q3 – 6	Identify a profile of the system implemented and the level of customisation.
Q9 – 12 Q15 – 18	Identify the perceived success or failure of the information system, and the quality of the system
Q13 – 14	Identify budgetary and timeliness issues
Q22-23	Identify the implementation approach adopted by the organisation.
Q19 – 21, Q45 Q54 – 57	Identify the influence of end user involvement on the implementation
Q24 – 31 Q58 – 59	Identify the influence of change management on the implementation
Q32, Q47, Q50 – 53, Q63	Identify the influence of Education and Training on the implementation
Q33 - 39, Q60-61	Identify the influence of Management Commitment on the implementation
Q40 – 42 Q62	Identify the influence of Project Management on the implementation
Q7-8 Q43 - 45	Identify the influence of Organisational Fit on the implementation
Q48 – 49	Identify the influence of Communication on the implementation

6.5.2 Pre-testing the Questionnaire

The questionnaire was presented to two Project Managers. They were asked to appraise and evaluate the questionnaire with particular emphasis on the following:

- The scope and content of the questionnaire, i.e. are all key issues in the context of information systems implementation identified, or are there issues omitted that would contribute to the research.
- The relevance of the questions, are they meaningful to the target audience.
- The wording of the questions
- The order of the questions
- The length of the questionnaire

Comments from the two evaluations resulted in only minor changes in the questionnaire content. One suggested changing some questions to include a quantitative scaling option. This was taken into account and the relevant changes were made to the questionnaire. The length of the questionnaire was considered in light of a comment and although it was considered lengthy it was agreed that to shorten it would be to compromise on quality. It was agreed that the length of the questionnaire and the associated interview, would be clarified with all participants prior to the interview.

6.6 Limitations of the Research Design

The research is subject to all the limitations imposed by the use of a case study; other techniques are needed to compliment the case study if general claims are to be made on the findings. The research is limited by time and resource constraints. The number of participants available also limits the research. The two case studies allow for in-depth analysis of similar cases but with limited representatives. The usefulness of the research is dependent on the interviewees understanding of the phases involved in systems development, in particular the implementation phase.

6.7 Obstacles to the Research

The researcher was unable to obtain primary data in relation to the cost associated with the implementation of the 'Banner' System due to confidentiality issues.

Due to work commitments of staff within the two organisations under study, the availability of individuals to participate in interviews was limited.

6.8 The Contribution of the Research

The contribution of the case studies is envisaged as follows:

- An evaluation of the implementation strategies and the factors that influence and impact the success or failure of that implementation as perceived by the target companies.
- Having derived an insight into worst or best 'Delivery Stage Practices', to prescribe for successful Information Systems Implementation.
- A platform for future research in this area.

This study is expected to set a marker against which further research into systems implementation of large-scale enterprise systems can be measured.

CHAPTER 7 RESEARCH FINDINGS

7.1 Introduction

The research findings are based on the analysis of two case studies; the implementation of 'PPARS' Enterprise Resource Planning (ERP) system in the Health Services Executive Western Area (HSE Galway), and the implementation of 'Banner' ERP system in the Galway Mayo Institute of Technology (GMIT). A preliminary profile of each organisation is presented. The primary research question is addressed in terms of a recent implementation of ERP systems in each organisation. The case study questions are predominantly exploratory in nature, as was deemed appropriate for a study of this nature.

7.2 Overview of the Case Studies.

The following section provides an overview of the organisations, and the information systems implementations examined in this research study.

7.2.1 Health Services Executive (Western Area)

The Health Service Executive Ireland is responsible for running the country's health and personal social services in the country. The Health Service Executive Ireland comprises seven Health Service Executive Areas, formerly the Health Boards. They each provide

many of the services directly and arrange for the provision of other services by health professionals, private health service providers, voluntary hospitals and voluntary/community organisations.

The Health Service Executive Western Area is examined in the first case study. The objective of the HSE, as outlined in the Health Act, is to use the resources available to it in the most beneficial, effective and efficient manner to improve, promote and protect the health and welfare of the public. The Board's area covers the counties of Galway, Mayo and Roscommon in the West of Ireland. The Board is a major employer in the Western Area, with over 11,756 staff.

7.2.1.1 PPARS

In 1998 the Health Boards (now the HSE) chose the SAP R/3 Enterprise Business Software to support the Personnel Administration, Payroll, Attendance Monitoring / Control, Rostering, Recruitment and Superannuation Functions of the organisation in an integrated manner. This system was also capable of interfacing and integrating with existing systems in the health agencies.

A fixed price contract for the implementation was awarded to Bull Information Systems (BSL) and it was anticipated that the implementation would take two years to complete. The overall budgeted cost was €9.14m. Soon after the establishment of the contract with BSL it became obvious that the system would not be implemented within this time frame. The contract with BSL was terminated due to a dispute regarding remuneration.

By 2001 only one element of the system had been implemented. The project received national coverage in May 2002 and the scope was extended to include all health board agencies. Deliotte Consulting Limited was engaged in October 2002 as project support adviser on a 'time and materials' basis.

The PPARS project was expected to address the need to develop a fully integrated human resource system; streamlining the processes of rostering and paying salaries to eliminate duplication of documentation; and, the desire to have a system that would facilitate the decentralisation of human resource functions.

Phase one of the project went live in August 2001. The implementation of Phase two of the project commenced in April 2004 and was abandoned in October 2005. Phase two of the implementation is the subject of this study.

Table 7.1: PPARS Project History

September 2000	SAP are engaged to blueprint elements of the system
November 2001	Technical Configuration personnel configure system to business requirements
May 2002	The Department insists national coverage of project is essential
October 2002	Consultants engaged. Scope of project defined
February 2003	Consultants engaged as project sponsor
April 2004	Phase 2 Commenced
August 2004	IBM appointed technical implementation partner
November 2004	Original Planned Go Live Date
April 2005	1st Revision Go Live Date
June 2005	2nd Revision Go Live Date
September 2005	3rd Revision Go Live Date
October 2005	HSE suspends the further rollout of project pending a review.

During the lifetime of the project there was many revisions to the timescales set, this resulted in considerable delays in the completion of the project. This contributed significantly to the spiralling costs of the project.

7.2.1.2 PPARS Implementation Approach

The implementation of the PPARS system within the HSE Western Area was a combination of a parallel and phased approach. A national pilot implementation took place in St. James Hospital, which is a much smaller and a less complex site than any of the others, and is not considered representative of the bigger, complex sites such as the Western Area HSE.

The subject of this study is the PPARS Phase Two implementation in the HSE Western Area. This was run in parallel with the legacy system until such time as Phase Two was ultimately abandoned.

Interpretation

When questioned on the effectiveness of the implementation approach one respondent suggested that if phase two had been piloted locally, as was regularly recommended by the local implementation team, there would have been a higher probability of success. The pilot implementation was rejected on a time and cost basis. He also suggested that if Phase two had been divided into smaller more manageable phases there would have been a greater chance of success. Phase One was approached in this manner and was considered a success.

The respondents suggested that a combination of approaches, possible a staged piloted approach, would be appropriate for such a large complex implementation.

Due to time constraints, lessons learnt in Phase One and the benefits experienced by running a pilot implementation were not capitalised on in Phase Two. In hindsight the long-term savings attributed to a pilot implementation, may significantly have covered the short-term cost of a pilot implementation.

7.2.2 Galway Mayo Institute of Technology

The Galway Mayo Institute of Technology (GMIT) is a multi-campus regional educational institution, catering for approximately 9,000 students. The college offers undergraduate, apprentice and post-graduate courses across a range of disciplines including science, business, engineering, technology and humanities. The GMIT employs approximately 1,100 staff.

7.2.2.1 Banner

The Management Information System for Academic Affairs 'Banner' is Phase Two of the implementation of the 'An Cheim' (Collaborative Higher Education Information Management Systems) suite of systems. The 'An Cheim' MIS Program was established to configure and develop a MIS solution that meets the strategic and operational needs of the Institutes of Technology. This system was to facilitate key aspects of the Institutes'

core business, such as student registration, course scheduling and examinations, to operate in a fully integrated and computerised system.

7.2.2.2 Banner Implementation Approach

'Banner' was implemented in GMIT in 2002. The implementation was part of a national implementation of the system in the Irish Institutes of Technology. The implementation of 'Banner' in the GMIT was the pilot implementation for the National Project. The pilot run in GMIT was a parallel implementation run simultaneously with the existing manual system. As a first mover, the institute provided a test case, which could result in innovative findings for any subsequent implementations.

7.3 Findings – PPARS Case Study

The following findings are presented in terms of the perceptions of the participants to the system, the implementation, and the factors that influenced success or failure of the ERP system implementation.

The results are being presented in a format that reflects the manner in which the interviews were conducted. The finding of the PPARS case study is presented in this section and this is followed by the findings of the Banner case study in section 7.4. A description of the question posed to the interviewee precedes each finding. Direct quotations from respondents are presented in quoted italics. The researchers interpretation is presented after each finding.

7.3.1 Customisation of the System Implemented

This section describes the degree to which the system implemented was customised to satisfy local requirements and business processes. The level of agreement reached on this is also examined.

The interviewees were questioned on the extent to which, in their opinion, the system being implemented was changed as a result of being customised.

Respondents estimated on average that between 40-60% of the original system was modified as a result of customisation. Most of the customisation was imposed on the local agencies as part of the national project. One respondent commented that the customisation of SAP was a large part of the problem, as 'SAP *did not want to be modified'*. Respondents said that the system, due to its inflexibility, was '*driving change in business process'* and this was hugely resisted by employees.

Interpretation

The greater the level of complexity with the business processes, the greater the need for a flexible and expandable system. SAP R/S was seen to have failed in the context of providing the required flexibility, adaptability and extendibility. According to Gebauer & Schober (2005) to be effective, an information system must be sufficiently flexible to accommodate and support the possible variety of business processes. Results suggested that PPARS did not achieve this.

The interviewees were asked whether or not in their opinion there was clear agreement between all interested parties on the level and type of customisation required.

Respondents agreed that there was neither clear understanding nor clear agreement between all parties with regard to the customisation requirements. The customisations were imposed by national decisions and were ever evolving throughout the life of the project. One respondent said that there was clearly '*no signoff*' with users and local agencies with regard to customisation requirements

Interpretation

The findings suggest clear evidence of 'scope creep'. During the requirements gathering and analysis phase, clear agreement must be reached on the business requirements. It is inevitable that some changes to these requirements will occur, but a sign off by all interested parties will minimise creeping changes. It is not enough to involve stakeholders; they must be party to, and agree with, decisions made.

