Identifying and Evaluating Factors that help contribute to IS "Success" for Software Development Projects in Multi-National Organisations

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ABSTRACT

This thesis examines the question of Information System (IS) success and looks to determine if it is possible to describe that success in terms of a *package* of separate, interrelated success factors which can be identified and tracked through the use of a *questioning framework*. This research examines "common" models of IS success and failure and proposes, based on those models, areas that are regarded as important contributors to IS success. A framework is proposed that will allow multi-national organisations to identify success factors that are specific to their organisational context and this framework is then tested in a global IS company. As a result of this testing, it was found that the success factors identified did indeed relate to the framework that was proposed, but that additional work was needed to include areas that the research identified and also, to improve how the resulting success factors were presented to the organisation for easy understanding.

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CONTENTS, ABBREVIATIONS AND TABLES

List of Abbreviations

BOM	Bill of Materials
CMMI	Capability Maturity Model
CSF	Critical Success Factors
GA	"General Availability" release of software
HTML	Hypertext Mark Up Language
IDEs	Integrated Development Environments
ISD	Information Systems Development Methodology.
IS	Information Systems
IT	Information Technology
ITIL	Information Technology Infrastructure Library
PLC	Another name for the SDLC
POC	Proof of Concept
PRD	Product Requirements Document
SCM	Software Configuration Management
SDLC	Software Definition Lifecycle
WAN	Wide Area Network

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I would like to thank all those who assisted me in putting together this research, with especial thanks to all those in the project-management group whose help was invaluable.

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1. Introduction

This section introduces the objectives of this thesis and in brief, presents some of the problems that organisations face when trying to develop and implement a "successful" IS system.

1.1 Chapter Overview

The goal of this chapter is to present the objectives of this thesis and discuss what is meant by a "successful" information system. The chapter explains in some detail what is meant by the term information system's "success", and why, in brief, it can be such a difficult goal to achieve. This discussion also examines the role that evaluations can have in helping a multi-national organisation move towards achieving a "successful" system, and from a high-level perspective, explores what such an evaluation process requires. The chapter then presents the key goals and assumptions that this thesis is based on and concludes, by listing the limitations that this research is believed to have.

1.2 Purpose of this Thesis

The purpose of this research is to look into how organisations define and evaluate the construct which is commonly called IS "success". The overall aim of this thesis is to evaluate the proposal that IS success can best be described as a package of interrelated success factors which, when taken together, contribute to the success or failure on an IS system. The thesis describes a proposed framework of areas that can be examined to help an organisation identify what factors are important to the success of their system(s). It also states questions that could be used within this framework to help organisations focus their attention on areas that might need addressing.

In brief, the overall aims of this thesis are as follows:

1. To identify "common" constructs or definitions of IS success and failure that are in use by industry or that have been proposed by the IS research community.
2. To analyse and breakdown these constructs to determine what "common" areas are regarded as being important for IS success. Then, once these areas have been identified, to define questions that would allow a multi-national organisation to interrogate these areas for success factors.

3. To examine the hypothesis that IS success can be more accurately described as a *package* of individual and unique success factors whose definitions and measurements depend on the organisational context in which an IS system is being developed.

4. To define and validate a potential framework that can help an organisation identify factors that would be part of such a success package.

5. Finally, to identify directions for further research based on the conclusions raised from this study.

1.3 INFORMATION SYSTEMS SUCCESS: WHAT IS IT?

To survive and prosper in today's business environment, organisations are having to invest more and more heavily in information technology (IT) and information systems (IS) as a way of both supporting their infrastructure and of meeting their business needs[1]. However, despite such levels of investment, figures from studies performed over the past 20 years (see table 1.1 below) have consistently quoted high rates of IS failure – e.g. 46%, Standish Group (2006), 29%, ARM Research (2007) - or IS systems that are not meeting the expectations held of them, e.g. under 50% quoted by Forrester Research (2009). In light of such statistics, it is easy to see why both practitioners and the IS research community as a whole are so active in trying to define ways in which the risk of an IS system being deemed a failure may be minimised. However, the means to achieving this goal has been a topic of hot debate for well over twenty years, with opinions over what factors are vital to a successful system giving rise to numerous methodologies and tools that purport to resolve essentially the same issue – that of ensuring that an IS system meets the expectations that an organisation has of it.

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[1] A sample of these costs taken from one study by Ballantine et al (1996) quotes a figure of £7.4 million, while another study by Willcocks (1996), quotes IT expenditure by both business and public sector organisations in the UK as being £33.6 billion in 1995, with expected increases of 8.2% quoted.

Study	*Findings*
Hochstrasser (1992)	60% general reported failure rate for IT/IS systems in that they did not deliver the expected benefits
Serafeimidis (1995)	An organisation only has a 30-40% chance of developing an IS system that meets with all their expectations
Coopers and Lybrand (1996)	67% of organisations in the UK had suffered at least one system project that failed to deliver on perceived expectations
Gregor (1999)	Failure rates of IS systems being as high as 40% in the UK
Robbins-Gioia Survey (2001)	Of 232 companies surveyed, 51% viewed their ERP implementation as unsuccessful
KPMG Global Survey (2005)	49% of participants have experienced some form of IT/IS project failure
Standish Group (2006)	46% of application development projects fail to deliver on time, on budget or in scope
AMR Research (2007)	29% of respondents reported failures in IS projects that stopped them going "live"
Forrester Research (2009)	Under 50% of CRM implementations fully meet the expectations held of them

Table 1.1 Sample Studies into rates of IS failure over the last 20 years

Arguably, one of the main reasons for this level of fragmentation is that while it is widely recognised that "success" is a multidimensional construct having both technical and social factors (Molla and Licker, 2001), a precise definition of what this construct contains is open to debate. An ambiguity, that has resulted in the development of numerous different approaches that are each based on their own unique underlying assumptions. However, while such diversity of opinion may be good for furthering the debate within the IS research community, it does little to resolve the practical problems that organisations face when trying to ensure that they do not fall afoul of such statistics as those described above. When an organisation undertakes the development or implementation of an IS system, they are investing a considerable amount of time and resources with the expectation that the eventual system will make some kind of positive contribution to their organisation. What they need is some form of mechanism that will allow them to determine if such a positive return is possible and guide them towards achieving it.

Usually, such a mechanism – if used – will be referred to as either a process of IS evaluation or as an IS development methodology (ISD). In either case, the role of this process is to provide some form of framework by which an organisation can minimise the risks associated with undertaking an IS project. This can be done by comparing the level of expected benefits against the imagined costs of undertaking that project. However, as stated

above, the problem that the organisation may face when attempting to tackle such an investigation is the scope of the entities that potentially need to be examined. As will be discussed in much greater depth in the next chapter, an IS system can potentially affect more than just the formal processes of an organisation. It can also impact upon the softer, more social aspects of how an organisation works. As such, the success of an IS system can be viewed as being dependant on both tangible entities[2] and intangible entities[3]. While it is fairly simple to map the visible aspects of an organisation, such as how an individual's payroll is calculated, this is not the case for the invisible, value-ladened aspects, such as group norms. These types of factors require an intimate knowledge and understanding of the organisation which might not always be possible without an extensive level of investigation. It is elements such as these which contribute to the uncertainty regarding precisely what makes an IS system successful.

The potential problems that organisations face when trying to aim towards a successful system are thus several. Firstly, the statistics show that simply investing in the process of undertaking an IS project is no guarantee that the resulting system will match the expectations that the organisation had of it. Secondly, even when the organisation does try and perform some kind of investigation, the scope of the entities that may need examining could potentially be so great that the cost of undertaking the investigation may be even greater than that of the IS project itself. The question therefore that must be asked is how can the organisation balance the level of risk associated with undertaking a project against the cost of implementing some form of control process. It is with regard to this question, that this research is primarily aimed at investigating.

1.4 WHY IS "SUCCESS" SO POTENTIALLY DIFFICULT TO ACHIEVE?

As described above, simply investing in developing an IS project is no guarantee that the resulting system will return a positive contribution to the organisation. Indeed, as the statistics show, there is a significant risk that the investment will fail to make any contribution at all, which when considering that a Compass report given in 1998 stated that some financial houses in the UK were devoting more than 20% of their total firm expenditure towards IT and IS (Willcocks et al., 1999), is a risk that could have serious implications for a firm's survival.

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[2] entities which refer to the visible, formal processes of the organisation.

[3] entities which refer to the invisible, value-ladened aspects of an organisation, such as organisational culture.

However, even with this being said, there is evidence from a number of studies that suggests many organisations either: -

- do not have any form of formal control/evaluation mechanism in place (Ballantine et al, 1996),

- focus primarily on conventional financial techniques or tangible factors (Ballantine et al, 1996; Wong and Behling, 1997; Farbey and Land et al, 1999; Willcocks and Lester, 1996) which potentially ignore the social and second order affects of an IS system.

- Farbey et al (1994) even reported that where formal evaluation/control mechanisms were in place, that the benefits and costs that they presented were often distorted so that the true costs or benefits were misrepresented. Farbey et al. also commented on instances where managers had deliberately subverted such mechanisms so that their own political agendas could be enhanced.

Studies such as these would seem to suggest that organisations either - underestimate the possibility of a project failing, are uncertain about how to control the impacts of an IS project, or do not truly appreciate the social dimensions that an IS system can have. However, given that instances of IS failure are regularly reported in the popular IT literature, and the fact that IS systems have a social dimension is almost common knowledge - why do organisations seem to have so many problems with controlling their systems development?

It is the contention of this research that one of the primary contenders for an answer to this question is the lack of an exact definition as to what it is organisations need to control. While the tangible factors that contribute to a successful system are potentially easy to identify and control, such is not the case with the intangibles. How, for example, does an organisation control/evaluate the impact that fear of change will have on the success of their IS system? If an organisation is incapable of answering such questions as these, then they are vulnerable to problems arising from such areas.

1.5 STRUCTURE AND THEMES OF THIS THESIS

This section of the thesis outlines the key areas of interest that this research focuses on. The intention is to specify up front what are the key underlying assumptions, definitions and limitations that this study has.

1.5.1 Key Goals for this Thesis

The purpose of this thesis is to examine the question of what possible factors may contribute to the success of an IS system, and attempt to define a way in which an organisation can both identify, and then evaluate, such factors. This study will draw on both theoretical models that

have been proposed by researchers in this area, and also, on primary and secondary sources of research which describe what factors organisations use when controlling their own IS projects. The goal is to examine those areas that are deemed vital to IS success by both practitioners and researchers and construct a framework that can help an organisation arrive at a more precise definition of what success factors they need to control.

This thesis will argue, as Willcocks did in 1992, that the resulting success of any IS system may well be influenced by the effectiveness of the evaluation mechanism used to support it. As such, the more ecologically valid this evaluation mechanism is, then the greater the chances of identifying and correcting any factors that might increase the risk of an IS system failing. This argument is based on the notion that any evaluation technique or development methodology that an organisation uses will be based on a set of underlying assumptions which will emphasize specific entities or factors as being vital to control. Such entities however may, or may not, be relevant to an organisation, leading to a potential issue of 'fit' where organisations are using evaluation or success constructs that are focusing on areas totally inappropriate to that organisation's requirements. The aim of this research therefore, is to construct a framework that can help an organisation better define and evaluate this 'fit'.

1.5.2 What is meant by the term "IS Evaluation"? – A Proposed Definition

One term which is used throughout this thesis is the term "evaluation" or "control process". In the introduction above, a brief reference was given as to what this term implies, however, since this thesis is fundamentally about defining and measuring success factors, then it is necessary to give a clear definition of the scope and meaning that the term evaluation has within this thesis.

All information systems are designed with an end purpose in mind, and while this end purpose will be unique for each system, to achieve it will usually require a significant outlay in both time and resources – an outlay, for which a return is not guaranteed. In addition to this outlay, the costs and impacts to the organisation of putting that system in place may very well be far greater than any perceived benefits it may eventually bring. As such, simply undertaking an investment in an IS system is no guarantee that this investment will result in any positive contribution to the organisation's bottom line performance. Indeed, there is a significant risk that this investment will simply result in a waste of resources that might have been better spent elsewhere. Therefore, the goal of any IS evaluation process is to attempt to ensure that such wastage does not occur.

In its simplest terms, IS evaluation is an attempt to quantify the costs associated with an IS system and compare those costs against any perceived benefits that such a system might ultimately bring. It is a form of control and review process that has the goal of defining what are the benefits that an IS system might bring, what are the potential costs associated with achieving those benefits, and from this information, deciding the perceived usefulness of undertaking that investment. It is thus attempting to minimise the potential risk associated with an IS system and determine if the stated goal can be achieved within the organisation's budget.

When considering at a high level what factors are necessary for an evaluation process to occur, this thesis would propose that two main stages are required. The first of these is to define what key benefits or costs a proposed IS system is expected to bring and from these generate a list of entities that will form the basis for a definition of success criteria against which the IS system will be evaluated. The second stage is the creation of a set of metrics that can be used to quantify this list of success criteria. Examples of such metrics might be financial ones such as *return on investment* (ROI) or *cost benefit analysis* (CBA). The function of defining criteria to investigate and control is also performed by IS development/implementation methodologies (ISDs) like *SSADM*[4] and *XP*[5]. Such ISDs also have an underlying set of assumptions as to what entities need to be controlled and have procedures build into them that are specifically aimed at measuring aspects of these entities. For example, documents and techniques with titles such as *functional specification*, *data flow diagrams* and *market requirements* are essentially just defining a set of entities that need to be controlled. This point is dealt with further in chapter 2, where the role of IS methodologies and their weaknesses are discussed.

1.5.3 The Contribution this Study makes to IS Success Research

The field of IS success research is very diverse. It covers multiple subjects ranging from definitions of IS success and failure, proposals on how to measure them, plus numerous suggested approaches on how to deliver a successful system The key area that this study has been investigating is that given this wide range of research is there a relatively simple, yet ecologically, valid mechanism that an organisation can employ to deliver a "successful" IS system?

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[4] Structured Systems Analysis and Design Methodology, please refer to *Information Systems Development* by Avison and Fitzgerald (1988) for more details.

[5] eXtreme Programming, please refer to *eXtreme Programming Explained* by Beck (2000) for more details.

For such a mechanism to be useful it would have to be able to define what are the key factors that would make an IS system "successful" and also, propose a way in which those factors could be tracked so as to ensure that this "success" is delivered upon. The contribution that this study makes to the field of IS success research is to offer up for debate a framework through which this goal can be achieved.

In proposing this framework, this study focused on a number of key areas within IS research. These included definitions of IS success and failure, methodologies that are used to deliver IS systems and lastly, evaluation frameworks that are used to validate such methodologies. The purpose behind this investigation was to identify common themes within these different research areas that could then be used as a basis for the proposed framework. What the findings of this research showed was that many of the definitions of IS success and the mechanisms used to deliver on that success shared commonalities which could be used as a basis for building such a framework. These commonalities were primarily in the organisational areas that gave rise to factors that directly affected the success or failure of an IS system.

This study thus had a number of goals it was intending to achieve. The primary goal was to determine if the proposed framework would be a valid mechanism for helping in the identification of success and failure factors. The second was to determine if the organisational areas proposed were indeed the best areas to focus on in the search for those factors.. In addition to these two main goals, the study also examined the proposal that IS success was not just a construct dependent on a few key factors, but was instead a package of interrelated factors that needed to be monitored as a whole. This is not a definition of IS success that has previously been highlighted and needs to be explored further.

What the study found was that for the target organisation investigated there were many individual success factors that people from within the target organisation nominated as being necessary for the long term success or failure of an IS system. The majority of these factors came from the way the organisation controlled its IS development projects and the priorities that people believed were put on different stages. Of the four organisational areas that were proposed as being critical to the search for success/failure factors – *project management*, *stakeholder expectations*, *organisational context* and *technology* - all of them were represented in the factors that the research highlighted. The most critical area that was identified was that of *project management*, followed by *stakeholder expectation* with *technology* coming last. The study showed that when asked to consider what a successful system was that the definition varied widely depending on who was asked. The dominant factors that individuals spoke about were mostly dependent on the organisational area that

those individuals came from. This subjective nature of the definition of IS success shows that for many who took part in the research what makes a system "successful" depends on their own unique perspective. As such, the proposed definition of IS success being a package of unique factors that the organisation needs to identify and control makes sense to such people.

In researching the proposed framework, this study had two main objectives. The first was to determine if the notion of a "questioning framework[6]" was a valid way of identifying success/failure factors. While the second was to prototype example questions in a live environment that would help to identify such factors. The study found that it was possible to reverse engineer questions that focused on critical success factors that key stakeholders within the target environment deemed were essential for IS success. The study also found that these factors – and the questions that they gave rise to – were valid for more than just one project. They could be applied to many projects within the same organisation. The questions that were identified were grouped by organisational area and by the taxonomy of critical success factors[7] (CSF) as proposed by Williams and Ramaprasad (1996). This was done to triangulate the results found to determine if the four candidate areas proposed were valid and reflected the priorities that had been assigned to them. The triangulation showed that the majority of the results found did indeed fit into the proposed areas and that the number of factors assigned to each area supported the proposed priorities. The numbers of factors found were highest in the area of *project management*, followed by *stakeholder expectations*, *organisational context* and lastly, *technology*. This supported the assumption used by the framework that the focus on delivering a successful system lay with the methodology used and expectations of key stakeholders.

To conclude, the goal of this study was to determine if the framework proposed was a viable mechanism for assisting in the identification and tracking of IS success factors. What the research undertaken has indicated is that the proposed framework will aid with this task. It has shown that by focusing on the four areas proposed that it is possible to identify many factors that both enhance and inhibit IS success that the organisation is not necessarily tracking itself. As such, the contributions that this study has made to the area of IS success research are several. The first is to propose an alternative way of defining IS success that is

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[6] The "questioning framework" is discussed in more detail in chapters 2 and 3, but is a proposed set of questions tailored for an organisation that they use to identify those IS success factors that they most believe are critical for them to monitor during an IS project.

[7] See chapter 2, section 2.6.2 for more information.

more focused on the needs of the organisation, rather than the more generic models that research into IS success promotes. Secondly, is to propose four organisation areas based on prior research into both IS success and failure that – as shown in this study – can be successfully queried for many factors that an organisation should be tracking, but may not be. Lastly, to build on these areas to propose and test a framework that can be used to identify and measure such factors. The goal being to provide an organisation with a tested mechanism that can be used to build libraries of success and failure factors that have occurred in past projects and to have questions that can then be applied to new projects to ensure that they do not run into similar issues.

1.5.4 Limitations of this Study

The final section of this chapter lists some of the known limitations which this author believes will have an impact on both the generalisability of the results from this research, and the framework which is ultimately proposed. While this list is by no means complete, it does aim to highlight those areas which will give bias to any findings generated.

- This research is specifically targeted at multi-national organisations which either develop their own in-house solution to an IS problem, or who have invested heavily in customising existing solutions. It is not aimed at organisations who purchase an "off the self" solution to a routine IS problem.

- While many of the issues that are discussed within this thesis are pertinent to any IS system, the focus of the research will be placed on the software development industry. The reason for this is that many of the issues that will be raised are to do with the design and development of software – tasks which are of specific interest to this sector.

- The nature of the data that this research needs to collect is primarily qualitative and as such, case-based research is being used. While the environments being investigated are mostly independent of each other, they do come under the same organisational umbrella and as such, this may affect the statistical generalisability of any findings produced. This is a subject which is commented on in chapter 3.

1.5.5 Conclusion

To conclude, this research is primarily concerned with looking at how organisations and researchers have defined IS success. It provides a framework that can be used by an organisation to identify factors that might be critical to the success of their system. The aim is to provide a more ecologically valid definition of success from which the organisation can then derive metrics to help evaluate the usefulness of their own development practices in

supporting these success factors. It will be argued that each methodology or success construct emphasises certain assumptions about what factors need to be controlled in order to produce a successful system. This research is aimed at providing guidelines to help validate if such assumptions are correct. The underlying principle being that if an organisation has a clearer understanding of what factors contribute to the success of their system, then monitoring the progress of such factors will help reduce the risk of IS failure. The next chapter builds on this argument by looking at models of IS success and failure, and proposing some key areas that need to be investigated.

2. Literature Review

This chapter is intended not only to familiarise the reader with the main themes, constructs and arguments relevant to the areas of IS success that will be referenced within this study, but also, to apply a structure to those concepts that will underlie the hypothesis and questioning framework that is ultimately presented.

2.1 Chapter Overview

The goal of this chapter is to provide a more rigorous theoretical grounding for the concepts that this thesis intends to pursue. This starts with a high-level review of the two main underlying research traditions[8] that have arguably been used to understand IS systems, and detail how these traditions have affected how people define IS success. Following this review is a discussion regarding just *what* exactly is meant by the term "IS failure" and some of the key elements that contribute to it being a reoccurring phenomenon. This discussion will also include a brief introduction to the phenomena know as the "IT productivity paradox" - a phenomena which highlights the risk of an IT investment failing to make any positive contribution to the organisation. Once the concepts of what is meant by the term IS failure has been investigated, this chapter will then review some of the models of "IS success" that have been proposed over the last decade or so. This review will include a discussion of what is meant by "IS success" and examine how models have attempted to measure it.

The final part of this chapter looks at how evaluation strategies and ISDs attempt to guide the organisation towards delivering a "successful" IS system. This discussion includes an introduction to the hypothesis that IS success can be viewed as a package of potentially unique success criteria, and concludes by proposing how the construction of such a package could be used to enhance the effectiveness of an existing evaluation process.

2.2 A Review of IS Theoretical Perspectives

Prior to the late 1980's, the majority of IS systems development and evaluation methodologies followed what was commonly known as the conventional, or cascading-waterfall model. This approach was pioneered in the 1970s by researchers such as Daniels and Yeats (1971). The concept behind this model was the definition of a rational engineering like process that would enable any organisation to take an existing manual system and then

[8] A common set of assumptions shared by all researchers from a particular research domain. Covers the methods used and the entities investigated (see Anderson, 1982).

essentially, 'computerise' it. The key underlying assumption behind this approach was that IS systems were a technical problem to which a technical solution could be found. As such, 'hard' technological and process-orientated issues, rather than 'soft' organisational ones, were the prime unit of analysis. The belief was that any system could be analysed via the same rational reductionist methodologies, and that success was ultimately determined by controlling the outputs identified by such methodologies.

In the mid-1980s however, the amount of dissatisfaction with these so-called conventional approaches began to give rise to methodologies and ideas that focused on the environment and the organisation as the prime unit of analysis, rather than the system itself. This rising concern was also reflected in the IS research community, with authors such as Keen (1987) and Mumford (1985) postulating that the problem domain of IS was much richer than the rational reductionist approaches currently in vogue at the time suggested that it was. Indeed, a Colloquium held in 1984 called 'Information Systems Research – A Doubtful Science' suggested that the main emphasis of the IS research domain should not be so much concerned with scientific method and rationalist approaches, but rather, more with social science methodology and focusing on human activities and their interaction with the environment.

As a result of such approaches to IS, it is suggested within this thesis that two predominant research perspectives have had the most influence on the development of IS theories and methodologies within this field. The first of these perspectives, which this thesis will call rationalist, is based on research assumptions and traditions that view IT from a normative, scientific basis. The underlying ontology of this perspective being that reality, or the problem domain under investigation is knowable, and as such, can be understood by reducing it to its materialistic components. The associated epistemology with this perspective is that knowledge, and the methodologies used to gain that knowledge, can be deduced from a number of self-evident axioms. The result of these two approaches is that the IS system is defined in terms of tangible effects and deductive reasoning that is universally 'true' - no matter what the context. The second perspective however, which this thesis will call interpretative, takes a more 'social' approach. It looks at IS in the context of group and human interaction. In this perspective, the ontological approach to reality is based on phenomenology. That is to say, that reality is not knowable and very much depends on an individual's interpretation of that reality. The associated epistemological approach to defining knowledge thus focuses on understanding the importance of context and perception in how knowledge may be derived rather than the knowledge itself. The result of these two

approaches means that this perspective focuses on defining IS systems in terms of unique, intangible, context specific effects, rather than just one instance of a generic phenomenon.

Each of these fundamental research perspectives have a number of advantages and limitations that are incorporated into any theory or methodology that may be derived from them. For example, the *rationalist* perspective concentrates on entities and methods that are objectively identifiable, and assumes that humans interact in a rational way. The benefit of utilising such a perspective is that it scopes the complexity of IS into a problem domain that can be rigorously validated in a deterministic and reproducible fashion. This means that, according to the positivistic ideas behind this perspective, any IS system can be analysed via a standard set of methods/toolkits, and assuming that these toolkits are well-constructed and complete, then any IS system that uses them will always be "successful". The attraction that such a perspective would have is obvious, and on first glance, seems to be ideally suited to computer based systems. However, as was argued in the late 1980s, IS systems are a much richer problem domain than that advocated by the rationalist perspective, and as such, focusing on this perspective alone may be ignoring factors that are essential to the overall success of the IS system.

On the other hand, the *interpretative* perspective views IS as a much more non-deterministic, context specific problem domain, that can only be understood by reviewing the social, environmental and political nature of the organisation in which it occurs. The problem however, in utilising such a perspective is that it requires extensive analysis of the organisation from an indeterminate number of viewpoints to understand what potential issues may be involved. Even then, the analyst(s), who are themselves bringing their own interpretation to the organisation, may not correctly identify all those issues that could impact on the overall success of the IS system. In addition to this, some of the entities that need to be examined, e.g. belief structures, are complex composites that are unique to each individual, making them impossible to objectively quantify. If viewed from this perspective, the factors that affect IS success are so complex and unscoped that it is literally impossible to comprehensively identify what will influence IS success or how such factors could be evaluated. In other words, while this perspective may extend the scope of the analysis, it does so at the cost of the time and conciseness of the investigation involved.

From this short theoretical review, it can be seen that there are two main conflicting perspectives on how IS systems can be viewed with each perspective having its own issues regarding how IS success is defined and what factors contribute to it. In part, resolving such issues is what this chapter has set out to do. The framework that will ultimately be proposed is intended to help the organisation construct a more precise definition as to what IS success

means to them and provide a set of evaluation criteria that can then be used to monitor this definition.

Table 2.1 below provides a more detailed summary of some of the main differences between these two perspectives. While by no means complete, it does help to position some of the issues that will be discussed later in this chapter.

Perspectives	*Methods*	*Entities investigated*	*Assumptions*	*Example Methodologies*
Rational	▪ Deductive ▪ Reductionism ▪ Deterministic	▪ Organisational processes ▪ Data and data flow ▪ Cost and Benefit analysis ▪ Optimisation of processes ▪ Organisational structure ▪ Tangible impacts	▪ Impacts of IS system can be objectively quantified ▪ IS systems are equal to the sum of their parts ▪ By optimising processes and data flow IS success will be achieved ▪ Boundary of the IS system is determined by transactions ▪ Organisational structure and processes can be broken down into transactions ▪ Human behaviour is driven by cost/benefit decision model and rational analysis ▪ Methodologies and success factors used can be easily replicated from organisation to organisation	▪ SSADM[9] ▪ IE[10] ▪ Extreme Programming[11]
Interpretative	▪ Inductive ▪ Nomothetic (group norms) ▪ Idiographic (Individual perceptions) ▪ Interpretative ▪ Ethnocentric	▪ History ▪ Culture ▪ Mental and Social schema ▪ Belief structures ▪ Need satisfaction ▪ Power struggles ▪ Coalitions ▪ Intangible impacts	▪ Impacts of IS system are context specific ▪ IS systems are more than the sum of their parts ▪ Success of the IS system is determined by complex social and political processes ▪ Boundary of IS system is determined by culture ▪ Organisational structure and processes are comprised of transactions and informal connections between groups ▪ Human behaviour is driven by complex social and personal needs. Decisions may be trade-offs between rational and irrational needs. ▪ Methodologies and success factors used are specific to the context in which they are being viewed	▪ ETHICS[12] ▪ SSM[13]

Table 2.1 Contrasting Rational against the Interpretative perspective

[9] SSADM, or Structured Systems Analysis and Design Methodology, is a highly structured ISD methodology used as a standard by UK government IS projects. It is modelled closely on the cascading waterfall approach and emphasises detailed analysis of data and manual procedures. For more information on this methodology, please refer to *Information Systems Development* by Avison and Fitzgerald (1988).

[10] IE, or Information Engineering, please refer to *Information Systems Development* by Avison and Fitzgerald (1988) for more details.

[11] Extreme Programming, or XP, focuses on linking the development code cycle to the specifications of the system by utilising "use cases" which detail the interactions between actors within a system. It is primarily concerned with rapid code development and modification. For more information on this methodology, please refer to *eXtreme Programming Explained* by Beck (2000).

[12] ETHICS, or Effective Technical and Human Implementation of Computer-based Systems, is an ISD methodology developed by Mumford and Weir (1979), that focuses on "fitting" the IS system into the environment for which it is being developed. It concentrates on analysing the culture, psychology and ethics of the environment, and adapting the technology to fit. For more information on this methodology, please refer to *Information Systems Development* by Avison and Fitzgerald (1988).

[13] SSM, or Soft System Methodology, developed by Checkland in 1981, is perhaps one of the most commonly known ISDs that have emerged from the interpretative field. This methodology focuses exclusively on attempting to identify the conflicting objectives, perceptions and attitudes between different groups of people. It is designed on the premise that human activity is completely unique, and thus, can only be understood in terms of conflict and shared culture. For more information on this methodology, please refer to *Information Systems Development* by Avison and Fitzgerald (1988).

2.3 WHAT IS AN IS SYSTEM? - A REVIEW OF IS SYSTEMS THEORY

It is important to note that the IS perspectives presented in section 2.2 above should not be regarded as being mutually exclusive in how they are defining IS systems. Each perspective is simply concentrating on one aspect or another of what an IS system does and the environment in which it operates. To further understand this concept, it would be useful to review a field of research called *systems theory* which aims to better understand the concept of a "system" and how it functions within its environment.

General System theory (GST) as developed by Ludwig von Bertalanffy in 1968 is the term given to a field of research that aims to examine what systems are and how they interact with their internal and external environment. The definition that it uses for a "system" is very broad and covers not just IS systems, but also social organisations and even life-forms. "Systems" are defined as anything where a group of objects work together to produce some sort of result. Obviously, with such a wide definition, systems theory as a field of research has split into many different areas each focusing on different aspects of what "systems" are and how they interact. In terms of IS systems, this focus has been on how organisations operate as social entities and the internal processes that take place within them. Some examples of this research include such theories as cybernetic systems, adaptive complex systems and systems thinking.