7.3.2 Cost of the System Implementation

IS implementations are notorious for time and cost overruns. According to research by the Standish Group, 52.7% of implementation projects cost 189% of the original estimate and only 16.2% are completed on time and on budget.

The original budget for the PPARS Project was €9.14m. By the end of Phase One the project was running a cost of €17m. A revised budget for Phase Two was set at €109m. The final cost of the project when the implementation was abandoned in Oct 2005 was €195m. This is approximately 20 times the original budgeted cost. The PPARS project encountered a significant number of restarts.

Interpretation

This concurs substantially with the Standish Report (2003), which suggests that one of the major causes of cost and time overruns are as a result of restarts.

7.3.3 Timeliness of the System Implementation

According to the Standish Report (2003) over one third of challenged or impaired projects take twice or even three times as long to complete than originally planned.

As outlined in Table 7.1 Phase 2 Project History, the revised project commenced in April 2004. By the time the project was abandoned in October 2005 the go-live date had been revised three times. The overruns with this implementation, combined with the restarts contributed considerably to the huge cost overruns.

7.3.4 Perceived Success or Failure of the Information System

This section details the perceived level of success or failure of the PPARS system from the users perspective.

As the PPARS system was abandoned before going live, it was difficult to answer some questions in this section. It was agreed that judgments and comments would be based on the users experiences during the delivery phase, up to the point that the project was abandoned.

The interviewees were asked to rate, from their perspective, the level of success or failure of the information system implemented.

	1	2	3	4	5	
Total Failure		*	* * *			**Total Success**

Although officially the system was abandoned and deemed a failure, all respondents agreed that there were many successful elements to the system. One respondent, who experienced the system operating in a less complex environment, felt that if the system had been implemented it would be a great success. Another respondent commented that as part of the system is in use in many agencies within the Health Board, it couldn't be considered a complete failure. The respondents suggested that, on the positive side, the system provided information in real time that was not previously available, and potentially, the organisations information would be available on one system as opposed

to many legacy systems. Referring to the abandoning of the project, one respondent regretted that the system was not implemented, as she envisaged many positive benefits forthcoming from a successful implementation.

Interpretation

The above findings suggests that despite the system being considered be potentially a success, there would appear to be some inherent '*weak link*' either in the system as a technical solution or in the implementation process. It appears to be very difficult to separate the success or failure of the system from the success of failure of the implementation. The two elements are not mutually exclusive when studied in this context.

The interviewees were asked to comment on the effect or impact the implementation had on their job.

All respondents agreed categorically that, from their experiences of the parallel run, the system would have a very positive effect on their jobs. One respondent said that although the system '*opened a doorway to more real-time information in a portable way*' and was '*expandable and transportable'* this was '*not enough'*. The new system never delivered what it promised and therefore buy-in was impossible. The other respondents had a very positive experience of the system and as a result of the training could appreciate its potential despite the huge learning curve.

The interviewees were asked to rate the system qualities on a scale of one to five based on the quality categories in Table 7.2.

Table 7.2 Rating of System Qualities by Interviewees (PPARS)

	1	2	3	4	5	
Completely Inefficient	*	*	* *			Completely Efficient
Not easily extended	*	* *	*			Easily extended
Not easily adapted	*	*				Easily adapted
Not easily maintained		*	*			Easily maintained
Not understood			* * *	*		Fully understood
Accuracy Not reflect Bus. Processes		*	* * *			Accuracy Reflects business processes
Not user Friendly		*	*	* *		Very user friendly

The variations in the rating scored by respondents are attributed to their different roles in the organisation and to their individual use of the system.

Efficiency: Respondents observed that some users saw the system creating more work for them as opposed to making their job more efficient as promised.

Extendibility, Adaptability and Maintainability: These factors were considered by the respondents to be outside the control of the local organisation and in effect were difficult for respondents to comment on.

Understandability: Respondents agreed that understanding the system very much depended on the training received by the individual, their level of computer literacy, their attitude towards the system, and, their willingness to use the system. One respondent suggested that in order to understand the system one would need to be trained and use it on a regular basis.

Accurately Reflect Business Processes: Respondents agreed that the system accurately reflected the business processes that could be automated by the system, but that there was significantly more business processes in place that could not be handled by the system.

Usability: Respondents that the usability of the system very much depended on the user attitudes. One respondent said she '*embraced the system as a opportunity to make their jobs more efficient'*. One the other hand, another respondent said that he felt that '*what they were doing was fine and why change it'*.

Interpretation

In summary there was a more negative view than a positive view of the qualities of the information system, suggesting that it was a failure. The respondents' comments on occasion contradicted the rating and this again would strengthen the argument that the

system and the implementation are not independent elements. The comments seem to indicate that the forces of users attitude, user resistance and lack of management control influenced their opinion of the system.

7.3.5 Influence of End User Involvement on the Implementation

This section examines the findings in relation to the influence of end-user involvement during the Systems Development Life Cycel on the overall outcome of the implementation.

Interviewees Observations

Interviewees were asked to what extent, in their opinion, was end-user involvement encouraged and supported during each phase of the Systems Development Life Cycle.

Technical Solution Selection Phase: One respondent suggested that as the system implementation was part of a national implementation, the system was seen from the users' perspective as being imposed on them. He did not see this as negative or as contributing to the success or failure of the project, it was seen as just a fact and one to get on with. The other respondents agreed with this and suggested that having a change of this magnitude imposed on users contributes to the resistance and absence of buy-in.

Requirements Gathering Phase: Due to the size of the implementation and the number of users within the organisation, a representative group of users were selected to participate in requirements gathering. These representatives, known as super-users, were in general well supported and encouraged to participate. One respondent noted that support and encouragement was not forthcoming in a minority of business areas where there was an underlying resistance to the new system by management of that area. The encouragement and support, albeit generally strong, was in one respondents opinion, '*lip service*', in that, arrangements to control extra workload as a result of this participation was not always in place.

One respondent commented that this representative group should have been selected from a broader user base, as the superusers were somewhat '*system minded*' and did not truly reflect the ordinary 'real' users, and therefore represented an '*incomplete picture*'.

Interpretation

Tyran & George (1993) argued that increased user participation would ensure requirements are more complete. This was clearly not the case with PPARS as evidenced by significant scope creep. As the literature warns, lack of user involvement at the requirements gathering phase had a negative impact on the overall outcome of the implementation. The comments by respondents suggest that end-user involvement was 'superficial' and that the users that were involved were not 'real' users.

Mapping of Business Processes Phase: Local representatives from each agency attended national workshops to map current processes and to standardise work processes in order to integrate them into the new system. These representatives had previously met with local management, the local project team, super-users and staff to document these processes.

One respondent commented that this was '*where things started to go wrong*' as the complexities and number of anomalies identified in the processes at this stage posed a huge problem with the standardisation of process, and those that were identified were '*only a tip of the iceberg'*. She went on to suggest that if the appropriate '*real'* users were involved in this activity, the '*surprises'* encountered later, with regard to business process complexity would have been discovered earlier. All respondents agreed that the lack of user involvement during the process mapping stage contributed negatively to the outcome of the project.

Interpretation

More involvement of users at the requirements gathering stage would have prevented the enormous extent of 'scope creep' that was experienced during the implementation. End-user involvement is critical during analysis and business process mapping. Mistakes made here are compounded during design and can cause feature creep, which can be more expensive to correct at a later stage. This finding suggests that the linear approach to systems development employed, although appropriate for Transaction Processing Systems, was not appropriate for this implementation. An iterative approach, with a valid

iterative process allowing for evolving and changing requirements, would be more appropriate for the implementation of an ERP system which by nature has substantial data, process and time complexities.

System Testing Phase: As the new system was imposed on the organisation as part of a national implementation, only members of the immediate local project team and the national project team participated in system testing. This was not seen as having a negative impact on the ultimate outcome of the project.

Interpretation

A number of issues remain unanswered with regard to testing. If testing was a success how could the outcome of the implementation have been so bad? This may suggest one of the following:

1. Perhaps the system worked as designed but was designed incorrectly.
2. Perhaps testing was incomplete or inconclusive.
3. Perhaps superusers who are more technically capable than real users tested the system and as a result did not identify issues during this testing.

Acceptance Testing Phase: Respondents agreed that user involvement during this stage was fully supported and encouraged. The appropriate infrastructure and support was put in place to carry out the steps involved in this process.

Implementation Phase: Respondents agreed that managers strongly encouraged and supported the involvement of users during this stage. They believed that involvement at this stage is paramount in order to bring users 'on board' and to gain 'buy-in' from them. Users were voluntarily involved in a very demanding parallel run and as a result were actively involved in this process.

One respondent suggested that this involvement created an opportunity for users to see the systems as '*her own*', and she suggested that as a result this would contribute to users acceptance of it.

Interpretation

The findings suggest that greater involvement by users would lead to a feeling of ownership. This feeling of ownership would create a more compromising user base when a need arose to modify and standardise business processes. The lack of compromise had a significant negative influence on the implementation. This concurs with Tyran & George (1993) who suggest that user participation will increase users commitment and foster a sense of ownership for the new system.

Interviewees Comments on Lessons Learnt

In this section the interviewer extrapolates the interviewees' opinions on the effectiveness or ineffectiveness of the implementation with regard to user involvement, and their suggestions for improvement.

The interviewees were asked whether or not they felt that end user involvement contributes to reducing resistance and to increasing the probability of a successful information system implementation.

All respondents agreed completely that user involvement is '*critical*', and of '*huge importance*' from the very beginning, and during all stages of the systems development life cycle. One respondent commented that more involvement would lead to a better understanding of the system, the project, and the potential benefits. One respondent said that users would have '*bought-in*' more if they were encouraged to become involved or if they were consulted during the system requirements analysis. Another respondent suggested that in the case of PPARS, user involvement contributed to reducing resistance by 30-40%, but regardless of levels of user involvement, resistance would never be reduced by more that 60% due to other more forceful influences in the organisation. The respondents said that these more powerful influences came in the form of '*power struggles between senior management, in the background*'.

One respondent pointed out that users '*on the ground*' should have been more involved in Business Process Reengineering as they are '*following the processes daily and would have a better insight*' into the operations of the business areas. He said that if '*real*' users were involved and had subsequently '*bought-in*', they would be '*more inclined to demonstrate upwards the benefits of the new system.*'

Interpretation

Doherty et al. (2003) argued that a high level of system success is associated with users being actively involved during the life cycle.