Cybernetic and adaptive complex systems are ways of classifying how organisations behave and interact with their environment, whilst systems' thinking is an approach that assumes the operation of a system can only be understood by looking at the system as a whole, rather than at its individual parts. By using such concepts, researchers have aimed to understand an IS system (or an organisation) from both a "hard" and a "soft" perspective. "Hard systems" describe the quantifiable processes and data that an organisation has and how that data is transformed and consumed by the organisation, whilst the "soft system" describes the parts of the organisation that cannot be easily quantified such as opinions, culture and politics. As such, to understand an organisation and any IS system needed to support it, the organisation must be understood in terms of both the physical processes that it has and also, the human interactions that go on within it. Focusing on just one of these aspects will not – according to systems thinking – provide the insight that is necessary for a successful IS system implementation. The whole is greater than the sum of its parts, so to understand what may affect the success of a system, it is necessary to understand that system as a whole.

Probably, one of the most widely known methodologies based on systems thinking and the concepts described above is that of Soft Systems Methodology (SSM) which was developed by Peter Checkland (1981) and Brian Wilson. SSM is a methodology which aims to analyse and model complex situations within an organisation to gain a better understanding of the divergent views within that organisation and how they interact. The methodology attempts to understand the *Weltanschauung* or world view that is dominant within that organisation and any problems and conflicts that might be present. This investigation examines areas such as sources of conflict, controlling bodies, organisational departments, lines of communication and the problem areas that come from them. An IS system is viewed not just as a set of hard problems or issues that need to be resolved, but also, as a social system that needs to be understood and adapted to.

To summarise, sections 2.2 and 2.3 have looked at some of the research perspectives that attempt to describe what an IS system is and the types of factors that have been proposed as needing to be investigated. The intention of this has been to show that there are various perspectives that need to be considered in understanding what contributes to a system's success and as such, a wide range of possible factors may need to be examined. In the next section of this thesis, the discussion turns to defining what is meant by the term "IS failure". As the reader will see, the theoretical perspectives outlined above have a direct bearing on what types of entities and factors have been nominated as contributing to what is defined as "IS failure".

2.4 WHAT IS MEANT BY THE TERM "IS FAILURE"?

So far, this thesis has discussed the concept of what is meant by IS failure in terms that are implicit and has, as of yet, not really defined what it is or how it can impact upon the goals of the organisation. The intention of this section is to review some of the theoretical work that has been done on IS failure and provide a clearer definition as to what it is.

2.4.1 Defining IS Failure

As with the concept of IS success, IS failure can best be thought of as a multidimensional construct which is dependent on both technological and social/organisational concerns. Lyytinen and Hirschheim (1987), for instance, as a result of conducting a review of the major literature available at the time, proposed a framework that defined IS failure in terms of four major theoretical classifications: -

- *Correspondence failure* which is defined as the failure of the IS system to meet the expectations that were originally held for it. This type of failure occurs if there is a lack of

correspondence between the initial design expectations and the results of having evaluated the delivered IS system against those expectations.

- *Process failure* which is defined as a failure of the development process to either produce an IS system that works satisfactorily, or produces such a system but overruns the allocated budget in terms of time and cost.

- *Interaction failure* which is defined as a failure of the system that arises because the system is either hardly ever used or has major problems with its usage. This is not so much a definition which focuses on any mismatch between initial expectations and the delivered product, but more on how the delivered system is utilised with regard to those initial expectations.

- Finally, *Expectation failure* which is described by Lyytinen and Hirschheim as being a superset of the other three types of failure. It is the failure of the IS system to meet the expectations that stakeholders originally held for it. Lyytinen broaden this definition in 1988, by making the distinction between development expectation and use expectation. Whereas development expectation is the failure of the IS system to meet the future expectations of stakeholders, use expectation is the failure to meet the current requirements. For development expectation, Lyytinen listed such elements as goals, technology, economy, control and perception of the development process, and organisational impacts as being important contributors to such failures. While for use expectation, elements such as technical and data problems, people's expectations and system's complexity issues rose to the fore.

As can be seen however, these categories give a very open definition as to what constitutes IS failure and has been criticised by others as being too loose and pluralistic (Sauer, 1993). So, in an effort to provide a stricter definition as to what makes a system be deemed a failure, Sauer proposed a more conservative definition. He stated that an IS system should only be regarded as a failure when either the development or the operation of that IS system ceases, leaving the stakeholders in a state of dissatisfaction. In such a way, Sauer defines IS failure more from a *termination failure* perspective, rather than an *expectation* failure perspective, thus giving a much clearer definition of when failure occurs.

Sauer's model also introduces the concepts of *flaws* into how an IS system is developed. Any IS system, according to him, is going to encounter flaws during its development lifecycle, but the presence of such flaws does not necessarily mean that the resulting system is a failure. Any flaw – for instance a bug or inaccurate specification – can

be corrected or accepted at an appropriate cost. A system should only be deemed a failure when the cost of correcting such flaws is so great that it triggers a decision to terminate the project.

Another useful classification of IS failure is the distinction between IS project abandonment and IS failure, proposed by Ewusi-Mensah and Przanyski in 1994. They regarded IS failure as being the failure of a system due to a lack of usage or operational issues, whilst project abandonment was caused by issues arising from within the development/implementation process itself. Building on this distinction, they proposed three separate levels of project abandonment: -

- *Total abandonment* which is the complete termination of all activities within a project prior to IS system delivery,

- *Substantial abandonment* which refers to a significant simplification or reduction of the system from the original specifications prior to IS system delivery, and finally,

- *Partial abandonment* which refers to a reduction in the original scope of the IS project without significant changes to the original specifications prior to delivery.

All these three classifications and models described above define IS failure as arising from factors that are both technical in nature and social/organisational issues within the development process itself. As such, IS failure can be viewed as being an unpredictable phenomena that is chiefly dependent on how stakeholders evaluate a system throughout its entire development and implementation process. This evaluation is dependent on factors that are both tangible in nature, e.g. the costs to fix bugs, and intangible – such as stakeholder expectations. It is also something that can result in either a total abandonment of the IS system or a phased level of abandonment. Within the scope of this research however, the levels of IS failure which are of primary interest are those projects which are either totally abandoned or deemed to be in such a state that they require substantial amounts of rework. The reason for this is based on both Ewusi-Mensah and Przanyski's work which suggests that total abandonment is the most common form of development failure experienced in the US, plus this author's anecdotal experience that IS projects may still be regarded as being "successful" even if they do not fully deliver on all their original specifications.

2.4.2 Scoping the issues that affect IS failure

From examining the models discussed above, it can be seen that the success or failure of an IS project is going to be dependent on factors that are both technical in nature, project specific, stakeholder specific or finally, those which are related to the organisational context. A similar approach was used by Stephen Flowers in 1998 when he was looking to develop an understanding of possible predictors of failure from analysing six well documented cases of IS projects that failed. He proposed three main domains that in his opinion needed to be investigated for those factors that might contribute to IS failure (see figure 2.1 below).

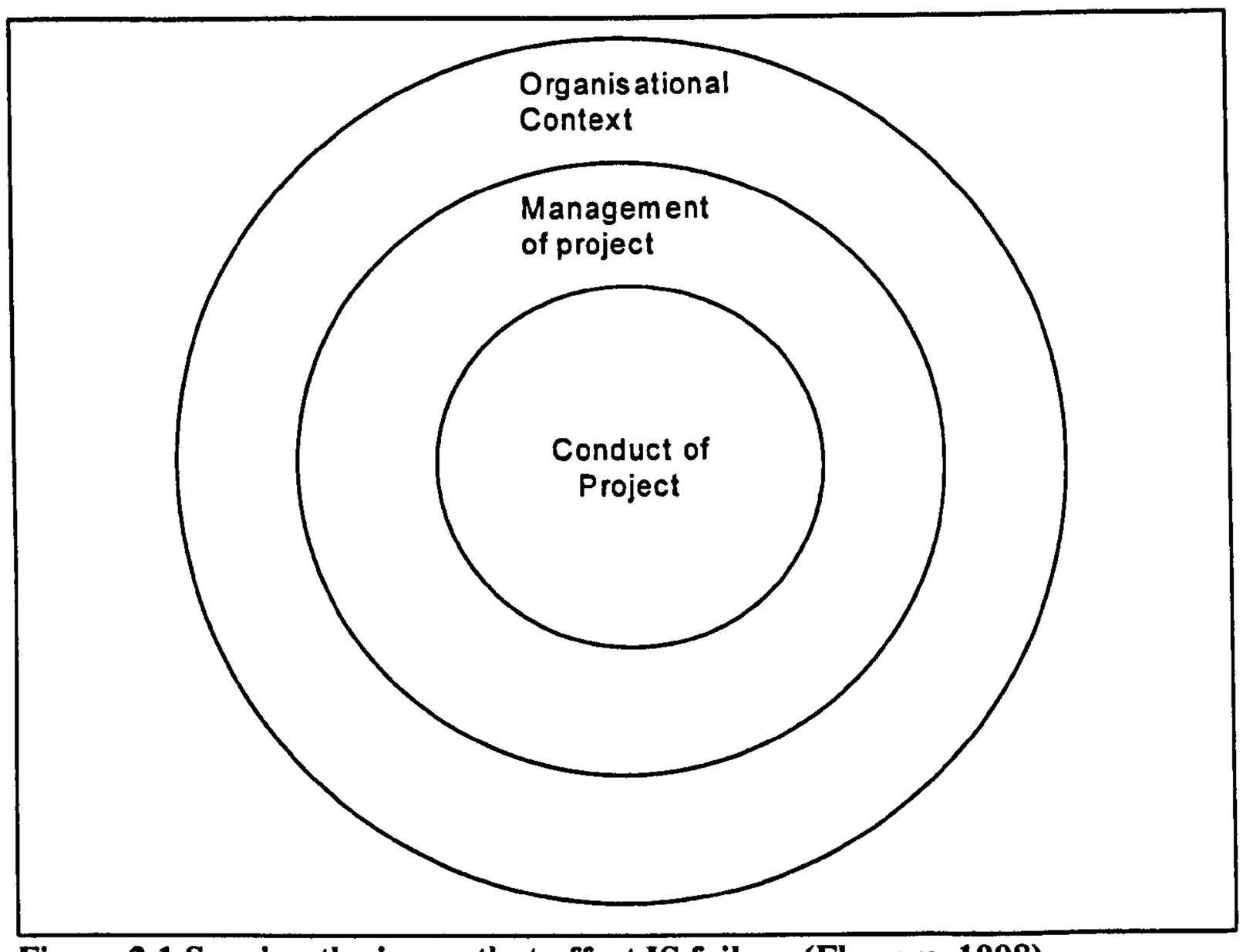

Figure 2.1 Scoping the issues that affect IS failure (Flowers, 1998)

These three domains – conduct of the project, management of the project and organisational context – were intended to scope those features and processes within the organisation that might give rise to IS failure. As a result of his analysis, Flowers identified a number of critical failure factors at each domain which he believed were common to all the case studies that he sampled. At the level of the organisational context, those factors were a fear-based culture and poor reporting structures. At the level of project management, these factors included such things as over-commitment of resources and political pressures. While finally, at the project level, factors listed included too much of a focus on technology, underestimating the project's complexity, shifting requirements, split development sites, project plan slippage, poor consultation, inadequate training and poor testing. In addition, it is interesting to note that in the conclusion of his analysis, Flowers remarked that the main body of the factors that he had

identified were mainly concerned with individual/group behaviour rather than the technology itself, and that the primary causal factor for such failures was due to the organisation being unable to provide a suitable environment in which the IS development process could take place.

Such remarks as these are also in keeping with the results from other similar investigations. For example, McKenzie (1994) in reviewing anecdotal evidence collected in the ACM's Software Engineering Notes, commented that 92% of the failures reported '...seemed to be caused by interactions of technical and cognitive/organisational factors than by technical factors alone'. While, Gregor (1999), reported that in the UK studies seemed to suggest that the problems with IS failure were not so much due to the technology, but rather, with the lack of attention paid to the people who have to use that technology. Such findings suggest that IS failure is mostly caused not by technological problems, but rather, by a lack of attention to the expectations of the stakeholders or problems in the organisational environment itself. Such a conclusion also implies that if stakeholder expectations and environmental context are key contributors to IS failure, then any evaluation process or IS methodology used needs to focus on those areas.

The main intention of this section has been to look at some of the work that has been done on IS failure and start to scope areas that need to be investigated. What has been highlighted is that while failures due to technological problems do happen, the primary unit of analysis that needs to be focused on is stakeholder expectations, organisation/environmental context and lastly, the development process that takes place within that context. Over the course of the next few sections, this scoping of areas that need to be investigated will be further refined and developed. This will be done by examining some of the models that have been proposed to describe IS success and comparing these against the work on IS failure discussed above.

2.4.3 The IT Productivity Paradox – The study into current evaluation practices

Although research into the phenomena known as the "IT productivity paradox" only has partial relevance to this study, it is mentioned here because it helps to highlight some of the problems that need to be considered when pursuing IS success. In a nutshell, the term "IT productivity paradox" refers to the study of the lack of linear relationship between IT investment and an increase in related productivity. It is concerned with investigating why, despite large investments in both IT and IS systems, many organisations do not get a directly related increase in their associated productivity. The reason why this phenomenon has relevance towards this research is that it highlights some of the potential problems that

organisations face when trying to evaluate whether or not their system has met the goals of their investment.

The IT productivity paradox is a term which covers not just IS systems, but IT technology in general, and so, has a much wider scope than is being examined by this research. However, many of the concerns being addressed are still the same. In describing the key issues, Willcocks and Lester (1999) highlight the problems of identifying what it is that organisations need to evaluate and how they go about it. They present the IT productivity paradox more in terms of a problem with evaluation practices, rather than a lack of actual return. This underlying principle has many similarities with the goals of this research. Here, the goals are to develop a framework that can identify the critical elements that need to be considered for delivering a successful system and then, determine how they can be evaluated. Like the IT paradox, the research problem under investigation is essentially one to do with evaluation practices.

In discussing what needs to be assessed with regards to evaluation practices, Tallon et al (1997) highlighted the multidimensional nature of IT business value and suggested that measurements need to include both economic and behavioural perspectives (Willcocks and Lester, 1999). Likewise, Philip Powell (1999) when categorising different types of evaluation practices, commented on how they focused on either objective or subjective factors, making the use of such techniques potentially confusing. Similar remarks were also raised by Ballantine et al in 1996. After investigating evaluation practices in UK companies, they reported that for their sample, identifying and quantifying relevant benefits was an issue for over 81% of their respondents. They also reported that while organisations often have some kind of evaluation practice, for over 53% of those organisations questioned, there were no formally defined evaluation procedures. Comments like these when bought together, highlight the problems that organisations face when trying to evaluate IS projects. The main one being that defining the exact nature of the benefits that a system will bring and trying to quantify them is a problem that many organisations have not yet been able to solve. As such, this raises two main issues that the evaluation framework being developed needs to tackle.

The first of these is that the framework will have to provide a mechanism for capturing and quantifying benefits that are both objective and subjective in nature. Secondly, as the nature of these factors can cover elements ranging from behavioural perspectives to business objectives, the unit of analysis that the framework employs will have to be very diverse in nature. This research therefore, will need to define a framework that can satisfy these two requirements.

2.5 MODELS OF IS "SUCCESS" – THE SEARCH FOR CONTRIBUTING FACTORS

As outlined above the goal of this section is to examine some of the models of IS success that have been proposed by the IS research community over the last 15 years and through these highlight some of the factors that have been viewed as being critical contributors to the success of an IS system. The point of doing this is to compare some of the work that has been done in both areas of IS success and failure and as a result of this, determine a criteria of what factors might need to be investigated as part of an overall evaluation process.

While the models that have been included in this section are by no means a complete list, the ones covered are either widely regarded as being seminal pieces of work or highlight key themes that are crucial to the arguments being presented.

2.5.1 DeLone and McLean – The search for the independent variable

In 1992, authors William DeLone and Ephraim McLean performed a comprehensive literature review of over one hundred research articles from seven of the leading journals in the field of IS studies. The intention of this review was to try and identify the main categories of success factors that other researchers and practitioners were using when they described what constituted a definition of IS success. Although rather dated, this review is perhaps one of the most comprehensive of its kind yet undertaken and is still widely regarded within the IS research community as a valid definition of what factors can contribute to IS success. The study identified a taxonomy of six main variables that researchers/practitioners had used when defining IS success factors (see table 2.2 below). Drawing on this taxonomy, DeLone and McLean went on to propose that IS success could be defined as being a cumulative result of the interactions between these six main variables.

Variable	*Description*
System Quality	Measurements of the information processing system itself. For example, system response times.
Information Quality	Measurements of the quality of the system's output. For example, the format of a report.
Information Use	Measurements of the use of the system's output by the recipient. For example, how often is the output utilised?
User Satisfaction	Measurements of the recipient's response to the output. For example, do they find it useful?
Individual Impact	Measurements of the effect of that information on the recipient. For example, does the information increase their efficiency?
Organisational Impact	Measurements of the effect of that information on the efficiency of the organisation. For example, the profitability of the organisation.

Table 2.2 DeLone and McLean's six variables

This study has however been criticised as being a child of its time and reflects the late 1980s concern for basing IS theory on the flow of information (Cule, 1995). One of the possible impacts of this emphasis is that the variables which DeLone and McLean identified may have been overly biased towards a rational reductionist approach to IS systems known as *Information Engineering* (Martin and Finkelstein, 1981). This approach, as with many others in the rationalist perspective, attempts to analyse the IS system in terms of its processes and structures which, as a result, tends to oversimplify the scope of the problem domain under investigation[14]. This over-simplification can be demonstrated through the use of a simple analogy. DeLone and McLean based their taxonomy of IS success on the principle that information systems were basically a method of communication. They adopted a mathematical theory of communication proposed by Shannon and Weaver (1949) to provide three main steps through which information was produced, analysed and then consumed (see figure 2.2 below).

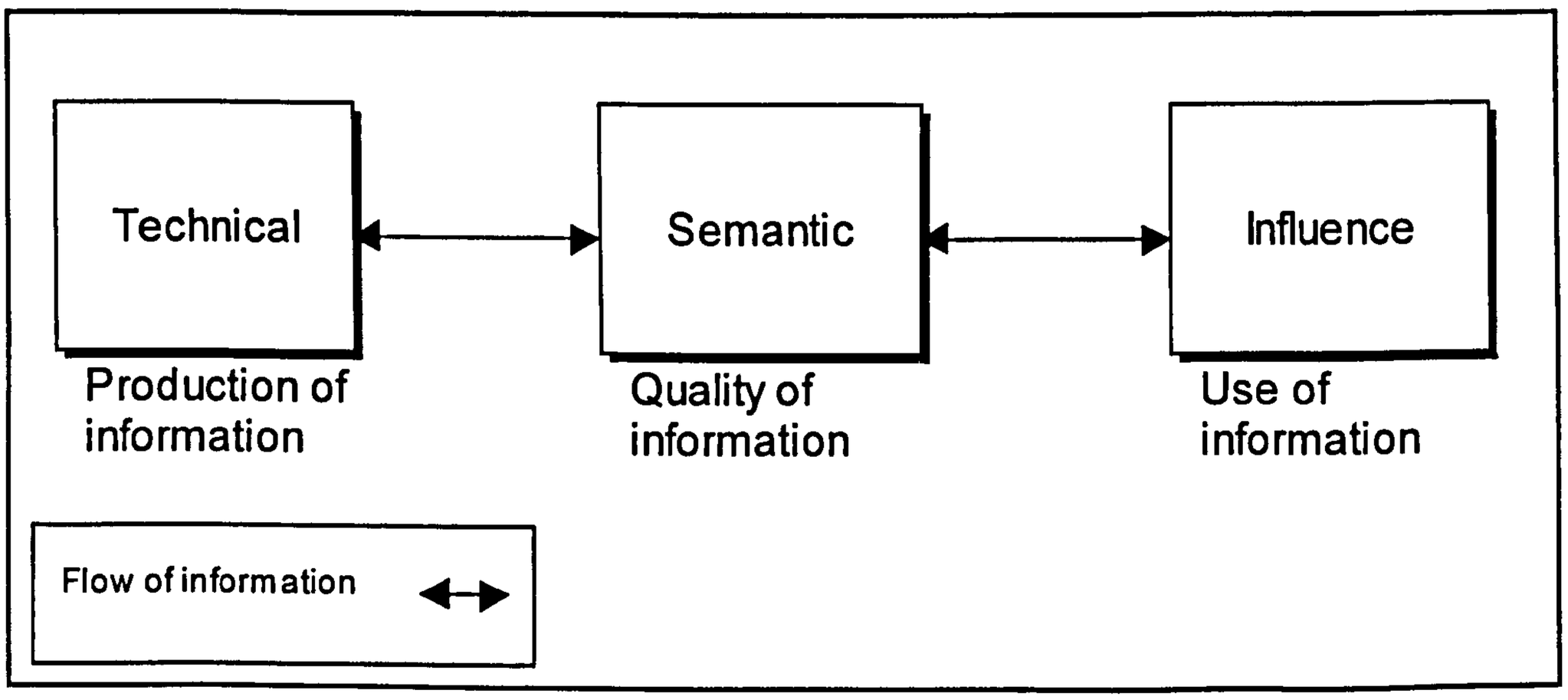

Figure 2.2 Communication Theory (Shannon and Weaver, 1947)

Using this theory as a base, DeLone and McLean associated their six variables to each of the three stages within this model (see figure 2.3 below). However, in performing this association DeLone and McLean only related one variable, information quality, to the semantic category. In addition to this, the measurements that they discussed to evaluate this variable was stated more in terms of the lexical construction of the information, rather than with how the information was actually being interpreted by the end consumer. By doing this, the resulting model opens itself up to the criticism that it is focused too much on how information is being

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[14] See section 2.0 for more information.

produced and consumed, potentially underestimating the role that the semantic context (and environment) has in bringing meaning to this information. In other words, the model is overly concerned with the information itself rather than the environment which gives that information meaning. It is primarily because of this overemphasis that the variables identified by DeLone and McLean could be argued as only representing an incomplete picture of success factors as derived primarily from a rationalist's perspective.

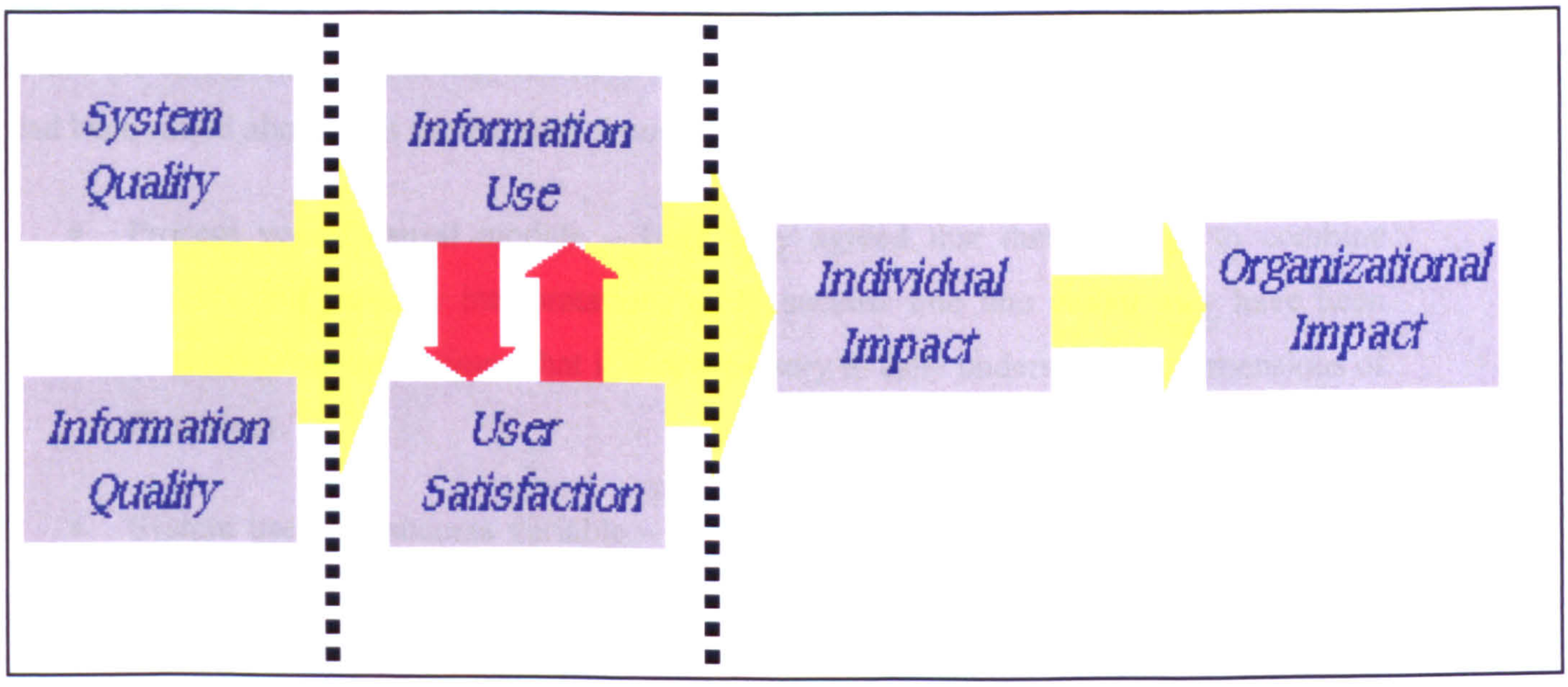

Figure 2.3 DeLone and McLean's IS success model (DeLone and McLean, 1992)

Although a further review of their work undertaken by Cule in 1995 suggested that the IS research community has identified two further variables - strategic impacts and contribution to the organisation's bottom line performance – the concern raised above about the lack of consideration given to the environmental context still remains.

Another criticism of this model that has been made is the implied causality of the relationship between the variables *information use* and *user satisfaction* and the impact that this has on the organisation (Molla and Licker, 2001). While a study made by Seddon and Kiew (1994) produced empirical evidence which seemed to support the relationships between quality and user satisfaction, the linear relationship proposed by DeLone and McLean between user satisfaction and organisational impact excludes the existence of any other intermediate factors (such as those in the environment) which may also affect this performance. By introducing such a linear relationship, DeLone and McLean are implying that any system which has a good user satisfaction rating will automatically lead to an increase in organisational performance which is a dangerous assumption to make. While this researcher agrees that a system which generates a high level of user satisfaction may well overcome some types of IS failure, e.g. expectation failure, this does not necessarily mean that the system will automatically be successful. It could, for example, still fail because it does not functionally perform the job it was required to do. It is important to keep in mind

that while user satisfaction may be an important part in any success model, it is not the only part.

In 2003, DeLone and McLean released an update to their model that incorporated changes that had occurred in the IS research community since their original paper was published in 1992. In this update, DeLone and McLean summarised the uses that their model had been put to over the last 10 years, their responses to the criticisms that had been made of it and the enhancements that they felt needed to be made. When reviewing the criticisms that had been raised about their model, they focused on the following:-

- Process verses causal models – Here they agreed that their attempt to combine process and variance interpretations of IS success into one model may have been confusing, but they argued that it was necessary to fully understand the dimensions of IS success.

- System use as a success variable – They continued to argue that system use was a valid measurement of IS success and not something that influences IS success. Building on this argument, they also updated the original variable – "*information use*"- to become "*intention to use*" and "*use*" instead. This was done to reflect the increasing use of voluntary IS systems, especially in the e-commerce market.

- Role of Context – Here they agreed with comments that the model was difficult to apply in research contexts. They argued however that this was to be expected as they had said that their original model needed further development.

- Independent verses dependent variables – Here they argued that many of the additional variables that had been suggested by researchers - such as "user involvement" - were not variables that are *part* of success, but instead, variables that could *cause* success and as such, different types of variables. They re-iterate that researchers needed to be clear on the difference.

When discussing possible extensions to their model, DeLone and McLean focused on a number of main points. The first of these was the definition of quality. Given the types of changes that have occurred to IS systems since 1992, DeLone and McLean agreed with other researchers that *service quality* – as a measurement of the quality of service that an IS system is providing to its users – should be included as a new dimension of success. This change is intended to reflect the voluntary nature of IS systems such as e-commerce. The second was a change to the definition of the "impacts" that an IS system can have. As the scope of possible impacts that a system may have is much wider than just to the individual or organisation,

DeLone and McLean expanded the definition of impacts to become "*net benefits*". This new variable was intended to capture any benefits – positive or negative – that the system may have on the environment as a whole. All these updates were then reflected into the modified model shown below.