7.3.6 Influence of Change Management on the Implementation

This section examines and qualifies the findings in relation to the effect of change management on the success or failure of the implementation.

ERP system implementations are people projects and for the project to succeed, the organisation, its structure and its employees must change (Langenwalter 2000). What makes the difference, to the overall outcome of the system implementation, is how the change is managed.

Interviewees Observations

The interviewees were asked to comment on whether or not they were aware of a Change Management Plan for the system implementation project.

Respondents were aware of a change management plan being in place. One respondent commented that the '*plan'* was not the issue, the problem was that external consultants who drove the plan, demonstrated an authoritarian approach, which '*put staff offside with*

them' and created and contributed to resistance. This approach contributed significantly to the problems encountered during implementation.

Respondents agreed that there was an abundance of documentation with regards to change, but despite this, users still did not realise the effect the system would have on them and their role. This concurs with Aladwani (2001), who stated that despite change management strategies, many implementations still face resistance or failure.

The interviewees were asked to what extent, in their opinion, were employees prepared for the transition from the old system to the new.

Respondents had mixed feelings on how prepared employees were for the transition. Two suggested they were very prepared and two suggested they were badly prepared. One respondent said he was beginning to question if the project team understood what they were talking about.

Interpretation

Umble et al. (2003) argue that if employees are not prepared for the profound changes the result might be denial of the inevitable change and resistance to this change. Evidence suggests that this applies to the PPARS case as, despite change management efforts and numerous briefings, employees began ignoring deadlines as these deadlines kept changing.

The lack of credibility with regard to management and deadlines had a very negative effect on change management efforts; this would suggest that there was a deficiency in leadership within the organisation. Employees lacked confidence in management as leaders. According to Statt (1994) cited in Tiernan et.al. (2001), leadership is critical to the success of any business activity. Leadership involves influencing others to follow; this will prove very difficult if confidence and credibility in management is lost.

The interviewees were asked to comment on whether or not the disruption to staff and their work patterns were monitored and controlled.

Respondents agreed that efforts were made to control and monitor disruption to staff and their workloads. Disruptions to services were planned where possible and extra staff were made available whenever feasible. Respondents said that they experienced a considerable increase in their workload due to the parallel run. These problems were dealt with locally, as a project management issues but it was not always possible to minimise the effect of the implementation on staff. One respondent said that some managers were resistant to the implementation in principle and did not monitor or control the disruption. This led to reduced productivity and had a negative impact on staff morale and motivation.

Interpretation

Monitoring and controlling disruption to staff is vital in ensuring that staff motivation and productivity are not negatively impacted (Bocij et al. 2003). According to Tiernan et al. (2001) disenchantment and de-motivation are major conditions that prevent organisations

from realising the highest possible benefits from performance improvement initiatives. Clearly this was the case with the PPARS implementation.

The interviewees were asked to comment on the extent to which the organisation was prepared for the changes to business processes.

Respondents agreed that despite a large amount of preparation being done by the National and Local project teams, the amount of preparation required was hugely underestimated. One respondent said that information sessions were held, and people attended, but despite all this they were still not prepared for the changes. The result of this was enormous resistance to the change being implemented. One respondent commented that new business processes were developed and rolled out immediately. This speed of rollout did not give the employees the opportunity to get used to new processes.

Interpretation

The findings concur with the findings of Umble et al. (2003), which state that if employees are not prepared for profound change, they will resist it. A local pilot implementation may have avoided this situation. If users were part of a small-scale implementation, the impact would have been more manageable, and issues and difficulties that caused concern would have been addressed and resolved during the pilot implementation.

The interviewees were asked to give their opinion on the extent to which users were resistant to the change brought about by the implementation of a new information system.

Respondents agreed that they felt employees were generally very resistant to change. This resistance had a negative impact on the implementation and was seen by the respondents to be one of the main contributing factors to the overall failure of the project. One respondent saw the implementation as a 'lose-lose' situation, in that, it presented them with extra work, and a change in the way they worked, without any additional benefits.

One respondent claimed that the level of resistance experienced, very much depended on the area and level within the organisation in which the individual worked, the impact the system would have on their job, and, the 'message' the were receiving from management with regard to the system.

One respondent suggested that there was considerable tension between some line managers who opposed the implementation, and the implementation team whose job it was to bring the project to a successful conclusion.

Interpretation

The findings suggest the employees felt threatened by a changing situation in which their jobs were being studied, and by their belief that new practices were being imposed on them

The resistance experienced during the implementation suggests a number of phenomena:

1. A lack of trust due to misinformation or lack of information.
2. A fear of the unknown and a lack of security with regard to potential changes in employees' roles.
3. Low motivation due to the absence of benefits or incentives.

Interviewees were asked to comment on the level of disruption experienced by users during the transition from the old to the new system.

Respondents concurred that the disruption experienced at times was significant if not severe, but overall could be considered high. As the implementation was a parallel run, employees had to duplicate their work efforts to operate both the old and the new system. One respondent said that this was a planned disruption and where possible efforts were made to alleviate the disruption with extra staff.

Interviewees were asked to comment on, in their opinion, the extent to which the organisation underestimated the impact the implementation would have on employees and their roles

One respondent suggested that due to the reform of the Health Boards there was conflicting interests and as a result too much change was going on, and he said '*management took their eye off the ball'* with regard to the system implementation. One respondent suggested that local management did not underestimate the impact; they always argued that the organisation was not ready, but the change was '*railroaded in'*.

Interpretation

The implementation of an ERP system in an organisation is considered a planned change, and therefore requires a 'change plan' to facilitate the successful outcome of such a change. This plan should identify and highlight the effects of this change on all elements in the organisation. The findings indicate that there was a lack of or insufficient planning and preparation for the implementation.

The interviewees were asked to comment on the extent to which the cultural factors of the organisation were considered.

Respondents were divided on this. The cultural element of the organisation is quite diverse and complicated, due to its size, structure and bureaucratic influences. Two respondents suggested that these factors were considered, benefits were explained, effort was made to facilitate areas of differences, attitudes and feelings were considered, and, hand holding and personalising was accommodated. Another respondent suggested that

cultural factors were given no consideration. One respondent suggested that although cultural factors were considered, managers chose to ignore inherent cultural factors.

Interpretation

This finding suggests that change and adapting to it was so alien to this type of organisation, that management was faced with 'quite a challenge' that they chose not to recognise or address it. Hackney & Mc Bride (1995) argue that the cultural and contextual factors must be given due consideration and deliberation, and addressed and taken on board. Clearly this did not happen in the case of the PPARS implementation.

Interviewees Comments on Lessons Learnt

One respondent strongly recommended offering some incentive to employees to gain their support and cooperation to successfully implement significant change in an organisation.

One respondent suggested that management of the resistance is critical in a situation like this. She said that employees and management locally seem to be '*dancing to a national agenda'*. She suggested that if there was more local control, management could consider local culture and attitudes. There are many ways of getting a message across; tailoring this locally would reduce resistance.

Interpretation

Employees must see some reward or compensation for the disruption and the changes in roles, and for anxiety and stress that a change of this magnitude brings. Offering some incentive will reduce resistance and get employees 'on your side'. This concurs with O'Brien (2005) who recommended that to enable a change, an organisation should make liberal use of financial incentives and should recognise the contribution of staff.

7.3.7 Influence of Management Commitment on the Implementation

This section presents the findings in relation to the effect of management commitment on the success or failure of the implementation.

Interviewees Observations

The interviewees were asked their opinion on the extent to which senior managers were supportive of the implementation.

Respondents agreed that the majority of senior managers were supportive of the implementation. A number of senior managers did not offer support; on the contrary they were exceptionally negative towards the implementation itself and towards those directly or indirectly involved in the implementation. One respondent said '*its all about perception*'. She suggested that if there had been a project launch where high profile leaders were seen to be buying in to the implementation, employees would have had '*more faith in this support*'.

Due to the lengthy duration of the project, and as a result of the finish date of the implementation being changed on a number of occasions, there was a high turnover of senior management. As a result of this there was a lack of senior management continuity and accountability with regards to the implementation project. One respondent said that there was '*escalation of commitment*' in that, despite the extent of the problems being encountered no one was prepared to '*shout stop*'.

Interpretation

Bakehouse & Doyle (2003) suggest that users perceive management commitment in terms of people, time, money, information and technology. Employees can be led by example, if they observe a credible leader or role model actively supporting and buying-in to the implementation they will follow suit. This supports Kamath (1999) who recommends appointing a Project Sponsor who has management clout, is forceful in their position, and, is respected and liked.

The interviewees were asked how supportive they considered their direct supervisor to be during the system implementation.

Respondents agreed that their immediate supervisors were fully supportive of the implementation. One respondent qualified this statement by suggesting that, in his opinion, some users in the organisation did not feel this support from their direct supervisors.

The interviewees were asked to comment on the extent to which 'business areas' committed people resources to the project as required

Managers in different functional departments tended to commit resources during the parallel run, but due to unrealistic work demands on staff this became a problem. As the parallel run was conducted during the summer period, resources were already at a premium with many employees taking holiday leave. More and more demands were being put on business areas, and as relief staff was not made available employees were overworked. One respondent said that '*it was always a battle'* due to management and staff resistance, as they could only see the impact of the implementation as creating more work for them.

Interviewees were asked to what extent managers dealt with implementation related issues and problems as they were encountered.

Respondents suggested that issues and problems that occurred during the implementation, were reported via the Implementation Team, logged and subsequently addressed at the steering group meeting. If the problem or issue was of a technical nature it was passed onto the national team. The respondent perceived this as a lengthy process, during which problems were '*moved around'* and issues '*got stuck in a loop*'. Each local organisation implementing the information system logged issues and problems with the national team, and if there had been more inter agency coordination encouraged, exchanging of these issues and problems may have led to a speedier solution. The respondent observed that

the issues were logged and even tracked but nothing got '*closed'* or '*resolved'*. One respondent commented that local issues were addressed, but many issues outside local control did not get addressed.

Interpretation

This could be explained by poor project structure, and lack of leadership and accountability, which could lead to poor coordination of tasks and delays as suggested by Block (1983). The procedure to be followed for reporting and addressing issues clearly was ineffective and required some attention.

Interviewees Comments on Lessons Learnt

One respondent said that senior management '*must be seen to make and back 'hard' decisions* '. It is essential that senior management are committed, supportive and involved, but one respondent commented that this is sometimes very difficult to achieve, particularly if, as with this project, the project is driven by a national team.