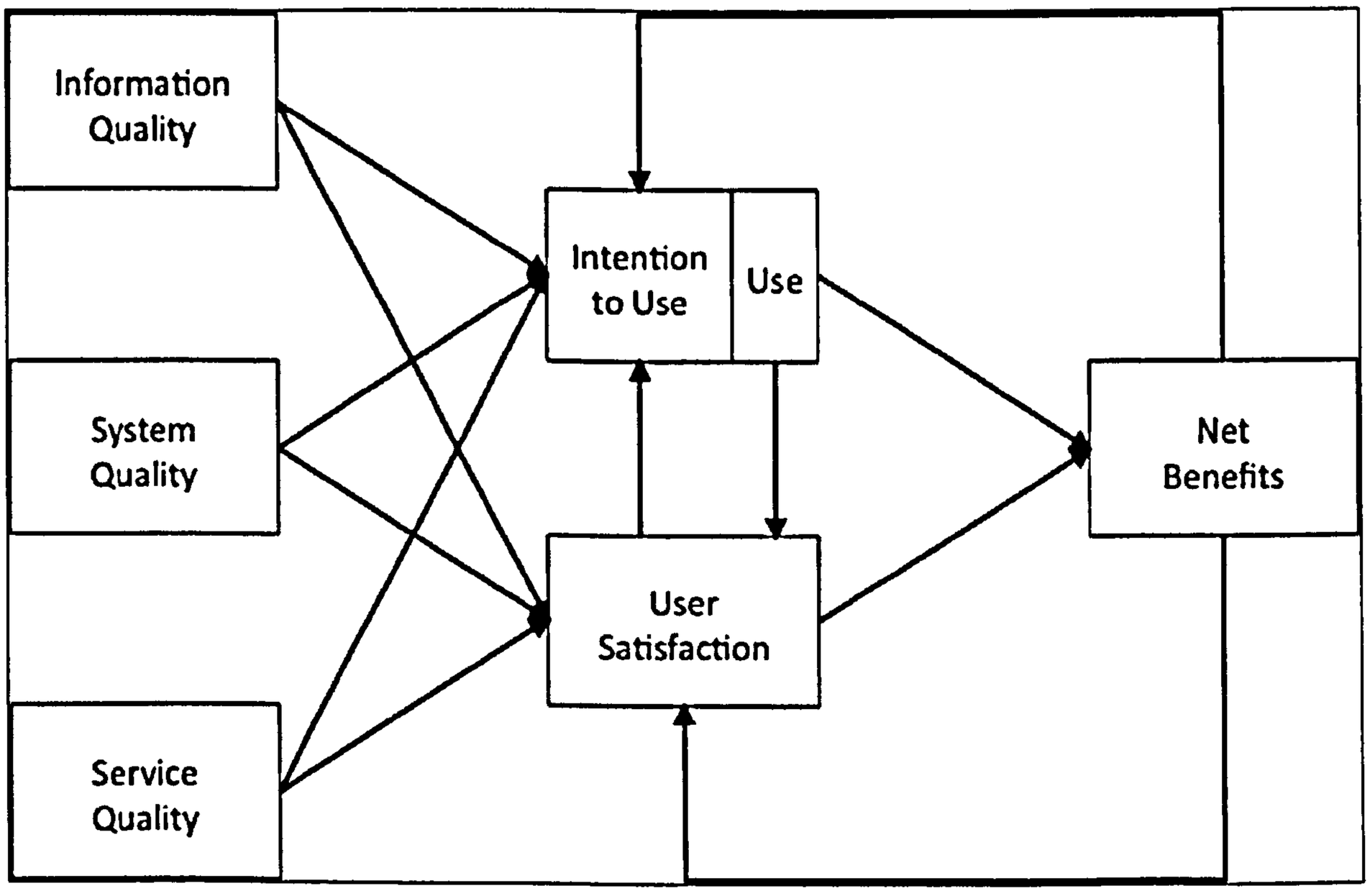

Figure 2.4 DeLone and McLean's IS updated success model (DeLone and McLean, 2003)

When summarising their updated model, DeLone and McLean stated that the changes they made "...are largely changed in degree, not in kind." (DeLone and McLean, 2003). As such, the fundamental nature of the model is the same, but the focus of the variables and the interactions between them has been modified. This shift was made to enable the model to better support e-commerce systems and the increasing importance of service quality.

On the whole, this updated model still does not address many of the original concerns that were raised and while it is a useful reference point, it cannot be seen as a definitive answer to what makes an IS system successful.

2.5.2 User Satisfaction Metrics – Are they the answer?

When considering what organisations might regard as being a "successful" system, it is worth mentioning the role that customer satisfaction metrics like American Customer Satisfaction Index (ACSI) and European Customer Satisfaction Index (ECSI) could have. Any firm or organisation considering how to define a "successful" system could not be blamed for looking at already existing measurements of customer satisfaction and using these as a basis for determining what factors might be vital contributors to that success. E-commerce systems for

example, which rely on a "satisfied" customer experience for repeat purchases, would seem to be an ideal candidate for such measurements. As commented on above however, user satisfaction - while being a fundamental part of any system's success (Seddon and Kiew, 1994) - cannot be regarded as being the only factor that may need to be investigated.

In terms of evaluation, such metrics as the ACSI are only useful in scrutinising the expectations of users against what an IS system actually delivers and while this may help combat the risk of expectation failure, it does nothing to address problems that may arise in other critical areas. As was stated by Sauer (1993), all IS systems are the result of a development *process* which can generate flaws at any stage during that process. Satisfaction metrics therefore, even if applied at various critical stages during the development process, are only measuring one partial aspect of that process leaving other areas unmonitored. For example, such metrics would be unable to identify or evaluate any issues that arose from the actual IS development process itself, or indeed, any political issues such as those highlighted by Farbey et al in 1994. So, while user satisfaction metrics could be useful in evaluating one important aspect of IS success, by itself it is not enough.

2.5.3 Scott-Morton's Model of Strategic Fit

When considering what organisations might regard as being a "successful" system, it is worth looking at a model developed by Scott Morton in 1991 that was devised to help organisations audit the 'fit' between the IT/IS policies that they were pursuing and their overall strategic goals (see figure 2.5 below).

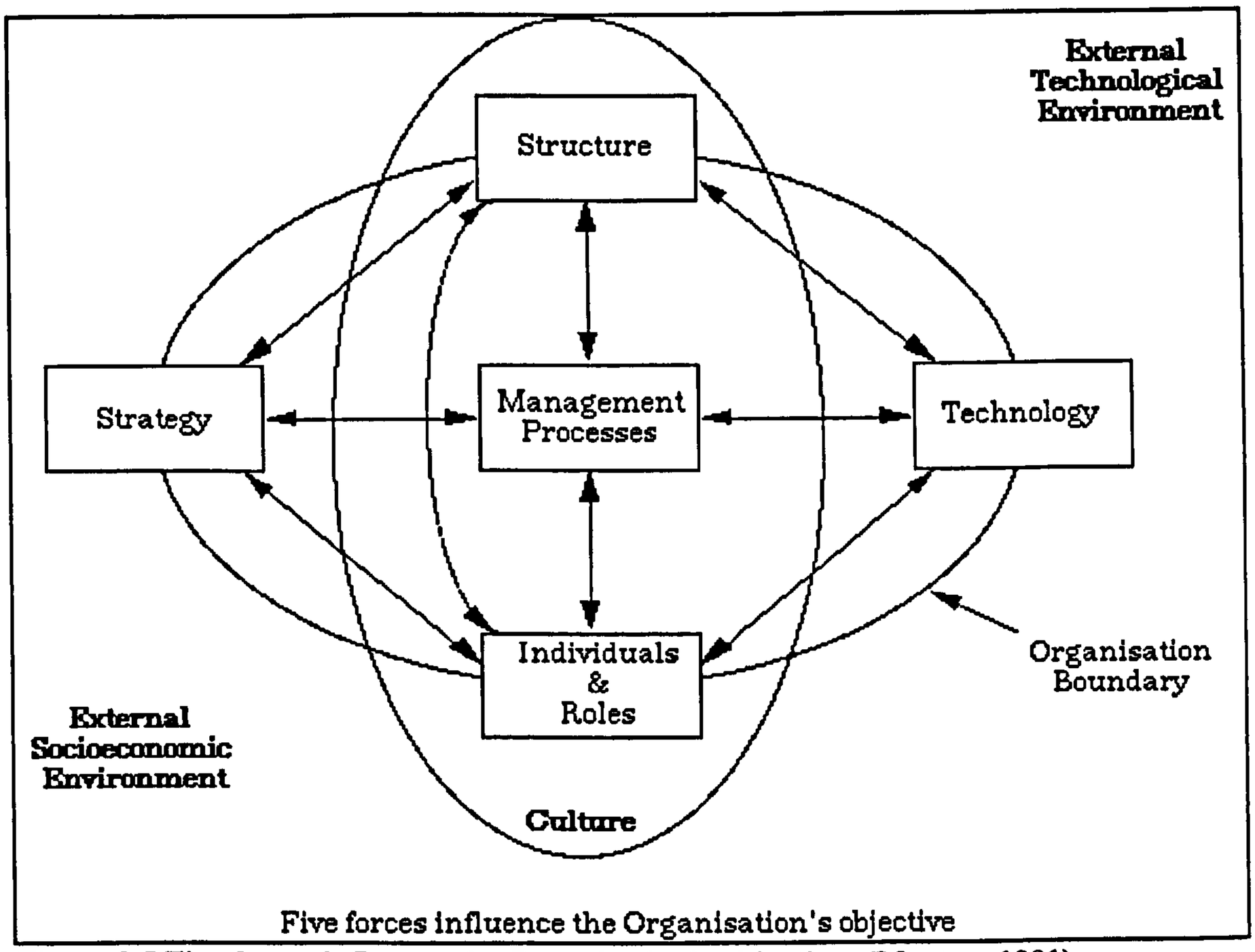

Figure 2.5 Five forces influence the Organisation's objectives (Morton, 1991)

This model is worthy of study because it identifies a number of key areas that could be important contributors to the success of an IS system and thus forms a basis for defining what generic factors might need to be evaluated. This model has already been used by a number of researchers to define at a high level those functional areas that might need to be evaluated when looking at IT/IS systems, e.g. Farbey et al 1994, and so is worth discussing in the context of this research.

This model discusses how five key forces influence the strategic direction that an organisation will take and aims to help evaluate the fit between these five forces and the IT policies that an organisation is pursuing. The usefulness of this model to this research is that it helps to scope those areas within the organisation which will form the basis for the questioning framework that this thesis is pursuing. The five forces that Morton proposed can be favourably compared with the three domains that were identified previously in section 2.4.2, and helps provide a sounder theoretical base for those areas which the final framework will need to address. In addition, Morton's model is far more specific about what the interactions between these key organisational areas are, and thus, provides an indication of a possible hierarchy of importance between these areas.

In both Scott Morton's model and the three domains proposed in section 2.4.2, the process or conduct of how a project is undertaken is a central area that heavily influences the other business areas and domains identified (see figure 2.1 and 2.5). This in turn implies that

how a project is managed and the processes that are used to deliver a system are both vital areas that need to be monitored. This same assumption also seems to be supported by Sauer, Lyytinen and Hirschheim in the importance that they place on the development process when categorising IS failure. These points lead to the conclusion that the management of such processes is the most crucial area in terms of evaluation. The next areas of criticality however are less clear. In Scott Morton's model, there is no clearly defined hierarchy that could be used to help suggest areas vital to IS success. To find these, it is necessary to return to examining some of the definitions of IS failure previously discussed.

In the work done on IS failure, the importance of meeting stakeholder expectations is viewed as being an important area where IS systems may fail. These categories of failure have been stated in terms of usage expectations and development expectations. However, by looking at these two types of expectations in another way, it could also be said that this classification can be split into tactical expectations, i.e. those expectations based on current known requirements, and strategic expectations, i.e. those expectations relating to the future or directional goals of the organisation. Taking this approach it is possible to say that in many ways the expectations of stakeholders could be redefined as being the strategic impact that the IS system in question will have on the organisation. After all, an IS system is generally initiated to support either a tactical or strategic direction that the organisation wishes to go, and thus, stakeholder expectations and strategic expectations could be said to have many common elements. This is not to say that they are one and the same, just that in practice many of the expectations that stakeholders have of a system can also be defined in terms of strategic expectations, and thus in terms of Scott Morton's model could be encompassed by this factor.

As for the roles that individuals have in the organisation and the structure of the organisation itself, these could be defined in terms of the impact that the organisational context has on the success of the system. In figure 2.6 above, these two factors are already directly linked with each other and categorised with management processes as defining the culture of the organisation. This grouping of factors links quite readily with the concept of the organisational context as proposed by Flowers in figure 2.1. The organisational context defines the environment, procedures and structures within an organisation that influence a development process. As such, it is an all-encompassing domain that will affect any IS project within that organisation. The last factor in Morton's model is the area of technology. The relevance of this area to evaluating IS success is obvious and can be linked directly to the failure of a system due to the technology that was employed. This proposed hierarchical breakdown is summarised in table 2.3 below and forms the basis for those areas that an evaluation process needs to cover. While the linkages made in this table are not perfect, they

are intended to bring together in a meaningful way some of the points that have been made in this chapter so far.

Organisational Area	*Possible Priority*	*Related to which models or failure definitions*	*Description*
Project Management	1	• Referred to as "Management Processes" within Morton's model • Referred to as "conduct of the project" and "management of project" by Flowers • Related to "Process failure" and "Project abandonment" in categories of IS failure	The processes and management strategies that are directly related to the development and/or running of the IS project.
Stakeholder Expectations	2	• Related to "Strategy" within Morton's model • Related to "conduct of the project" in Flower's model • Referred to as "Use expectation" and "development expectation" in categories of IS failure, also as "correspondence failure"	The expectations – both future and present – that stakeholders have regarding what a system is supposed to deliver
Organisation Context	3	• Referred to as "Structure", "Individuals", "Roles" and "Management processing" within Morton's model • Referred to as "management of project" and "organisation context" by Flowers	The management and organisational context within which the IS project operates. Does not specifically refer to the management of the IS project itself, but rather the organisational structures
Technology	4	• Referred to as "Technology" within Morton's model • Related to "interaction failure" in categories of IS failure	The technology used to implement an IS system

Table 2.3 Examining those areas that may need to be evaluated

To summarise, unlike the other models discussed in this section, Scott Morton's model was not specifically designed with the intention of identifying factors that influence IS success. It is a more generic model aimed at proposing what forces may need to be investigated when trying to determine what factors might influence an organisation's strategy. As such, it is for the most part too generalised to be considered as an IS success model, it does however, present a useful basis for scoping those areas that might need to be examined for success factors. As has been discussed above, it is possible to draw linkages between categories of IS failure and the forces identified by Morton. In looking at these linkages, this section has put forward possible priorities that could be used for those forces. These priorities are primarily based on categories of IS failure identified in section 2.4. Of these, the

management and conduct of the IS development process appears to be the area that needs most attention. This is based on the assumption that the role of the IS development process is critical to the realisation of any IS system, and as such, will need to be the one most carefully monitored. The other priorities in descending order are strategy, individual roles, organisational structure and technology. As with the management of processes, these priorities have been assigned based on the discussions of IS failure above. The strategic area identified by Morton has been equivocated to those use or developmental expectations that stakeholders may have of the IS system. So, to conclude, Morton's model, while not explicitly developed to look at IS systems success, does provide a useful guide in identifying areas that might be candidates for further investigating when considering what entities or factors may be critical to success.

2.5.4 Delivering Success through Benefits Management

Benefits management - as an approach to delivering positive outcomes to IT/IS investments - was developed by John Ward and Elizabeth Daniel in 2005 as a possible framework for aligning the strategic business needs of the organisation, the benefits that are expected from them and the technology that is used to deliver those benefits. It is a framework that was developed to help counter the issues which the authors believed came from poor benefits management. They postulated that investments were not delivering what was expected of them because of factors such as misalignments between the uses of IT/IS and business strategy, poor benefits planning/identification and inappropriate investment decisions. If the benefits that were expected from an IS system were better identified and planned for, then they argued that the outcomes from those investments would have a better chance of being realised.

To better help manage this process, the authors proposed a framework known as Benefits Management. This framework proposes a number of key stages that can aid with the identification and execution of plans to better obtain the benefits intended from an investment. The key stages for this framework are as follows: -

- *Identifying and structuring the benefits* – This stage is concerned with analysing any perceived benefits that might be obtained from an investment and determining if that investment meets the business drivers of the organisation, It is also concerned with: -
    - establishing owners of perceived benefits and methods for measuring them,
    - understanding the business changes that might be needed to release those benefits,

- identifying any stakeholder or organisational issues that might hinder the overall process and finally,

- to use this information to produce an outline business case or stop the investment before it proceeds.

The goal of this stage is to determine the feasibility of the benefits obtained from an investment and understand at a high-level, any impacts on the business.

- *Planning benefits realisation* – This stage is concerned with analysing the planned benefits in more detail and understanding how they will be achieved and who will own them. The goal is to identify the risks, ownership, action plans and measurements associated with the realisation of any proposed benefits. In this way, the progress to achieving the planned benefits can be monitored as planned changes are executed.

- *Executing the benefits plan* – This stage is concerned with the execution, monitoring and correction of any plans made to achieve the proposed benefits.