Operational management likewise must be seen to be supportive. One respondent suggested that it is vital that management attend training, as they gained an insight during training of what is happening on the ground in different areas. All respondents suggested that more support and involvement by management would have a very positive effect and might encourage employees to have a more positive attitude towards the project.

Interpretation

Aladwani (2001) argues that successful implementation can only be achieved when senior management are fully committed. Krasner (2000) argues that a combination of frontline and corporate commitment and involvement is required throughout the project.

7.3.8 Influence of Project Management on the Implementation

This section presents the findings in relation to the effect of project management on the success or failure of the implementation.

Interviewees Observations

Interviewees were asked to rate on a scale of one to five the following elements of Project Management for the system implemented.

Table 7.3 Project Management Rating (PPARS)

	1	2	3	4	5	
Goals unclear				* *	* *	Goals clear
Work Plan unclear	*		*	* *		Work Plan clear
Resource Plan unclear	*		* *	*		Resource Plan clear
Project Tracking Poor			* *	*	*	Project Tracking complete

Goals: One respondent commented that the ultimate goal of the implementation project was clear, but secondary goals kept changing and the project team and employees felt that the '*goalposts kept moving*'. There was, in her opinion, a conflict between the national goals and the local goals, but ultimately the National Project was driving the project.

One respondent suggested that, the perceived clarity of the goals depended on one's involvement in the project or on one's position in the organisation. The level of detail required by some employees will differ from others. A clear organisation structure and project structure will facilitate the appropriate distribution of project information and goals.

Work plan: The work plan, according to one respondent, evolved as the workload involved became apparent. This reflects the lack of user consultation in the requirements analysis stage. If requirements were clear at the early stages, the work plan should remain static apart from minor changes.

Resource Plan: The resource plan was clear but due to resource availability and constraints the plan was not realistic. Little attention was given to the timing of the pilot implementation, which in fact was scheduled during the summer holiday period, thus putting huge demands on resources.

Project Progress Tracking: Interviewee three commented that the local project was completely tracked and traceable, but, the national plan was not kept up-to-date and lacked clarity.

Interviewees Comments on Lessons Learnt

The interviewees were asked how important they felt Project Management is to the overall system implementation.

All agreed with Hoffer (2000) and Adam et al. that Project Management was very important to the overall success of the implementation. One respondent suggested that in order for project management to be truly effective, feedback from employees must to be considered. He stressed the importance of Project Management as a benchmarking tool on which to base activities and plan. According to another respondent, local project management was dependent on the project management of the national team, it was very important that both were managed well to avoid the knock on effect of problems with one level affecting the other.

7.3.9 Influence of Education and Training on the Implementation

This section presents the findings in relation to the effect of education and training on the success or failure of the implementation.

Interviewees Observations

The interviewees were asked to comment on whether or not employees were informed of the potential benefits associated with the new system.

Respondents agreed that all employees were informed of the potential benefits associated with the new system. They suggested that how that information was received and perceived by employees depended on the employees' attitude towards the system and on their level of acceptance or denial of the system.

One respondent stressed that both the benefits and the drawbacks of the system were outlined honestly in order to prevent inflated expectations. Another respondent said despite regular briefings, mail shots, presentations, etc., employees were not '*convinced that there was anything in it for them'*. They found it hard to believe these '*promised benefits*' were in effect '*realistic'*.

The interviewees were asked if they were aware of the activities of the project in advance.

The respondents said that they were fully aware in advance of all planned activities of the implementation project. One respondent suggested that the local project was not always aware of the activities and plans of the National Project and as a result some local activities were rolled out with little notice.

The interviewees were asked about their opinion of the training provided, in relation to all aspects of the project (Roles, Business Processes, and the System).

One respondent said the type and quality of training provided very much depended on the target group receiving the training. He said that not all elements were explained to employees, and this generated a '*fear of the unknown*'. People became anxious about their jobs, their ability to deal with the new system, and the change in general. '*The timing, handling, and planning of these caused problems.*' '*A little information is a bad thing'*. If people had the full picture they would be more inclined to accept it.

Interpretation

Training should incorporate an explanation of all aspects of the system, the implementation, and the impact of the implementation on the individual and the organisation.

The interviewees were asked to comment on the training offered to them.

Superusers, who are extensive users of the system and members of the project team, provided the training in-house. According to one respondent, who was involved in coordinating the training, training was in many forms and was extensive and complete. In her opinion, because of training, some employees saw the systems as potentially revolutionising their jobs. According to this respondent, despite the relentless, ongoing, top quality training in the West, which was considered 'best practice', users were still

very aware, that using the system during training was not the same as the 'real thing'. Because of this many employees did not avail of the training.

One respondent commented that, although the training was very good, the effectiveness of the timing was dependent on an '*ever changing go-live date*'. As a result of this refresher training was required and provided.

Interpretation

Although the quality of the training is paramount to its success, the timing is crucial to the overall effect of the training on the success or failure of the implementation. Most respondents considered training to be critical to the overall success of any implementation, and agreed that the lack of training would have a huge negative impact on the implementation and would consequently contribute to its failure. One respondent felt that users must have the confidence to use the new systems and that this confidence would only come as a result of adequate training. On the contrary one respondent felt that training is an important component of any implementation but did not feel that lack of training would necessarily cause the implementation to fail.

7.3.10 Influence of Communication on the Implementation

This section presents the findings in relation to the effect of communication on the success or failure of the implementation.

Interviewees Observations

The interviewees were asked to comment on the format, the mechanism, and the effectiveness, of the project communication.

Respondents agreed that project communication was extensive in the following formats: Initial briefings, regular meetings, conference calls, project meetings, newsletters, e-mail updates, intranet, presentations, training sessions, users manuals, user documentation, circulated minutes and frequently answered questions.

Notwithstanding the extensive list of communication methods used, respondents had varied opinions on the effectiveness of this communication. One respondent commented that despite '*all*' the communication, she '*still felt uninformed*', and the efforts at communication did not have the desired result.

One respondent suggested that the effectiveness of the communication very much depended on the interest of the individual receiving the information and what they needed to know. She commented that employees were only interested in the details being communicated, if they were relevant to them, and their roles '*on a need to know bases.*'

Interpretation

The extensive communication may have over-burdened staff with what they perceived as irrelevant information. The timing of the communication is all-important and often this came too late. A stronger pushier approach at a later stage in the project may have been more effective.

The findings suggest that the misinterpretation and misperception of the extensive communication had a negative impact on the implementation. This was largely due to the resistance and lack of credibility by users as a result of continuous time delays. This corresponds with Aladwani (2000), who stated that, through effective communication the organisation should attempt to affect the cognitive component of users attitude when trying to change the attitude of potential users.

7.3.11 Influence of 'Organisational Fit' on the Implementation.

This section presents the findings on, the suitability of the new system to the business processes of the organisation in which it is being implemented.

Interviewees Observations

The interviewees were asked to comment on the suitability of the new information system to the existing business processes.

The interviewees were divided on the question of suitability of the system to the existing business processes. Two respondents suggested that the system was a 'good fit' in their area, as there were fewer and less complex business processes than in some business areas. One the other hand, two respondents agreed that the system was a very 'poor fit' and not suited to the business processes in their area. One respondent suggested that a significant number of '*work arounds*' were incorporated to compensate for the fact that the system could not cope with the anomalies of business processes.

Interpretation

Sumner (2000) recommends that the organisation should, where possible, re-engineer the business processes to be consistent with the software, thus limiting changes required to the original system. The findings indicate that the solution was selected without knowledge of all business process anomalies, which suggests a deficiency in requirements gathering and analysis.

The interviewees were asked to comment on the extent that the business processes changed as a result of the new system.

Twenty to forty percent of business processes changed as a result of the new system being implemented. According to one respondent these changes caused huge operational changes within the organisations, which resulted in significant resistance.

When it was not possible to customise the new system, a work around solution was adopted. There were such huge variations in processes, and in their level of complexity from one agency to another, that finding a standard solution was an enormous problem both technically and operationally.

Respondents agreed that although few processes changed, those that did changed significantly. One respondent felt that although the chosen system was not flexible enough to meet the needs of the organisation, he doubted if any system would due to the level of business process complexity.

The interviewees were asked, to what extent were business processes mapped, and who was involved in this activity.

User representatives, superusers, local staff, the project team, and appropriate management were involved in the mapping of business processes. A primary goal of the implementation was the standardisation of business processes. This was accommodated by a national business process-engineering workshop. One respondent said that the business process engineering activity was unsuccessful as '*unanticipated complexity and variety of business processes*', were only uncovered as the project progresses. One respondent suggested that users were unsure of the purpose of the reengineering process and as a result felt threatened by it. She also felt that that the most relevant and appropriate people were not involved in this critical activity.

Interpretation

One respondent suggested that it is vital to ensure the business processes are understood before proceeding to the next stage of the implementation phase. In her opinion the approach taken, and the timeframe being worked to, did not lend itself to the successful streamlining of all business processes. Whitten & Bentley (2007) advocate studying business processes for problems and potential improvements that may be addressed by the new technology. If greater emphasis was put on business process engineering and if more consultation had taken place at this stage, other subsequent tasks may have been easier to complete.

One respondent suggested that the organisation sought a solution to fit current business processes and practices. It appears that no consideration was given to the possibility that these current processes and practices were unsuitable, outdated or in need of reengineering. This concurs with Dobriansky's (2004) argument that, business process reengineering (BPR) is vital to ensure that the new system does not just overlay an existing organisation and its business process. An attitude of '*that's the way we have always done it*' was prevalent. This approach contributed to a negative attitude, resistance to change and the ultimate failure of the implementation.

All respondents agreed at this point that more attempts should have been made to change the business processes and not the system. Unfortunately due to employee resistance, and lack of change management, this was virtually impossible. Bocij et al. (2003) suggest that BPR recognises that business processes and management structures can be fundamentally

transformed so that the definition, function, organisation and running of the business are improved.

7.4 Findings – Banner Case Study

The following findings are presented in terms of the perceptions of the participants to the system, the implementation, and the factors that influenced the success or the failure of the information system implementation.

The results are being presented in a format that reflects the manner in which the interviews were conducted. The findings of the Banner case study are presented in this section. The findings of the PPARS case study are presented in section 7.3. A description of the question posed to the interviewee precedes each finding. Direct quotations from respondents are presented in quoted italics. The researchers interpretation is presented after each finding.

7.4.1 Customisation of the System Implemented

This section describes the degree to which the system implemented was customised to satisfy local requirements and business processes. The level of agreement reached on this is also examined.

The interviewees were questioned on the extent to which, in their opinion, the system being implemented was changed as a result of being customised.

One respondent suggested that 40-60% of the system changed. She suggested that these changes were due to the fact that, although this was a national project, the needs of each organisation implementing the system varied considerably. The original system was designed for the American college system.

Interpretation

Sumner (2000) argues that organisations should resist '*going to war*' with the software solution and that changes to the system must be limited. In order to find the optimum solution, organisations face a huge challenge in finding a balance between making changes to the system or making changes to their business processes. A system should not constrain the capability of the organisation to cope with changing business requirements.

The interviewees were asked whether or not in their opinion there was clear agreement between all interested parties on the level and type of customisation required

The respondents felt that there was agreement and sign off, but said that what was '*signed off in good faith*' at the outset was a '*naïve interpretation of the requirements*' and, the level of customisation required was not anticipated. One respondent commented that administration staff, who were the main users, were not part of any agreement or requirements sign off.

Interpretation

The issue of resistance and buy-in from users can be addressed somewhat by consultation. Sumner (2000) advises on the importance of getting the agreement of IT managers, management and users at the outset of the project.

7.4.2 Cost of the System Implementation

Details of budget cost and actual cost for the Banner implementation was not available for this study.

7.4.3 Timeliness of the System Implementation

The Banner system was implemented on time with regard to the original project plan. The timeliness of the implementation was tightly controlled in line with academic deadlines and a timeframe defined by the National Project Plan.

7.4.4 Perceived Success or Failure of the Information System

This section details the perceived level of success or failure of the Banner systems from the users' perspective.

The interviewees were asked to rate, from their perspective, the level of success or failure of the information system implemented.

	1	2	3	4	5	
Total Failure		* *	* *	*		**Total Success**

Some elements that were promised at the outset have yet to be delivered. One respondent suggested that even after the academic pilot implementation some problems persisted and the system did not provide the functionality the user expected it to provide.

The interviewees were asked to comment on the effect or impact the implementation had on their job.

The respondents had very mixed feelings on this. Their feelings were determined by their role in the organisation and the elements of the systems they used. The administrative staff experienced very positive effects from the new system. One respondent said that the system '*improved efficiency no end'* and '*made things easier in most areas'*. This improved efficiency depended on the accuracy of the information input into the system. Another respondent agreed that the system had a very positive effect on student record information and on her job in general.

One respondent suggested that from the perspective of academic staff, the implementation had a significant negative effect on her job and she said that the system '*failed to deliver efficiency gains'* and *'merely duplicated what was done manually'*.

The interviewees were asked to comment on how they perceived the organisation was effected by the implementation of the new information system.

All respondents agreed that the system had both negative and positive effects on the organisation.

Negative Effects: One respondent suggested that the new system created a considerable amount of extra work and due to the many complexities it was difficult to get some people to use it. He said that the new system created a '*morale issue*' as it was perceived to be causing duplication. One respondent suggested that the potential positive effects were '*dependent on the accuracy of the information put into the system'* and that early on there was an issue with regard to the lack of validation of data input.

Positive Effects: The computerisation of records was seen as beneficial, mainly due to student information, exam results, and transcripts being available automatically from the new system. Up to this exam details and results were held in paper format only.

The interviewees were asked to rate the system qualities on a scale of one to five based on the quality categories in Table 7.4.

Table 7.4 Rating of System Qualities by Interviewees (Banner)

	1	2	3	4	5	
Completely Inefficient	*	*	* * *			Completely Efficient
Not easily extended		* * * *	*			Easily extended
Not easily adapted	*	* * * *				Easily adapted
Not easily maintained	**N/a**					Easily maintained
Not understood		*	* * *	*		Fully understood
Accuracy Not reflect Bus. Processes	*		*	* *	*	Accuracy Reflects business processes
Not user Friendly		*	* * * *			Very user friendly

The variations apparent in the rating of the quality of the system are reinforced by the differences in opinions from academic staff and administrative staff.

Correctness: Although the system received a score of 4 for functionality, one respondent (academic) suggested it was '*cumbersome*' to use.

Efficiency: Efficiency received a low to medium rating, but one respondent qualified this by pointing out that this lack of efficiency was attributed to managements '*lack of trust in*

the system' and their reluctance to '*let go of the tried and trusted'* manual recording of information, which now resulted in duplication. One respondent went on to explain that due to the unanticipated level of data being recorded, the system required more resources than expected.

Extendibility: This project was driven by a National Project and was coordinated by a third party. This, in the opinion of one respondent, created '*a bureaucratic structure which presented an unnecessary difficulty when the system required extending'* either for local modification or additional functionality.

Respondents suggested that the problem with extendibility lies in the fact that all the Institutes of Technology using the system use it differently and have many different requirements. The national project team will only accommodate changes or modifications that apply to a number of organisations. As a result individual colleges *'must employ work around solutions'* to compensate for the shortcomings in functionality.

Adaptability: Most of the comments on extendibility applied equally to adaptability. The respondent perceived the system as '*rigid'* and '*inflexible'*.

Understandability: Respondents suggested that frequent users of the system and those who had received training found the system easy to use, but those that use it less frequently experienced difficulties. One respondent said '*it is not menu driven, is not easy to navigate, and the user interface is not appealing'*. He said that it is difficult to '*see the*

full picture', and how it all integrates *'when some users only use a small element of the system'*.

Usability: The academic respondent, considered the system to be '*cumbersome'* as the system did not replace manual business processes, it merely replicated them. Data, which had already been input into a manual system, had to be duplicated and recalculated before being entered into the Banner system.

Accuracy: From an administrative perspective, respondents considered the system reflected business processes well and it automated manual processes efficiently.

User Friendliness: One respondent said that when one is '*used to the system and uses it often it is easy to navigate'*, but others who use it '*once off may find it cumbersome'*. Another respondent commented that, as it is not menu driven some users might have difficulty as the '*look and feel is very different to most Windows applications'* they would be used to.

Interpretation

Despite the ratings awarded being predominantly more negative that positive, respondents had a positive opinion of the effect the systems had on their jobs. Respondents agreed that, as with the PPARS system, the negative ratings were attributed to management, implementation, attitude and control issues, and were not particularly attributed to the technical elements of the system.

7.4.5 Influence of End User Involvement on the Implementation

This section examines the findings in relation to the influence of end-user involvement during the SDLC on the overall outcome of the implementation.

Interviewees Observations

Interviewees were asked to what extent, in their opinion, was end user involvement encouraged and supported during each of phase of the Systems Development Life Cycle.

Technical Solution Selection Phase: As the local implementation in GMIT was part of a national implementation, users were not involved in the selection of a technical solution.

Requirements Gathering Phase: User involvement during the requirements gathering stage was limited to a select group who represented the organisation at national level. This group was predominantly from the management team. The concept of user involvement generally suggests real users who use the system on an operational basis. Management would not be considered representative of 'real' users.

Mapping of Business Processes Phase: Involvement in the mapping of business processes was confined to the IT manager, middle managers and representatives of the registrar. The respondents agreed that it would be imperative that the users on the ground were involved at this point.

System Testing Phase: Testing was limited to members of the project team.

Interpretation

Findings with regard to user involvement in testing indicate that the post implementation difficulties experienced by some users were not uncovered during testing due to either, the 'wrong users' testing or a lack of functional testing.

Acceptance Testing Phase: End-users representative were seconded from the implementation team for the purpose of acceptance testing. All respondents agreed that full support and encouragement from managers was forthcoming for acceptance testing. Testing was performed on test databases and pre-production databases. The acceptance testing on the Banner system was in the form of a pilot implementation over the course of one year. The involvement of users during this pilot implementation was also well support by managers.

Implementation Phase: One respondent suggested that as the system was imposed on users, the support and encouragement given during this stage very much depended on the individual attitude of managers and staff in each business area.

Interviewees' comments on Lessons Learnt

The interviewees were asked if they felt end-user involvement contributes to reducing resistance and to increasing the probability of a successful information system implementation.

All respondents agreed that end-user involvement from the very beginning to the end of the project is critical to the overall success of the implementation. One respondent said that '*user involvement gives the users ownership and a feeling of being a part of the project'*. One respondent said that if users had been involved early on to a greater extent the '*requirement and specification would have been clearer'*. She also said that if users were more involved they would '*understand the constraints under which the project was operating and would be more forgiving of the limitations of the system'*

Interpretation

The findings suggest that if users are involved in the implementation, they are '*more likely to embrace the inevitable change and be less resistant to the implementation'*. One respondent commented that if users were involved they would be more inclined to see the potential benefits and '*might jump at the chance to make their job more efficient.*' They would also have the opportunity to give feedback at the early stages; that would reduce the 'moaning' later and might create better morale among employees.

One respondent argued that you must '*weigh up organisational constraints and project deadlines against the benefit of involving users.*' The result he said might be, '*that you just have to get on with it without users.'* He said that '*if you over consulted and over involved user you might never get anything done*'. He was not convinced that buy-in would be achieved as a result of more user involvement.

7.4.6 Influence of Change Management on the Implementation

This section examines and qualifies the findings in relation to the effect of change management on the success or failure of the implementation.

Interviewees Observations

The interviewees were asked to comment on whether or not they were aware of a Change Management Plan for the System Implementation Project.

Four of the five respondents were not aware of a change management plan. The respondent who was aware of such a plan was a member of the implementation team.

Interpretation

Strategic change, the like of an ERP system implementation, requires significant and careful planning. The lack of awareness of such a plan does not necessarily mean there was no plan, but it might suggest a lack of information and education with regard to it. This could result in users and other stakeholders being misinformed or uninformed with regards to the project.

The interviewees were asked to what extent, in their opinion, employees were prepared for the transition from the old system to the new

The respondents agreed that employees were not prepared for the transition. Most of the users knew that there was a new system coming on stream, but according to one respondent, despite availing of training '*no one was prepared if things went wrong'*. He said that '*rules seemed to be made up as we went along; it seemed that no one was prepared and things just evolved.'*

One respondent said that '*in hindsight the level of preparation was not adequate'*. Due to the site being a pilot implementation '*the functionality was hardly tested before it was rolled out'*.

Interpretation

Both the implementation team and the users were poorly prepared, as the timeframes and deadlines being imposed were outside the control of the local implementation team. Poor planning locally, due to unrealistic timeframes and deadlines imposed, resulted in poor preparation.