- *Reviewing and evaluating the results* – This final stage is concerned with performing retrospectives when a project is complete and determining which of the planned benefits were realised, and if not, why? The goal is to learn from any issues that might have been encountered and improve on the process going forward. This retrospective is also used to identify any unexpected benefits that might have been obtained from the investment and capture these for future use.

The focus of the benefits management process is to improve the identification of realistic benefits that might be obtained from an investment and ensure that any actions or decisions that are made over the lifespan of that investment focuses on obtaining those benefits. It is not intended as a replacement for other methodologies, but rather, to work in conjunction with them to keep the focus on the benefits. The primary areas that this approach is intended to work with are strategic planning, program management, investment appraisal, risk management, project management, system development and change management.

In the context of this research, benefits management is mentioned as a success model because it is an example of an approach that has tried to integrate elements from strategic planning, financial management, change management, project management and development methodologies in an attempt to deliver successful IS/IT systems. As such, it shows areas that are worth considering for the success package.

2.5.5 Extensions to DeLone and McLean's Model of IS success

Although DeLone and McLean's model of IS success is regarded as being one of the more complete and better know models (Ballantine et al, 1998), it has been extended by a number of researchers to include different variables and/or a different emphasis on the variables already identified. The role of this section is to discuss some of these extensions and draw from them possible factors that might be necessary to evaluate.

- **Clarifying the Definition of "User Satisfaction"**

One of the outstanding issues with DeLone and McLean's model, as commented on previously, is the link that has been drawn between the level of user satisfaction and the effectiveness/success of that IS system (see figure 2.3). While user satisfaction may often have been used as a surrogate metric for the effectiveness of a system, there is no clear theoretical link that exists to relate these two variables together (Woodroof and Kasper, 1998; Melone, 1990; Klenke, 1992; Barki and Hartwick, 1994). In addition, the number of measurements and instruments that have been proposed as evaluating user satisfaction are often so conflicting and varied that there seems to be a lack of consensus on both how user satisfaction such be measured or even, what "user satisfaction" actually means. Until such a consensus is reached the link between how a user "feels" about a system and what this means with regards to the effectiveness of that system will remain unclear. As user satisfaction is one of the most widely used measurements of IS success (Myers et al, 1998), a much richer conceptual foundation for user satisfaction has been called for by a number of IS researchers (Woodroof and Kasper, 1998; Melone, 1990). In an attempt to help clarify this issue, Garrity and Sanders (1995) proposed an extension to the basic DeLone and McLean model that attempted to provide a much more stable definition for the concept of "satisfaction" than had previously been undertaken.

Garrity and Sanders proposed the introduction of four new variables which they believed would refine the notions of systems quality and information quality in relation to "satisfaction". These new variables were based on two specific viewpoints of the organisation. The first, which was termed the *organisational system*, looked at the organisation in terms of the tasks and processes that it undertook or in other words, a rationalist's perspective. Using this viewpoint, Garrity and Sanders proposed three different dimensions of IS success that would aid in refining the definition of satisfaction from a task or process based perspective. These dimensions were

- *Task support satisfaction* which represents the fit between the job description that a user undertakes and how an IS system helps supports this,

- *Interface satisfaction* which evaluates the quality of the IS system interface, and includes such elements as presentation, efficiency, format and language, and finally,

- *Decision making satisfaction* which evaluates how well the IS system supports the decision and problem solving aspects of the user's job. Figure 2.6 below demonstrates the interaction of these variables.

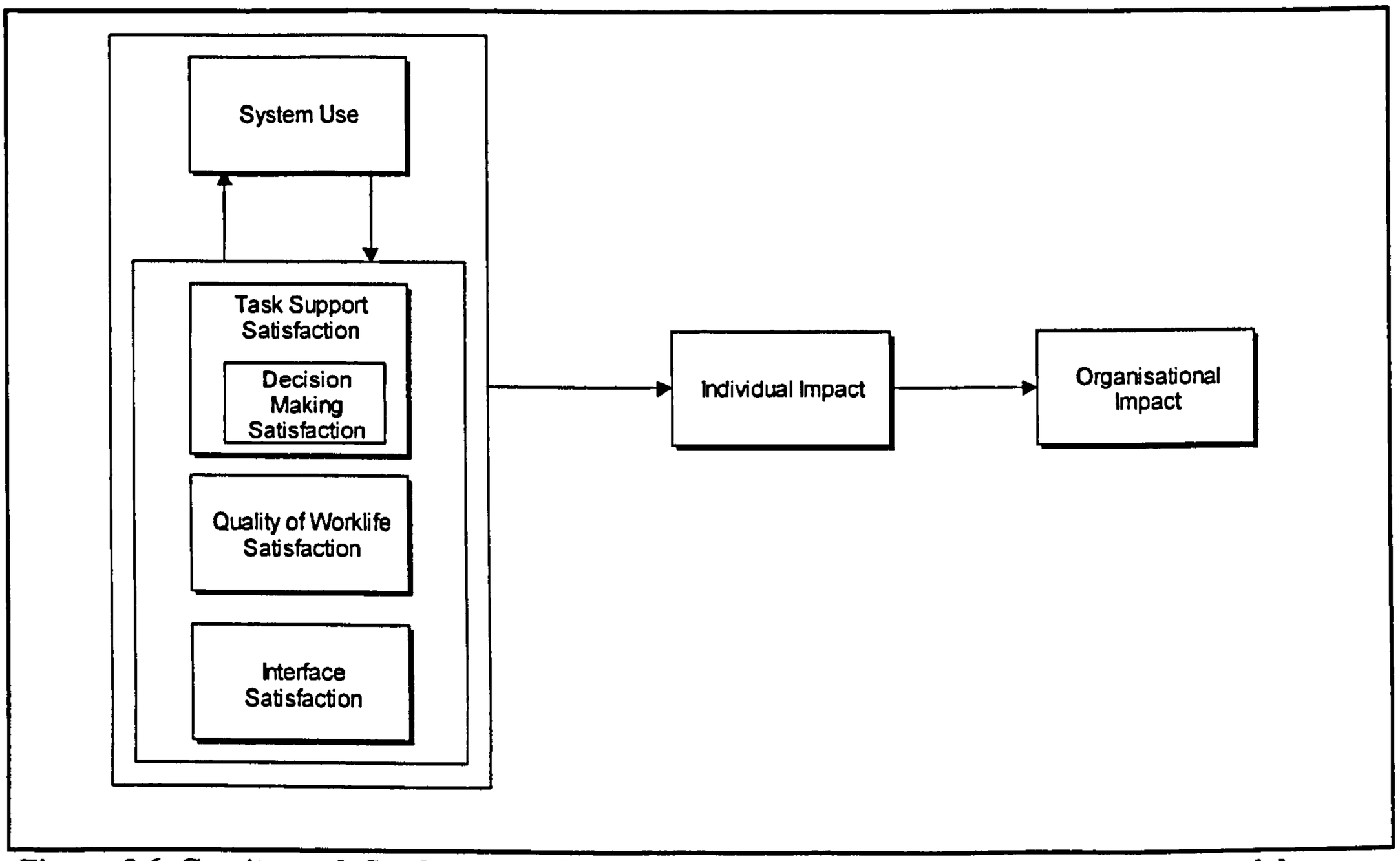

Figure 2.6 Garrity and Sanders modification of DeLone and McLean's IS success model (Garrity and Sanders, 1995)

The second viewpoint, which was termed as the *socio-technical system* perspective, was defined to include both the task and process view of the organisation, but in addition, to also include the human element. Or in other words, the notion that individuals and groups within the organisation have their own intrinsic and cognitive needs which may conflict with those of the organisation. This perspective gave rise to an additional dimension of satisfaction which was called *quality of worklife satisfaction*. This dimension was intended to evaluate how well the system supports the social and cognitive needs of the user in relation to their job requirements. With regards to the models of IS failure discussed above, these enhanced dimensions of user satisfaction could provide a clearer way of evaluating certain aspects of stakeholder expectations. However, while this model has had some initial validation work undertaken by Garrity and Sanders themselves, it is still to be seen if these extensions will attract support from the IS research community. In terms of this research, these extensions

only highlight the fact that an IS system needs to be evaluated both in terms of the functions that it performs and also, in the attitudes of the stakeholders it is supposed to be serving.

- **Defining DeLone and McLean's Model for E-commerce**

Over the last decade, the importance of e-commerce to organisations and the impact that this has had on IS research has been steadily growing, and despite slumps in the use of e-commerce systems, the impacts on IS success still needs to be examined. In a paper by Molla and Licker (2001), the question of what exactly makes an e-commerce system successful gave rise to an attempt to extend and re-specify DeLone and McLean's model with reference to the specific nature of e-commerce systems. This new model was based around the increased focus on customer satisfaction[15] that is now regarded as the most widely used dependent variable in e-commerce literature (Molla and Licker, 2001). This new model (see figure 2.7 below) differs from DeLone and McLean's model in the following respects: -

- The variables *System* and *Information Quality* are replaced by the variables *E-commerce system* and *Content Quality* with the intention of emphasising the importance that web-site consistency has as contributors to the eventual success of the e-commerce system.

- The variable *user satisfaction* is replaced by the variable *Customer E-commerce satisfaction*. This new variable emphasises the restricted definition of users that Molla and Licker have with regard to e-commerce users. They argue that such users are a specific subset of the more common form of end-user in that the goals and needs of such users are much more simplified.

- Finally, two new variables - *trust* and *service* – that are introduced to capture the repeat transactional and customer services components of e-commerce.

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[15] as defined by system use and user satisfaction

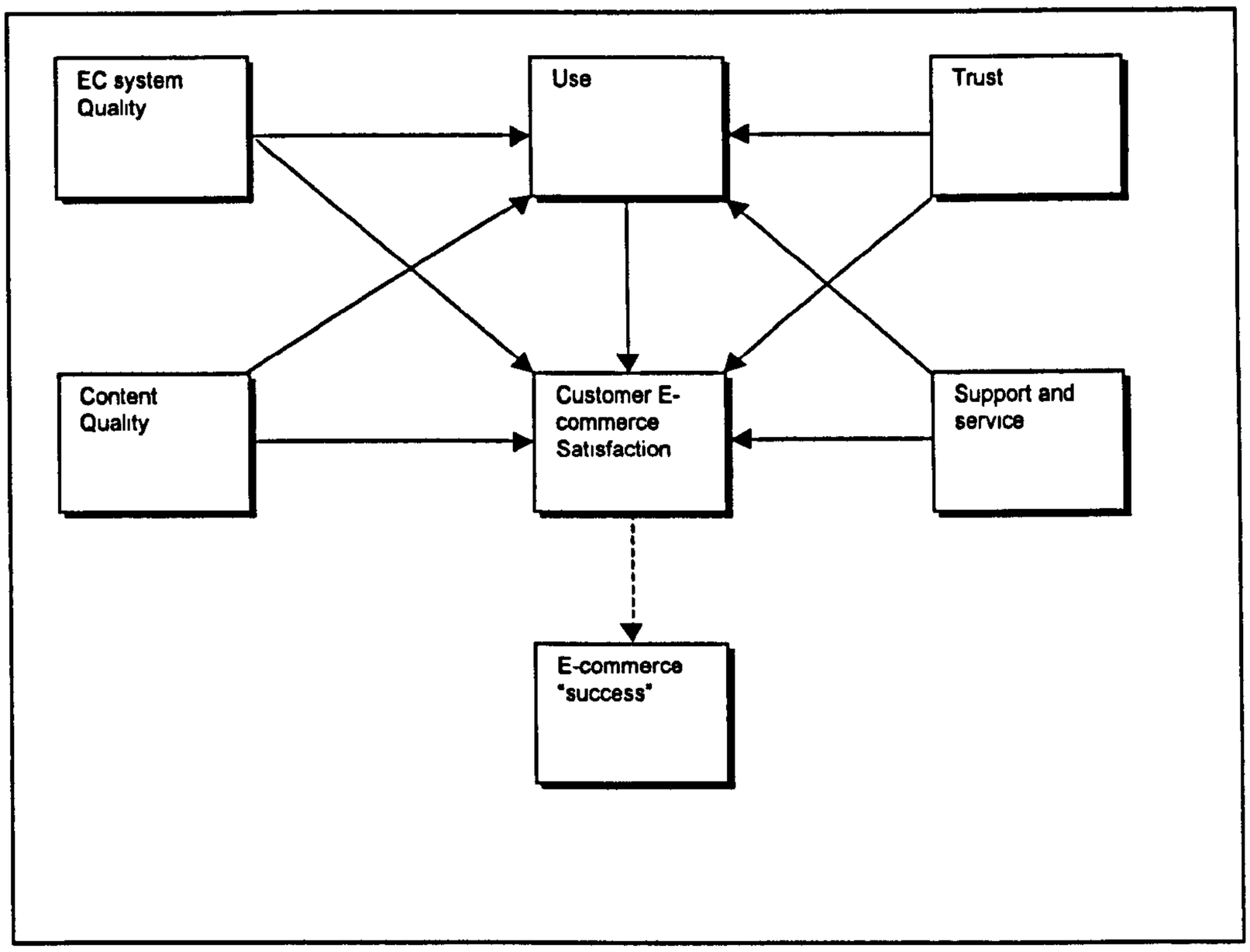

Figure 2.7 Molla and Licker's Model for E-commerce (Molla and Licker, 2001)

When comparing this model of IS success against those types of IS failure described above, this model could be said to only be evaluating factors that might lead to either interaction failure or expectation failure. However, because e-commerce systems are so dependent on the reliability and quality of their interfaces for customer satisfaction, then such an emphasis is understandable.

To summarise, the goal of this section has been to examine sample works that have been done building on DeLone and McLean's model in an effort to identify areas where the original model may have been be lacking with regards to more up to date IS systems. What has been identified are a number of potential weaknesses above and beyond those previously discussed in section 2.5.1 that may need to be further addressed.

2.5.6 Critical Success Factor(s)

While it is debatable whether or not critical success factor (CSF) analysis is really suitable to be described as an IS success model, it is included here because it is a useful way of specifically identifying those key factors which stakeholders believe are critical to the success of an IS system. The CSF approach was originally conceived by Rockart (1979) as a method for determining the key information needs of top business executives within an organisation. It was designed to allow the identification of not only just the needs of such executives, but also the social actors that would be key in order to deliver on those needs. As such, it is generally regarded as being an acceptable top-down approach to a planning methodology

(Bryers and Blume, 1994). However, the CSF concept has also been applied by a number of researchers to identify lists of 'generic' critical success factors that can be applied to any IS development process (Naddhakumar, 1996; Sumner and Ryan, 1994), and thus is being used in much the same way as other success models listed above.

These researchers identified two levels at which CSF(s) can be used. The first are 'critical core' CSFs (Pollalis and Frieze, 1993) which are viewed as being applicable across all IS developments. These CSFs are generic in nature and can be generalised to any IS development an organisation is undertaking. The second level refers to project-specific CSFs (Rockart, 1982; Williams and Ramaprasad, 1996) which can be applied either: -

- to a specific IS development project,

- or aggregated across the entire organisation to identify a set of CSFs which - while specific to that organisational context - can be generalised to any IS development undertaken within the scope of that organisation (see Barat, 1992).

One example set of 'critical core' CSFs (see table 2.4 below) was developed by Butler and Fitzgerald (1999) based on a study into four IS development projects within Telecom Eireann. By conducting a meta-analysis on the CSFs identified, they were able to construct a list of critical factors which potentially could have been applied to any IS development project within that organisation.