The interviewees were asked to comment on whether or not the disruption to staff and their work patterns were monitored and controlled

Respondents agreed that the disruption was not controlled. One respondent said that *'management did not want to be aware of the disruption; employees felt they had to get on with it regardless'*. Another respondent felt that the disruption was monitored in that

calls for support were logged, but no action was taken which led to an uncontrolled situation.

Interpretation

One of the most critical functions of management is control, that is, making sure goals and objectives are attained. The findings suggest that the disruption and extra workload associated with this implementation was not tightly controlled or monitored.

The interviewees were asked to comment on the extent to which the organisation prepared for the changes to business processes.

One respondent suggested that although there was some preparation for the implementation project, the impact was unanticipated and more preparation would have helped. One respondent said that there were '*many unforeseen requirements, which evolved during the pilot implementation'* and 'even *if all eventualities were considered there will always be something forgotten.'*

One respondent suggested that the managers within the organisation were more prepared for the changes to business processes than the users of the system. Another respondent agreed and said that due to deadlines imposed on the local project there was '*not enough time to communicate the changes*' to all interested parties.

The interviewees were asked to give their opinion on the extent to which users were resistant to the change as a result of the new system implementation.

Respondents agreed that there was strong and considerable resistance to change. One respondent said that there was '*an institutionalised feel to the approach taken by management'* with regard to the change; '*this is what we are going to do'.* Many staff felt threatened by this approach.

One respondent commented that naturally you would have some resistance to change, particularly from '*non IT literate employees who felt the way things were being done was fine.'* She said that really there was '*no point being resistant to change as users had no choice'* but to use the new system. One respondent suggested that the majority of older users who had been with the organisation longer were more resistant than the younger, newer employees, who accepted the change. She suggested that those who strongly resisted the change imposed by the implementation were determined that the project would fail.

Interpretation

These findings suggest the following:

(a) 'Group inertia', a desire by employees to resist the change even when the present situation is inferior to the proposed new one, was present.

(b) Employees felt that their levels of expertise were being threatened, and as a result they naturally resisted. This situation could possible have been avoided by providing more information and education earlier.

Interviewees were asked to comment on, in their opinion, the extent to which the organisation underestimated the impact the implementation would have on employees and their roles.

The respondents considered that the organisation completely underestimated the impact the system implementation would have on people and their roles. One respondent suggested that from a functionality perspective management did not seem to consider the way some staff did things now and how they would have to change. Two respondents implied that the skills needs were underestimated and people's workload increased considerably as a result of the new system.

Interpretation

The findings suggest that, there was a lack of planning, in particular with regard to the level of skills required by users. This is evidence that management are not in touch with the operational aspect of the organisation or with their employees.

The interviewees were asked to comment on the extent to which the cultural factors of the organisation were considered.

Respondents agreed that little or no consideration was given to the cultural and traditional factors of the organisation. One respondent suggested that the project was very much IT driven and not staff or people driven.

Interpretation

A project of this size cannot be viewed as just an IT project. The changes brought about by a new system implementation will inevitable have a huge impact on the cultural elements of the organisation and its employees.

Interviewees Comments on Lessons Learnt

Respondents categorically agreed that the way change was managed had a considerable impact on the overall implementation. It was very clear that increased involvement of end-users would lead to a more positive attitude to change. One respondent said that 'users *are resistant if something is imposed on them and if it is out of their control'* or more importantly if it is perceived to be out of their control. One respondent strongly advised '*keeping en- users in sight'* at all times and keeping them up-to-date with progress and activities..

One respondent said '*as workload increased, efficiency and productivity decreased and morale and motivation increased.*' It was perceived by many staff, particularly academic staff, as a '*bureaucratic exercise in duplication and ultimately a waste of time'.*

Interpretation

People like to be consulted about change and have the opportunity to contribute to decisions that affect them. She went on to say '*that as users' understanding and appreciation of the system grew, their resistance reduced'*. This concurs with the argument by Tiernan et al. (2001), that resistance to change frequently results from a lack of understanding of the proposed change

7.4.7 Influence of Management Commitment on the Implementation

This section presents the findings in relation to the effect of management commitment on the success or failure of the implementation.

Interviewees Observations

The interviewees were asked their opinion on the extent to which senior managers were supportive of the implementation.

Respondents agreed the there was support but at times it was neither visible not convincing. The respondents said that as senior managers were the owners of the system and initiated the implementation they obviously supported the system implementation. One respondent suggested that while senior managers were enthusiastic at the outset; this enthusiasm and drive wavered during the lifetime of the project.

The findings suggest that commitment was not sustained throughout the project. Gunson & deBlasis (2001) argue that continued involvement, commitment, support and mobilisation of top management are vital to the successful completion of an implementation.

The interviewees were asked how supportive they considered their direct supervisor to be during the system implementation.

The respondents agreed strongly that they experienced excellent support from their direct supervisors. As the implementation was inevitable and driven by very tight deadlines in lines with the academic calendar, failure to meet these deadlines would have had a huge detrimental operational impact on each school and each business area. In light of this, operational management recognised the importance of meeting these deadlines.

Interpretation

The finding indicates that management had a clear vision of the strategic goals of the organisation in light of the implementation. This clarity is as a result of information, consultation and good communication at management level.

The interviewees were asked to comment on the extent to which 'business areas' committed people resources to the project as required

Respondents suggested resources were committed as required throughout the project.

Interviewees were asked to what extent managers dealt with implementation related issues and problems as they were encountered.

Respondents agreed that there was a structure in place for reporting issues and problems. One respondent said that the way issues and problems were addressed '*very much depended on the problem and the knock on effect on other functional areas*'. He said that '*functional difficulties, particularly with regard to duplication of work for academic staff, were not addressed*'. He went on to say that failure to address this led to '*lower morale and the de-motivation of academic staff*'.

Interpretation

Failure to address problem seemed to compound the problem of resistance alluded to in the context of change management and user involvement. Lack of user involvement and consultation led to an increase in the levels of resistance to the new system.

Interviewees Comments on Lessons Learnt

One respondent suggested that strategic management commitment is required but not at quite a detailed level as the commitment required from operational management. She said that involvement by strategic management should be on a '*need to know basis*'. Another respondent agreed with this opinion that, in the background, senior strategic management need to have sight of the project at a high level, and, that issues at a high level need to be brought to the attention of senior management.

Interpretation

The implementation of an ERP system is a strategic organisational objective; therefore it has to be supported by strategic management. Without this support it will not receive the credibility from employees required to see it to a successful conclusion.

In order to ensure the appropriate information with the desired level of detail gets to the relevant management level, the organisation must ensure that an organisational structure conducive to this is in place. Reporting structures reflecting the project needs and objectives, and the organisations goals must be in place, understood and followed. Block (1983) advocated the need for a good organisational structure in a large implementation project.

7.4.8 Influence of Project Management on the Implementation

This section presents the findings in relation to the effect of project management on the success or failure of the implementation.

Interviewees Observations

Interviewees were asked to rate on a scale of one to five the following elements of the Project Management for the system implemented.

Table 7.5 Project Management Ratings (Banner)

	1	2	3	4	5	
Goals unclear			*	*		Goals clear
Work Plan unclear			*	*		Work Plan clear
Resource Plan unclear			*	*		Resource Plan clear
Project Tracking Poor				* *		Project Tracking complete

Only two respondents answered this question. The others did not answer on the basis that either the question was not relevant to them or they were not aware of the project documentation or plans being referred to.

As there was no project manager at national level at the beginning of the project, plans, scoping documentation and project documentation lacked clarity. When consultants were appointed to manage the project the situation improved considerably.

Interpretation

The findings on project management suggest that appointing leadership to the project from the outset would contribute to visibility and clarity of plans and objectives. The control mechanism of a well-led project team is critical to the success of the implementation.

7.4.9 Influence of Education and Training on the Implementation

This section presents the findings in relation to the effect of education and training on the success or failure of the implementation.

Interviewees Observations

The interviewees were asked to comment on whether or not employees were informed of the potential benefits associated with the new system.

Despite many information sessions and briefings taking place, respondents were still unclear about the potential benefits of the new system.

Interpretation

This lack of clarity suggests that either the message relayed about the benefits was ineffective or there was 'noise' preventing the message being heard and interpreted. This also suggests that the timing of the briefings was inappropriate, or that the target audience was incomplete.

The interviewees were asked if they were aware of the activities of the project in advance.

The responses from this ranged from 'no awareness', to 'little awareness' to 'a high degree of awareness'. One respondent said that, the '*level of awareness depended on who*

you were and where you fitted into the organisational structure'. For high-level activities there seemed to be full awareness, but much less awareness for detailed tasks. For these activities there was never enough information or notice.

The interviewees were asked about their opinion of the training provided, in relation to all aspects of the project (Roles, Business Processes, and the System).

The respondents' opinions depended on what was deemed to be appropriate training for different categories of stakeholders. Withholding information, with regard to employees' roles and all aspects of the project, results in users resisting the system implementation on the basis of lack of understanding and knowledge.

The interviewees were asked to comment on the training offered to them.

The training was provided by super users who were in turn trained by An Cheim as part of the national project. Respondents agreed that this training was effective. Comprehensive, tailored training was provided to users. All respondents agreed that adequate and timely training was provided. One respondent commented that attendance at training was compulsory, monitored, and controlled.

Interviewees Comments on Lessons Learnt

Respondents agreed that education and training is critical to the successful implementation of an information system. One respondent said that positive and effective training will help to '*get users on your side'*, and if users understand the system and its

limitations they will be '*less likely to have cause to complain or need for support.*' One respondent said that if users were not provided with training they would use the system '*their own way'* which may not necessarily be the right way. Training reduces the learning curve for users. She strongly recommended that '*trainers should assume users know nothing when they attend training'* as many users in this instance may not be used to using any computer application. One respondent said that if users are not comfortable using the system '*they may muddle through'*; this might lead to time wasting and frustration. The long-term effect of this will be de-motivated staff, reduced productivity and increased costs.

Interpretation

Some users in this case study felt threatened by the implementation of a new system due to their lack of computer skills. It is important to recognise this and to build it into the training in an attempt to reduce the resulting level of resistance. It is equally important to appreciate the possible high levels of skills of other participants and to tailor the training equally to their needs. Training increases users knowledge of the system and of the implementation, and will reduce the need for support and will reduce resistance.