Rank	*CSF for the ISD process*	*Process*
1	Low level user representation/participation at all stages of the development process.	Development process
2	Project estimation, planning, tracking to agreed targets, co-ordination and control of project activities.	Development process
3	Obtaining an appropriate level of vendor support.	External Environment
4	Spend adequate time on end-user requirement analysis.	Development process
5	The use of prototyping techniques/case tools to determine and refine user requirements.	Development process
6	Ensuring that business client/end-user industrial relationships (IR)/change management issues related to the ISD process and product are resolved.	Organisational Environment
7	Having a committed project sponsor.	Organisational Environment
8	The availability of structured methods and supporting case tool environments.	IS Function Environment
9	Overcoming project technical obstacles.	Development process

Table 2.4 Examples of Critical Success Factors (Butler and Fitzgerald, 1999)

Similarly, another study by Kremer and Lucas (1991) which focused on the development of strategic IS systems, identified factors such as *recognising and sizing on opportunities, cost justification, need for a sponsor, marketing the application, building on existing infra-structure* and *possessing a customer orientated view.*

One of the advantages of CSF analysis is that it can be used to identify factors that are outside of the constraints of any predetermined methodology and thus can potentially be used to counter all the identified categories of IS failure. The problem with this approach however, is that the factors identified are entirely subjective in nature and run the risk of reflecting inappropriate concerns or defining factors that are extremely difficult to evaluate. How, for example, do you evaluate a CSF such as "spending an adequate amount of time on end-user requirement analysis"?

In each of the success models that have been presented so far, there exist validated measurements that have been used by both practitioners and researchers to measure the variables that have been targeted as key contributors to IS success. Measurements, that due to their very nature are generalisable from IS project to project. However, this may not be the

case with some of the CSFs that can be identified. As stated previously, the identification of such success factors is only one part of the process necessary for an adequate evaluation methodology. The presence of a suitable measurement or metric that will allow the organisation to monitor the progress of a specific CSF is also necessary, and will require the organisation to invest time and resources in constructing and validating such a measurement. This investment will have to be undertaken for both 'core-critical' CSFs (if not already done) and also, for those which are project specific. Of course, while the organisation could use surrogate or non-validated measurements, there would be an associated risk that the use of such metrics could affect the accuracy of the results obtained, or even lead to such subversion behaviour as that reported by Farbey et al in chapter 1.

One process methodology that has been proposed for identifying the criticality of business CSFs is known as *Process Quality Management* (PQM) which was presented by Hardaker and Ward in 1987. This methodology proposes a number of steps that have been used by IBM to aid in the identification of business process critical CSFs. It is worth mentioning that this methodology is primarily aimed at supporting high-level strategic business processes, but does help to give some indication on how such a CSF process might be managed. The PQM method has a number of stages which are intended to walk the user through how to identify CSFs, assign them to business processes and define the criticality of such CSFs. These stages are described below.

- *Step 1 – Understanding the mission*

  This step of the process is concerned with aiding the management team develop a clear understanding of the mission statement for the organisation and ensuring that it is correct. Such a statement should be clear, concise and to the point. It should also mention a definition of success. Once the mission statement is accepted, then the team should brainstorm everything that they believe may impact on achieving that success. The resulting list may have 30-50 items, but puts the team in a position to start thinking about CSFs.

- *Step 2 – Spelling out the goals*

  This step is for the team to start identifying the CSFs that they believe are necessary to achieve their stated goal. These CSFs have to be agreed by the whole team and should have a maximum number of about 8. Each of the CSFs agreed must be critical towards success and when taken together be sufficient to deliver upon the mission statement.

Each CSF must also deal with a separate issue and include strategic as well as tactical goals.

- *Step 3 – Find what matters the most*

  The third step is concerned with identifying what must be done for the CSFs to be achieved. This involves listing all the business processes necessary to support the identified CSFs. Each process listed must be critical for an identified CSF and when taken together, must be enough to achieve it. Each process identified must also have an owner who was a member of the team that originally agreed the CSFs, although no member should own more than 3-4 processes. Once the important business processes have been listed, the next step is to prioritise them. This is done by listing the processes and for each CSF and asking the question – *what business processes must be performed especially well for this CSF to be achieved?* Once these processes have been identified, the question – *are these processes sufficient to achieve this CSF?* - must also confirmed. If they are not, then the list must be re-examined.

  This process is repeated for each CSF until at the end the most critical processes are identified by simply summing up the number of CSFs affected by each process. Each process is than given a rating to see how well it is being performed. The most common rating used is A-E, where A is excellent and E is embryonic (just starting). Graphing is then used to display the results – quality of each process is plotted horizontally and the number of CSFs they affect vertically. This can then show the most critical of the processes that need to be monitored.

- *Step 4 – Follow through*

  The last step is to follow through the decisions that have been made and monitor them to ensure that issues with implementation are tracked and solved. The PQM process recommends revisiting the CSFs once a year to ensure that they are still relevant and on track to deliver the mission statement.

The PQM process described above is one CSF methodology primarily aimed at identifying – from the senior executive team – high-level strategic success factors which are absolutely critical for delivering business success. As such, in itself, it is not a wholly suitable process for identifying the types of success factors that an IS system might need to focus on, but does present some ideas about how such a CSF process could be followed. These concepts are discussed later on in this thesis.

The CSF methodology potentially presents an extremely useful tool for capturing those factors which might be considered as being critical to a project's success, but it does have a number of potential issues that need to be carefully considered. The first of these is that due to its subjective nature, the CSF(s) which are identified need to be carefully vetted to ensure that they are appropriate to the project under scrutiny. Secondly, generating suitable metrics for the factors identified may be extremely difficult and time consuming, and as such, difficult to justify. In addition, the specifics of how to go around constructing and validating such measurements are not a straightforward process. For those who are uncertain as to how to perform it, there appears to be very little guidance given in the CSF literature. As will be covered in more detail later on in this chapter, a precise definition of how to construct an appropriate set of CSFs is something which is very much still open to debate. As a result, the CSF concepts, while presenting a useful tool for identifying success factors does need a further degree of structure and process being available before becoming a technique that can be used by itself.

2.5.7 Financial Measures

Financial measurements, such as ROI, are included here because evidence from surveys done into how organisations evaluate IT/IS technology suggests that for a good many businesses cost based measurements are amongst the primary instruments that they use (Hillam and Edwards, 1999; Ballantine et al, 1997; Wong and Behling, 1997 and Owens, 1999; Hochstrasser and Griffiths, 1992). Basically, such financial techniques attempt to estimate the level of financial return that will be given for a fixed level of investment. Such standard financial practices are preferred because they are easy to use and organisations are familiar with them. These techniques are based on standard financial accounting models and utilise rational criteria to evaluate if investing in an IS project is worth the cost. The benefits to an organisation of using such practices is that they are proven, easy to use, give predictable results and are popular. They do however have certain limitations in that they are only able to evaluate certain aspects of an IS system. Financial techniques, such as CBA, cannot address the hidden or social aspects of an IS system, so while such techniques might be useful in evaluating the more obvious criteria of IS success, they cannot evaluate all of them.

2.5.8 Comparing Models of IS Success and Failure

This final section regarding success models looks at comparing and contrasting the models so far discussed with the intention of identifying key areas that may need to be evaluated. To begin with, it is necessary to review some of what has been learnt regarding IS failure. From the categories of IS failure previously described, it can be seen that this phenomena can arise from numerous different areas – including those which are project specific, related to the

organisational context, and also derived from the external environment. Each of these areas can give rise to faults or issues that will accrue as the IS system progresses through its development cycle. These faults can be caused by hardware and software, the processes used to develop that software, the organisational environment which supports those processes and finally, problems meeting stakeholder expectations[10]. This gives a view of IS failure as being a multifaceted construct that potentially grows as the IS system moves down its development process. As such, it can be implied that at a certain point the amount of accumulative "faults" or problems will be such, that the IS system will suffer some sort of abandonment. It can also be implied that if these faults can be identified and corrected early enough, then it is possible to reduce the chances of IS failure occurring.

In contrast to the description of failure, IS success models are attempts to identify those areas or variables which are seen as making a positive contribution to the resulting "success" of an IS system. However, in looking at these success models in comparison with those of IS failure, there are a number of potential issues that arise. The most striking of these is the implied "static" nature of the IS system that these success models seem to portray. Unlike the definitions of IS failure, the success models discussed present IS success as something which is evaluated at one fixed point in time. There is no emphasis on the process that is followed to arrive at that success or the importance that this process can have in contributing to that success. A simple example of this can be seen by looking at the work of Sauer and comparing this to the taxonomy proposed by DeLone and McLean. Sauer, when defining failure, focused on the concept of the gradual accumulation of flaws that would over time lead to a system failing. As such, the importance of the development/implementation process in being able to identify and correct faults before they cause a project to be abandoned takes a prominent place. In contrast, in DeLone and McLean's model (and associated extensions), the factors identified as contributing to IS success are primarily based on the flow of data and user satisfaction. The importance of the development process as the vehicle that is able to deliver that success is not mentioned. This is also true for definitions of success such as financial and user satisfaction metrics.

The definition of stakeholders is also an area of conflict between success and failure models. For some success models, such as those based on DeLone and McLean, the definition of the "stakeholder" is expressed more in terms of an end-user, rather than the looser interpretation which is used in IS failure. This means that in terms of understanding failure, a

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[10] Stakeholders being defined as those both external and internal to the organisation.

stakeholder could be defined as anyone who has an expectation that the system is supposed to be satisfying. In these terms, a stakeholder could be defined as a customer, a project sponsor or even a marketing manager who is expecting the IS system to match the marketing message that has been communicated. However, in terms of the IS success models discussed, this more fluid definition of stakeholders is undermined by the focus on end-users that such success models have.

Apart from these two areas of potential conflict, both success and failure models agree on a number of areas. The first of these is the importance of meeting stakeholder expectations. In terms of what kind of expectations must be met, both types of models identify subjective and objective expectations. In the case of objective expectations, these are focused on the expectation of the system to meet the functional requirements that were held for it. While in the case of subjective expectations, the emphasis that success and failure models pursue is slightly different. For the success models discussed here, the focus is more on satisfying the subjective needs of the end-user, whilst the definition used by failure models is more open-ended and can theoretically, include anything. This open-endedness however is a potential problem. Like a methodology such as CSF, the factors that might be regarded as being important for stakeholder expectation are potentially unscoped and can be completely independent of each other. As such, the criticality of these factors and when they need to be resolved is unknown. The impact of this is that when it comes to monitoring or taking action on such factors, it will be unclear as to the priority of what factors need to be resolved or when.

Besides stakeholder expectation, both success and failure models share a common viewpoint on those areas that can contribute to a system's success. These include the technology that is used to implement a system, the organisational environment, stakeholder expectations and the external environment. Of all the models that have been discussed, the ones that show this most effectively are Scott Morton's model of strategic alignment and Flower's three domains (as shown in table 2.3). These four areas will form the basis of the unit of analysis that will be applied by the framework.

In summary, this discussion has attempted to identify some of the potential gaps that might be seen to exist between definitions of IS failure and success. It has been shown that an IS system can fail due to problems with the development process, problems with the environment used to support that process, problems with the underlying technology itself or finally, problems with meeting the expectations of critical stakeholders. As such, failure itself cannot be attributed to any single cause, but may instead result from many different unique factors. Failure is also not an absolute. A project can still be deemed as "successful" even if it

has not met all the expectations that were originally held for it. IS failure therefore can be viewed as a perceived construct whose contributory factors are dependent on the circumstances and history behind a project.

IS success, like failure, can also be defined as a perceived construct. It too has contributory factors that are both tangible and intangible in nature. However, in trying to determine what these factors are IS success models, such as those discussed above, seem to have removed or under-emphasized, a number of key underlying assumptions that are clearly stated in the definitions of IS failure. The most telling of these is the linear nature of IS system's development. IS failure is clearly stated as being a construct which accumulates over time. As such, there is an implicit understanding that to combat the risk of failure, it is necessary to continually seek out and resolve any potential flaws or mismatches in expectations before they become too costly to fix. This temporal aspect of IS systems is not however so clearly portrayed in success models. Because of this, such success models seem to portray success as a construct that is defined purely at a single point in time, i.e. after the project has been delivered. This in turn implies that unlike failure, the nature of IS success is absolute in that a project is either "successful" or not. The impact of this is that the nature of the success construct portrayed by such theories is static. There is no sense of the gradual, accumulative effect that comes across so well in IS failure and thus the potential of the development process to provide this success is underplayed.

By drawing all the comments made so far regarding IS success and failure together, it is possible to synthesise a number of potential requirements that will need to feature in the evaluation framework that this research is attempting to construct: -

- The framework has to support the linear or temporal nature of IS system's development. It must be able to identify *when* certain factors are critical and incorporate any key stages within the organisation's development process. This could be done by examining a development process and highlighting the main checkpoint stages that take place.

- The definition or scope of the stakeholder is something that goes beyond simply the end-user. As such, when identifying those factors that are deemed critical to success, it is vital that all those who have an expectation of the system be consulted. In addition, it is also necessary to clarify just who the primary stakeholders really are, so that their expectations can be incorporated into any evaluation criteria.

- The factors that need to be identified are both tangible and intangible in nature. They can also reflect purely subjective criteria. As such, these factors may be completely unrelated

to each other and need additional work to place them in context. This context is important because it is only when such factors have been placed at the appropriate stage of the development process that the criticality of those factors becomes clear. Once the critical of a factor is known, then the importance of when and where to evaluate it can also be determined.

The above requirements means that the evaluation framework needs to be able to identify both tangible and subjective factors, place them in a given context and identify who these factors are important to. These requirements will be discussed more in chapter 3, when procedures will be suggested as to how the framework could be operationalised.

The next section builds on the argument that the IS development process is one of the key weapons in fighting IS failure and considers why IS development methodologies – either formal or informal – may not be enough by themselves to fully combat this risk.

2.6 THE ROLE OF IS METHODOLOGIES IN MITIGATING AGAINST IS FAILURE

So far, this chapter has focused on discussing theoretical definitions of IS success and failure, then using these to derive a clearer understanding of what this research needs to do in order to help combat the risk of such failure from occurring. As part of this discussion, an emphasis has been placed on the temporal nature of IS systems and the importance that the development process can have in contributing to IS success. As a result of this, the next logical step is to review the role that IS methodologies have in controlling this process and as part of this review, highlighting any weaknesses that might undermine their effectiveness.

2.6.1 What is the role of an IS methodology?

The purpose of a methodology is to provide a framework by which some of the complexities of the "real world" can be simplified into a specific epistemological viewpoint upon which a number of common assumptions regarding the behaviour of that world can then be based. Utilising these assumptions IS methodologies can then provide tools and techniques for analysing the behaviour of an organisation in terms that are consistent with such epistemological views. As such, an IS methodology can be described as being a set of procedures which carry the implicit promise that any IS system developed using them will, if the procedures are followed closely enough, achieve success. Such methodologies however have been around since the late 1970s and IS systems are still failing – so why is this still the case?

To pretend that there is a simple answer to this question would be wrong. There are many possible reasons why such methodologies might be failing to deliver the successful

systems that they seem to be promising; reasons that could include organisations simply not using them or using them incorrectly. For the purpose of this research however, the specific area under investigation is the issue of 'fit', or in other words, determining if the assumptions beneath a methodology are valid for the organisation where that methodology is being used..