7.4.10 Influence of Communication on the Implementation

This section presents the findings in relation to the effect of communication on the success or failure of the implementation.

Interviewees Observations

The interviewees were asked to comment on the format, the mechanism, and the effectiveness, of the project communication.

Communication was extensive and delivered in the form of initial briefings, regular meetings (project team), project meetings, E-mail updates, Intranet, presentations, training sessions, user manual and documentation, and, Frequently Asked Questions.

Despite widespread communication, respondents felt that it lacked effectiveness. One respondent suggested that communication failed to have any impact at the early stages of the implementation and as a result failed to gain user buy-in. She commented that this communication was usually one-way and feedback was not accommodated. One respondent suggested that there were significant communication barriers with regard to the National Project. The local project was dependent on the national structure for support and maintenance, but due to communication difficulties the local team experienced considerable problems with support.

Interpretation

One of the main difficulties encountered by the local project team was the lack of communication with the national team and in particular the inadequate notice for the completion of a particular activity. A more formal structure for communication and information would be required for any subsequent implementations. Feedback is a

component of the communication process, and as this component was neglected real communication did not take place. The users felt there was some breakdown in how feedback was handled. Valuable feedback should be encouraged, addressed and action must be taken. Effective feedback is essential to organisational effectiveness; feedback provides a benchmark by which performance can be assessed. Ongoing quality improvement will only be possible if action is taken on feedback.

7.4.11 Influence of 'Organisational Fit' on the Implementation.

This section presents the findings on the suitability of the new system to the business processes of the organisation in which it is being implemented.

Interviewees Observations

The interviewees were asked to comment on the suitability of the new information system to the existing business processes.

All respondents agreed that in general the system fits the existing business processes reasonable well, but that there are some processes where the system does not '*fit*'. Two respondents felt that the reporting element was inflexible and that generating reports was difficult. One respondent pointed out that '*Banner*' was originally designed for the American academic structure and was reconfigured completely for the Irish context.

Interpretation

An IS implementation requires a study of the existing processes to identify areas for improvement, bureaucracy, and inefficiencies that need to be addresses by the technology. The issue of 'fit', and the appropriateness of this system in satisfying business needs, would have to be questioned. The success of any system implementation depends on the organisational 'fit' of the new system. This 'fit' needs to be considered during the selection of a technical solution (Hong & Kin 2001).

The interviewees were asked to comment on the extent that the business processes changed as a result of the new system.

The respondents agreed that fewer than 20% of business processes changed as a result of the implementation. One respondent suggested that many processes were '*formalised and standardised as opposed to changed'*. He said that rules associated with business processes were more '*formally enforced and any difficulties with process anomalies were ironed out.*' One respondent said that some '*processes were just tweaked to fit the system.*'

The interviewees were asked, to what extent were business processes mapped, and who was involved in this activity.

Three of the respondents were not aware of a business process mapping activity. Two respondents agreed that the mapping was conducted at national level and representatives,

primarily from management, were involved in the activity. Many of the processes were not a true reflection of '*how things are done'* possibly due to the fact that 'real' users were not involved.

Interpretation

The research suggests that more consultation is required with users. In the case of the Banner implementation the needs of academic users were very different to the needs of the administrative users. A more accurate and complete account of the current business processes on which the systems is being built is possible by involving users from all groups.

7.5 Summary

In this section the research findings from both the PPARS case study and the Banner case study are summarised and the conclusions are presented.

7.5.1 Customisation

Both systems studied were considerably customised to suit the needs of the organisational business processes, and in line with changes imposed by the national projects driving the local implementations. Based on the findings of this research it is recommended that customisation of the system is minimised and attention is focused on streamlining and reengineering business processes to suit the technical solution.

7.5.2 Requirements Sign-off

The research indicated that both implementations experienced time delays and spiralling costs due to 'scope creep' throughout the project. It is strongly advised on the grounds of this finding that an ERP system implementation project does not proceed without complete requirements analysis, user consultation, agreement and clear signoff.

7.5.3 Quality of New System

When the interviewees in both studies were asked to rate the systems on quality, they rated them poorly on all quality components. This rating contradicted the respondents' comments on quality, which were more positive. The research suggests that the implementation strategies were in fact the factors that the respondents' felt negatively influenced the implementation.

7.5.4 End User Involvement

The findings from both the PPARS and Banner studies in relation to end-user involvement, would suggest that, all interviewees consider the involvement of end-users at all stages of the SDLC as vital for a successful information system implementation.

More meaningful involvement at the requirements gathering and analysis phase, and during business processes engineering would ensure that the opinions and suggestions of those who have 'on-the-ground' operational knowledge are taken on board. More

meaningful involvement by 'real' end-users creates an atmosphere in which users feel that they have been consulted and given the opportunity to contribute to the future of the organisation. As a result this will foster a sense of 'buy-in' and of being more in control of their fate, and thus will reduce resistance. This concurs with O' Brien (2005) who suggests that the key to addressing resistance is to promote end-users in the development and implementation of an information system.

More meaningful involvement by 'real'user will:

- Reduce resistance and increase employee buy-in.
- Increase the probability of establishing complete clear requirements.
- Improve business process reengineering.
- Ensure users have a better understanding of the capabilities, benefits and limitations of the system.
- Ensure end-users understand the business objective of the implementation.
- Facilitate invaluable feedback at early stages.
- Improve morale and motivation.

7.5.5 Change Management

The research strongly suggests that the following aspects contributed to the failure in managing change in the PPARS implementation project:

- The authoritarian approach of consultants driving the change plan.
- The lack of preparation for the transition.

- An absence of control over extra workload.
- Employees' inherent resistance and negative attitude to the new system.
- Conflicting interests and tension among management.
- Substantial disruption during the implementation.
- Underestimating and failing to address cultural factors.
- The lack of incentive to succeed.

The factors outlined above highlight the importance of ensuring effective change management plans are followed during an information system implementation.

The research strongly suggests that the following aspects contributed to the failure in managing change in the Banner implementation project:

- Inadequate planning with regard to timescale and impact of change.
- Poor preparation and unanticipated problems.
- Lack of control with regard to workload.
- Evolving requirements and feature creep.
- Lack of communication and poorly timed communication.
- Resistance caused by 'group inertia' and threatened expertise.
- A dismissal of the need to address cultural factors.

The findings from both case studies suggest that change management is critical to the success of the implementation. The research reveals a number of aspects of change management that required exceptional consideration. A consultative, open, informative

approach should be taken to the change process; an authoritative approach ought to be avoided. All aspects of the organisation must be prepared for the transition and extra demands on employees and workloads must be controlled.

The organisation must consider and address the following:

- Cultural factors and tradition.
- Unanticipated events
- User resistance and negative attitudes of employees
- Employees' feelings of being threatened
- Management conflict and tension.

The findings recommend addressing these factors through, information, communication, consultation, demonstration and example, participation, and incentive.

7.5.6 Management Commitment

The findings from both case studies suggest that, management commitment is critical to a successful ERP system implementation. Both projects were driven by a National Project, which added a degree of structural complexity. The involvement of a national project team caused some conflict with the local project team responsible for driving the implementation on the ground. Clarity of roles, organisation structure and project structure is vital in large and complex ERP system projects.

Senior management must be visibly and vocally committed to the project. Example must be demonstrated from the top to ensure operational management, and in turn employees commitment. Senior management must take responsibility for the project and have the authority to make crucial decisions. Management must be credible leaders, they must plan, organise, direct, motivate and control the project at the appropriate level in the organisation, and with the relevant information available to them.

7.5.7 Project Management

The findings suggest that project management is important to any project but particularly to one of this scale and complexity. Clear goals, objectives and plans must be communicated and understood. A large-scale enterprise information system implementation project requires planning, monitoring and controlling. Continuous tracking, performance measurement, follow-up on feedback will contribute to the ongoing improvement of the process of project management.

7.5.8 Education and Training

The findings clearly indicate, in line with the literature reviewed, that lack of knowledge and understanding of the project purpose, the system, the impact on employees and their roles, and the potential benefits and limitations; leads to the following:

- User resistance and lack of user buy-in.
- Fear of the unknown, inefficient use of the system.

- Ongoing, spiralling support costs.
- De-motivated staff, and inflated expectations
- Lack of credibility and lack of user confidence.
- Reduced productivity.

Based on the findings, it is recommended that training, preferably provided by superusers, is timely, effective, on-going and tailored to the individual and to the various skill levels in the organisation. Training should include information and education on, the system, the implementation and the potential risk and benefits of the implementation.

7.5.9 Communication

People in business spend a very significant amount of their time communicating. Ineffective communication is often the root of the problem. Improved communication in the context of a large-scale enterprise information system implementation project, will lead to the following:

- An understanding of objectives and goals.
- An improved awareness of the associated costs and benefits.
- A clear understanding of employee roles and the expected changes.
- An appreciation of the organisations expectations of employees during the implementation.
- A timely distribution of relevant documentation.
- Valuable feedback from users.

- An improved implementation process.

The findings suggest that despite huge efforts to communicate, the impact of such was sometimes ineffective. In order for the communication to be valuable and effectual it must be appropriate, relevant, timely, two-way, and realistic. The project process and the system implementation will be improved if an improved communication structure is employed and if valuable feedback is encouraged and considered. Organisations must find a balance between over communicating and the effectiveness of the communication.

7.5.10 Organisational Fit

The research findings clearly suggest that it is critical to address business processes reengineering and improvement, in consultation with users, prior to the selection of a technical solution. This presents an opportunity to uncover possible areas, processes and functions that can be improved within the organisation.

CHAPTER 8 CONCLUSION & FURTHER RESEARCH

8.1 Conclusion

More meaningful involvement of 'real' end-users, at all stages of the SDLC, is vital for a successful large-scale enterprise information system implementation. This improved involvement creates an atmosphere in which users feel that they have been consulted and have been given the opportunity to contribute to the future of the organisation.

Effective change management is critical to the successful implementation of a large-scale enterprise system. A consultative, open, informative approach should be taken to the change process. Organisation must be prepared for the transition; extra demands on employees and workloads must be controlled. Management must address cultural factors, unanticipated events, resistance, negative attitudes, conflict and tension.

Management commitment is critical to a successful ERP system implementation. Clarity of roles, organisation structure and project structure is vital. Senior management must be visibly and vocally committed to the project and they must have the authority to make crucial decisions.

Clear goals, objectives and plans must be communicated to all stakeholders of the large-scale enterprise information system implementation. These plans must be understood, monitored and controlled.

Training, preferably provided by superusers, must be timely, effective, on-going and tailored to the individual and to the various skill levels in the organisation. Training should include information and education on the system, the implementation and the potential risk and benefits of the implementation.

Communication with regard to the ERP system implementation project must be appropriate, relevant, timely, two-way, and realistic. The project process and the system implementation will benefit if an effective communication structure is employed, and if valuable feedback is encouraged and considered.

It is recommended that customisation of a large-scale enterprise system is minimised, and attention is focused on streamlining and reengineering business processes to suit the technical solution

The research suggests that the implementation issues were in fact the factors that the respondents' felt negatively impacted the implementations and not the quality of the actual systems.

8.2 Further Research

This thesis constitutes a study that is descriptive and exploratory by nature. As the research progressed, several areas requiring more focused investigation surfaced.

1. Will the increased involvement of 'real' users in the requirements gathering, business process engineering and delivery stages of an ERP system implementation, minimise user resistance and 'scope creep', and improve user buy-in and acceptance?

2. Will greater consideration of the following change management factors positively influence the outcome of the ERP system implementation project?
    - Cultural factors.
    - The reason for user resistance and negative attitudes towards change.
    - Management conflict.

3. The findings revealed that despite considerable communication the communication was ineffective. In order to make recommendations with regard to effective communication the following questions require answering. Why was the communication in relation to the information system ineffective? What measures can be taken to make communication more effective? What are the barriers to effective communication in the context of an ERP system implementation?

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APPENDIX 1

INTERVIEW QUESTIONNAIRE

1. What is your role in the organisation?_____

2. When did the system implemented commence?_____
_____
_____

3. When was the system implementation completed or abandoned?_____
_____
_____

4. What proportion of the system changed as a result of customisation?

0-20%	20 – 40%	40 – 60%	60 – 80%	80 – 100%

Please tick appropriate box.

5. Was there clear agreement between the project manager, users and technical staff with regard to the required level of customisation required?
_____
_____

6. Was there a sign off on system requirements?_____
_____
_____

7. What proportion of business processes changes as a result of the implementation of the new system?

0-20%	20 – 40%	40 – 60%	60 – 80%	80 – 100%

Please tick appropriate box.

Comment:_____
_____

8. With respect to business processes, comment on the extent to which they were changed.

Comment:_____
_____
_____

SUCCESS OR FAILURE OF THE INFORMATION SYSTEM

9. With respect to the information system implemented, please rate on a scale of one to five how successful the information system was/is in your opinion.

Total Failure 1.....|.....2.....|.....3.....|.....4.....|.....5 Total Success

Place X on appropriate point on line.

Comment:_____
_____
_____

10. What effect (positive or negative) did the new information system have on your job?_____
_____

11. What effect (positive or negative) did the new information system have on the organisation?

Comment:_____
_____
_____

12. With respect to the information system implemented, please rate on a scale of one to five the following qualities of the information system.

Place X on appropriate point on line for each.

12.1 **Correctness**: The extent to which the final system satisfies the functional requirements of the business

Completely Incorrect	1……..|……..2……..|……..3……..|……..4……..|……..5	Completely Correct

12.2 **Efficiency**: The extent to which the system maximises effective resource usage.

Completely Inefficient	1……..|……..2……..|……..3……..|……..4……..|……..5	Completely Efficient

12.3 **Extendibility**: The ease with which new functionality can be added to the system.

Not easily added	1……..|……..2……..|……..3……..|……..4……..|……..5	Easily added

12.4 **Adaptability**: The ease with which the existing system can satisfy unforeseen requirements

Not easily adapted	1……..|……..2……..|……..3……..|……..4……..|……..5	Easily adapted

12.5 **Maintainability**: The ease with which existing functionality can be corrected.

Not easily maintained	1……..|……..2……..|……..3……..|……..4……..|……..5	Easily maintained

12.6 **Reliability**: The frequency of failure involving the whole system or a component thereof.

Completely Unreliable	1……..|……..2……..|……..3……..|……..4……..|……..5	Completely Reliable

12.7 **Manageability**: The ease with which the operational system can be controlled

Completely unmanageable	1.....|.....2.....|.....3.....|.....4.....|.....5	Completely manageable

12.8 **Understandability**: The ease with which the business processes incorporated in the system can be understood.

Not understood	1.....|.....2.....|.....3.....|.....4.....|.....5	Fully understood

12.9 **Usability**: The degree to which the system can be integrated into work practices.

Not easily integrated	1.....|.....2.....|.....3.....|.....4.....|.....5	Easily integrated

13. On the scales provided below, identify approximately the degree to which the implementation of the information system was over or under budget.

Under budget by	10%		20%		30%		40%		50%		>50%	

Please tick appropriate box

Comment:_____

_____

Over budget by	20%		50%		75%		100%		200%		If >200% comment

Please tick appropriate box

Comment:_____

_____

_____

14. In relation to the expected delivery date of the information system, please identify in months if the system was delivered, on time, early or late?

Early by:				**On time**	**Late by:**			
>12	7 – 12	4 – 6	1 – 3		>3	6-12	13-24	>24

Please tick appropriate box

Comment:_____

_____

15. (Accuracy) On a scale of one to five please rate the extent to which the functions performed by the system are a true reflection of business processes.

Place X on appropriate point on line.

Do not reflect business processes 1.....|.....2.....|.....3.....|.....4.....|.....5 Reflect business processes

Comment:_____

_____

16. (User Friendliness) On a scale of one to five please rate the extent to which the system is user friendly, i.e. easy to learn, simple to use and generally agreeable

Place X on appropriate point on line

Not user friendly 1.....|.....2.....|.....3.....|.....4.....|.....5 Very user friendly

Comment:_____

_____

The following questions address factors that influence the success or failure of the implementation of an information system.

17. To what extent was end-user involvement encouraged and supported during the following phases of the systems development and implementation.

    Selection of Technical Solution: _____
    _____
    _____

    Requirements Gathering_____
    _____
    _____

    Testing_____
    _____
    _____

    Implementation _____
    _____
    _____

18. What implementation approach did your organisation adopt?

    Parallel Implementation ☐
    Direct Implementation ☐
    Phased Implementation ☐
    Pilot Implementation ☐

    Please tick appropriate box

Comment:_____
_____
_____
_____

19. If a pilot implementation was adopted, did end-users get to use a Pilot System?__
    _____
    _____

20. Were you aware of a change management plan being in place for the implementation of the new system?_____
_____
_____

21. How prepared employees were for the transition from the old system to the new?
_____
_____

22. Was the disruption caused to staff and their work patterns monitored?_____
_____
_____

23. Was the disruption caused to staff and their work patterns controlled?_____
_____
_____

24. To what extent were users resistant to the change?_____
_____
_____

25. To what extent was the orrganisation prepared for the changes to the business processes

_____
_____

26. Please comment on the level of disruption experienced during the transition from the old system to the new.

_____
_____

27. To what extent did the organisation underestimate the impact that the implementation will have on people, their roles, skills and organisational structure?_____
_____
_____

28. Comment on the consideration given to the cultural factors of the organization.

_____
_____
_____

29. Were employees informed of the potential benefits associated with the new system?_____
_____
_____

30. To what extent were senior management supportive of the implementation of the Information System

_____
_____

31. To what extent was your direct supervisor supportive of the implementation of the Information System

_____
_____

32. Did the associated "business" areas commit people resources to the project as required?_____
_____
_____

33. If issues were encountered during the development and implementation were they reported to senior management?_____
_____
_____

34. How did senior management deal with these issues?_____
_____
_____
_____

35. On a scale of one to five please rate quality of the goals of the implementation project.

Place X on appropriate point on line.

Unclear Goals 1.....|.....2.....|.....3.....|.....4.....|.....5 Precise, well defined Goals

Comment:_____

_____

36. On a scale of one to five please rate the following in terms of clarity:

Place X on appropriate point on line for each.

41.1 Definition of Objectives

Unclear 1.....|.....2.....|.....3.....|.....4.....|.....5 Very clear

41.2 Work Plan

Unclear 1.....|.....2.....|.....3.....|.....4.....|.....5 Very clear

41.3 Resource Plan

Unclear 1.....|.....2.....|.....3.....|.....4.....|.....5 Very clear

Comment:_____

_____

_____

_____

37. On a scale of one to five please rate the tracking of the project process during all stages of the implementation

Place X on appropriate point on line.

No tracking 1……|……2……|……..3……|……4……..|……5 Complete tracking

Comment:_____
_____
_____
_____

38. To what extent does the new information system "fit" the existing business processes

Comment:_____
_____
_____
_____

39. Were current business processes mapped before or during the implementation of the new information system?_____
_____

40. Who was involved in the mapping of these business processes?_____
_____
_____

41. Comment on the importance of communication to the successful implementation of a new information system

Comment:_____
_____
_____
_____

42. Were you aware in advance of the activities of the project?

Comment:_____
_____
_____
_____

43. What format did the project communication take?

Please tick appropriate boxes.

Initial Briefings	☐	
Regular Meetings	☐	
Conference Calls	☐	
Project Meeting	☐	
Newsletters	☐	
E-mail updates	☐	
Intranet	☐	
Presentations	☐	
Training Sessions	☐	
User manual/documentation	☐	
Minutes Circulated	☐	
Frequently Asked Questions	☐	
Other	☐	Please specify: _____

44. Comment on the effectiveness of the communication.

Comment:_____
_____
_____
_____

45. Did the training provided to you incorporate an explanation of all aspects of the system.? _____
_____
_____
_____

46. What training was offered to end-users?_____
_____
_____
_____

47. Who provided the training?
_____

48. Do you think end-user involvement is an important factor to the overall success of the implementation?_____
_____

49. At what stage during the systems development and implementation do you think users should be involved?_____
_____
_____

50. To what extent do you think end-user involvement reduces resistance to the new system and the changes it will bring?_____
_____

51. Do you think more involvement from users would contribute to the success of the implementation_____
_____

52. What effect did the implementation of the new system have on staff motivation and productivity?_____
_____

53. Do you think the way change is managed has an impact on the overall success of the implementation?_____
_____

54. Do you feel that the involvement of strategic management is required throughout the project and contributes to implementation success?_____
_____

55. Do you feel that the involvement of operational management is required throughout the project and contributes to implementation success?_____

_____

56. In your opinion, how important is effective project management to the overall implementation of a new system?_____

_____

57. To what extent does learning and training of end users affect the overall success or failure of the implementation of the new information system?_____

_____