As stated at the beginning of this chapter, the field of IS research has been dominated by the presence of two distinct theoretical perspectives, each of which have fundamental opposing viewpoints as to what IS systems involve. Because of this, numerous different opinions have arisen as to what factors need to be controlled in order to guarantee a successful system. So, while an IS system may be influenced by many different forces both internally and externally to the organisation, each IS methodology is only designed to control a certain subset of all these possible factors. In addition, each methodology will also impose its own specific assumptions about how these factors will interact that may, or may not be, applicable to an organisation. So, when this thesis discusses the concept of 'fit' it is primarily concerned with the ecological validity of such methodologies in terms of the target environment that they are providing a control process for.

The concern that this research has is that IS methodologies which may be used to control development processes could be significantly out of alignment with the actual requirements of an organisation. This could have a significant negative impact on the resulting effectiveness of that methodology to do its work. This is because an IS methodology designed to detect faults based on one set of assumptions will not so readily be able to identify issues that may arise due to circumstances not covered by those assumptions. This means that faults which might have been detected under a different methodology may go uncorrected until it is too late, so increasing the risk of a system failure. Given this argument, it can be seen that while IS methodologies could indeed be of help in reducing the risk of IS failure, they can also introduce a potential bias that could serve to increase that risk, thus giving rise to a need for that methodology to be validated in some form before it is used.

2.6.2 What are the requirements for an effective IS methodology?

Given the assumption that IS methodologies are in place to aid an organisation in mitigating against the risk of IS failure, what are the types of issues that organisations need to consider when examining what sort of methodology to use? As commented on above, the number of methodologies that an organisation could select from are numerous and as such, the organisation faces a baffling choice of possible tools and technologies that they could use. To help give some guidance with this choice, an organisation needs to consider some of the points raised below.

Two of the more important considerations that arose from looking at IS failure were the key roles of the development process and the need to meet stakeholder expectations. While the concept of the development process is fundamental to any IS methodology, the definition of stakeholder that each methodology supports may be very different. This may become an issue because the tools and checkpoints embraced by each methodology are designed to support system requirements based on that methodology's perspective of who is the primary stakeholder. This can become a problem when there are multiple stakeholders who each may have a distinct expectation of what they want that system to provide. In cases such as these unless something is done to identify and capture such expectations, then the IS system runs the risk of failing to satisfy those specific stakeholders. This means that one possible activity an organisation could undertake to help validate the selection of a methodology is to define at a high level who are the principle stakeholders the IS system is being designed for and what it is they expect that system to deliver. Such an activity will help to clarify who the development process should be focusing on and what sort of requirements may be necessary for it to support.

In addition to the definition of stakeholders and ensuring that the development process supports their expectations, the IS success models previously discussed have helped to identify a number of key areas that potentially contribute to a system's success. These are: -

- *how well an IS system supports the task it was designed to accomplish,*
- *how well it fits into the environmental context into which it is being targeted, and finally,*
- *the importance of resolving project and organisational issues which may occur.*

This means that - according to these models - if an IS methodology is going to be effective it needs to support aspects of each of these key areas. In other words, it needs to be able to capture the task(s) that the IS system is being designed to undertake, match the way these tasks are implemented to the language and semantic models used in the target environment, and finally, provide a control mechanism that allows the development process to move smoothly through each identified stage. When also taking into consideration the points raised in the paragraph above, this identifies two fundamental requirements that any IS methodology must aim to satisfy: -

- *To provide a reliable and repeatable process that identifies stakeholder requirements in the context that those requirements occur and allows the constant monitoring of those requirements so that they can be delivered in a controllable and timely fashion.*

- *To provide a mechanism for identifying faults or mismatches in the expectations of stakeholders and allow these to be corrected as soon as possible.*

While at a high level many IS methodologies will meet certain aspects of these requirements, they are restated here to help clarify what this research believes organisations should be looking for in any methodology or evaluation mechanism which they are aiming to use. These requirements are drawn from both the models of success and failure previously examined and represents the principle areas upon which the questioning framework will stand. In light of this, the rest of this chapter deals with how the questioning framework can help meet these objectives. Before that however, this chapter will look at examples of existing evaluation frameworks and consider what they regard as being important to IS and ISD success.

2.6.3 What are examples of existing evaluation frameworks and do they work?

Frameworks that look to evaluate an organisation's development processes are not a new idea. Indeed, a number of example frameworks exist such as the PDA ARC (Process Model for Auditing Suppliers of Computer Products and Services - http://www.pda.org and http://www.auditcenter.com) and CMMI (Capability Maturity Model Integration - http://www.sei.cmu.edu/cmmi/cmmi.html) which are in use today in both government and industrial organisations. However, frameworks such as these exist specifically to evaluate an organisation against a set of predetermined criteria and determine strengths or weakness against those criteria. For example, the PDA ARC audit is a process auditing methodology which is specifically aimed at companies who are involved in the pharmaceutical industry. The purpose of the PDA audit is to focus on areas such as - quality systems, configuration management, project management/planning, methodologies, testing, manufacturing, security, training/education, maintenance and documentation. It asks a set of standard questions to evaluate what level of processes an organisation has in place and determine how rigorously those processes are being followed. The more commonly used CMMI model is similar in nature to the PDA audit, but is more focused on assessing the organisation in terms of the maturity of its processes against a pre-defined set of levels and measures.

The focus of this section will be to concentrate more specifically on the CMMI as an example of an evaluation framework which is already in common use and to compare it against the organisational areas proposed above (see table 2.3) to determine if these areas are consistent with existing auditing frameworks. There are two main reasons for focusing on the CMMI for this purpose. The first of these is that the CMMI model is a much more commonly recognised standard both in academia and the IT industry. Secondly, that it is more open-

ended as an auditing framework than the PDA in that it is driven by the context of the environment in which it is being used. The aim of the CMMI (or to be more precise – the CMMI SE/SW v1.1 – Staged Representation) is to use a set of fairly prescriptive areas to help determine the level of maturity that an organisation's processes are at. The levels of maturity range from 1-5 and are meant to describe the repeatability of a process and the number of process areas that are covered by the standards of an organisation. In brief, these maturity levels are as follows: -

1. Initial

At this level, the model views organisational processes as usually being ad-hoc and chaotic with success in projects being driven most by "heroics" rather than proven processes.

2. Managed

At this level, the model views organisational processes as being planned and managed in that project requirements are controlled in that resources, project statuses and processes all follow a documented plan. All projects have known deliverables whose status is clear to management at various defined points and any alterations to those committed deliverables are reviewed as necessary by the relevant stakeholders and plans revised as needed. The whole philosophy is that the processes necessary to deliver a project or service are well documented and then *followed.*

3. Defined

The goals of level 3 are very much the same as level 2 with the critical difference being that at level 3, all the processes, procedures, tools etc that are being used are part of organisational standards that are consistent to all projects across that organisation.

4. Quantitatively Managed

At this level, the intention is to establish quantitative metrics within the organisation that can be used to analyse performance and process quality according to standard organisational measures. The goal is to be able to statistically track process performance into an organisational repository, analyse any process variance and account for it so that special cases can be coped for in the future. The long term goal is to have a project process which is quantitatively predictable in terms of things like costs, budgets, timescales and defect lifecycles.

5.*Optimizing.*

The last level is for organisations who have achieved all the requirements for the levels above and are proactively using the statistics they have gathered to optimize and continuously improve their processes.

As can be seen, the requirements for an organisation to achieve a CMMI maturity rating get ever more complicated the higher up the rating level you go. As such, it is not uncommon for many organisations seeking a CMMI rating to identify the level they believe they can already achieve and get assessed according to that rating. The business case for why organisations might want to achieve a CMMI rating are several, but can be grouped into the following primary areas: -

- The need to satisfy customer/market demands for a "good" CMMI rating.

- The need to use CMMI along with other standards such as ITIL (http://www.itlibrary.org/) to help to comply with regulatory standards such as Sarbanes-Oxley (http://www.sarbanes-oxley.com/section.php) or the Basle Accord (http://www.bis.org/publ/bcbs04a.htm) etc.

The benefits of using an evaluation framework such as the CMMI is that it can offer a way of evaluating the IS processes and methodologies used by an organisation according to a recognized standard, and focuses on process areas which have been "proven" to be more critical to organisations as they evolve. However, as with ISDs, the CMMI does have its issues which will be discussed later on in this section. The table below lists those process areas that are covered by the CMMI model.

Maturity Level	*Process Area Covered*	*Description*
2	Requirements management.	This area covers the management of a project's requirements and identifies inconsistencies between those requirements and the project's plans/deliverables.
	Project planning	This area covers the definition and maintenance of a project plan. It covers identifying stakeholders, getting commitment to a plan and estimating tasks/resources needed.
	Project monitoring and control	This area covers monitoring the project process and taking any corrective action if necessary to get the project back on plan.
	Supplier agreement management	This area covers the acquisition of products or services from 3rd party suppliers.
	Measurement and analysis	This area covers the definition, collection and analysis of data that can be used to support management information needs. The type of data collected and how it is analysed is wholly dependent on the type of informational needs that the data has to support. Typical sources of information listed in the model are - project plans, monitoring of project performance via status reports, interviews, established management objectives, business plans, requirements, contractual obligations, past experience and industrial standards/benchmarks.
	Process and product quality assurance	This area covers providing staff and management with objective feedback on the quality of performed processes/standards and procedures, identifying/addressing issues with non-compliance and providing feedback on quality assurance activities.
	Configuration management	This area covers the integrity of code baselines, code modules, approval audit trails, code changes and the building and delivery of controlled software.
3	Requirements development	This area covers the gathering, analysis and validation of customer requirements, product requirements and product component requirements.
	Technical solution	This area covers the process areas relevant to the design, development and implementation of solutions to product requirements.
	Product integration	This area covers the process areas relevant to the assembly of the product from the various product components and ensuring that those components work together as specified.
	Verification	This area covers ensuring that the delivered product or product components fulfil the requirements that they are supposed to.
	Validation	This area covers ensuring that the delivered product or product components fulfil their intended use when placed into the target environment.
	Organisational process focus	This area covers the process areas relevant to the identification of weaknesses in the organisation's processes and plans pertinent to resolving those weaknesses. Typical sources of information listed in the model to help with this are measurements of processes, lessons learned from previous projects, process appraisals, results of product evaluations, benchmarking activities and other improvement initiatives within the organisation.

Maturity Level	*Process Area Covered*	*Description*
	Organisational process definition	This area covers those processes or assets that detail lifecycles, procedures, documentation or anything that is related to describing an organisation's processes. This process "library" is used to help build and maintain a standard project process lifecycle.
	Organisational training	This area covers identifying and addressing training needs within the organisation.
	Integrated Project Management for IPPD (Integrated Product and Process Development)	This area covers those processes that are aimed at creating a shared/common project process across a potentially geographically distributed environment where stakeholders may work in different environments or use different project paradigms.
	Risk management	The purpose of this area is to identify any potential problems before they occur and define contingencies to handle them when or if they do. Risk management covers both technical issues, schedule risks and internal/external risks. Typical sources of risk identified by the model include uncertain requirements, efforts where estimates are not available, infeasible design, unavailable technology, unrealistic schedules/estimates, inadequate staffing/skills, funding issues and issues with sub-contractors or vendors.
	Integrated teams	This area covers defining those processes that are necessary to form and sustain an integrated team.
	Integrated supplier management	This area covers processes for identifying sources of products that can satisfy project requirements and using this information to select suppliers.
	Decision analysis and resolution	This area covers those processes that are used to analyse and evaluate possible decision paths.
	Organisational environment for integration	This area covers those processes that are used to provide an infrastructure for any IPPD activities (defined above).
4	Organisational process performance	This area covers establishing process performance metrics to create and maintain a quantitative understanding of how an organisation performs and to use this data to help quantitatively manage projects. Typically, these measures are divided into process orientated measures (e.g. cost estimates etc) and product measurements such as defect rates and reliability.
	Quantitative project performance	The purpose of this area is to quantitatively manage a project's processes in order to achieve the desired quality and performance objectives. This area will typically involve selecting key processes or sub-processes within the project that can be statistically managed and use these to determine if process and quality goals are being met.
5	Organisational innovation and deployment.	The purpose of this area is to proactively select and deploy incremental changes to an organisation's process that can give a measurable increase in performance.
	Causal analysis and resolution	The purpose of this area is to identify any causes of defects or other project problems and take action to prevent them occurring in the future.

Table 2.5 Process areas covered by the CMMI framework

As can be seen from the process areas outlined above, the overall goal of the CMMI model is to move an organisation towards a single, tailorable process that can be quantitatively measured and improved as the organisation gathers more statistics. Obviously, the level of investment necessary for an organisation to move up the maturity model increases the higher the level sought, so many organisations only seek a level that matches their needs at a particular point in time. However, the CMMI website does quote some interesting results reported by various large companies (e.g. Siemens, THALES, Lockheed) that seem to indicate positive gains can be achieved by moving up the various CMMI levels (http://www.sei.cmu.edu/cmmi/results/results-by-category.html[16]).

One major weakness to note is that the CMMI framework was originally developed to meet software development standards for the US Defence industry and thus has a heavy historical bias towards that sector. While this bias might not be as applicable as it has been in the past, it still means that the process areas which are focused on might not be so applicable to organisations which operate in more agile, rapidly changing environments.

The goal of this section has been to look at two existing IS evaluation frameworks and examine the types of organisational areas that they consider to be important. To help determine if the proposed organisational areas in the framework are valid, the following table takes each of the areas contained in the PDA and CMMI frameworks and places them into the categories proposed by this thesis. This will help to determine if these categories have a level of validity in that they are examining the same types of process areas as these two well established frameworks.

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[16] This URL was last visited 1st November 2005 and contains various quoted assertions by companies and/or anonymous sources backed up by snapshots of statistics where available.

Organisational Area	*Identified process areas that fit into these organisational areas*
Project Management	• Project Management and planning (PDA) • Configuration Management (PDA/CMMI) • Quality Systems (PDA) • Testing (PDA) • Requirements Management (CMMI) • Project Planning (CMMI) • Project monitoring and control (CMMI) • Measurement and analysis (CMMI) • Process and Product Quality Assurance (CMMI) • Requirements Development (CMMI) • Technical Solution (CMMI) • Verification (CMMI) • Validation (CMMI) • Organisational Process Definition (CMMI) • Integrated Project Management for IPPD (CMMI) • Risk Management (CMMI) • Decision Analysis and Resolution (CMMI) • Quantitative Project Management (CMMI) • Causal Analysis and Resolution (CMMI) • Methodologies (PDA)
Stakeholder Expectations	• Requirements Development (CMMI) • Requirements Management (CMMI)
Organisation Context	• Training/education (PDA) • Documentation (PDA) • Organisational Process Focus (CMMI) • Organisational Training (CMMI) • Integrated Teaming (CMMI) • Organisational Environment for Integration (CMMI) • Organisational Process Performance (CMMI) • Organisational Innovation and Deployment (CMMI) • Security (PDA)
Technology	• Manufacturing (PDA) • Technical solution (CMMI) • Product Integration (CMMI) • Maintenance (PDA)
Other	• Supplier Agreement Management (CMMI) • Integrated Supplier Management (CMMI)

Table 2.6 - Mapping PDA and CMMI process areas into proposed organisational areas

As can be seen from the above table, the majority of the process areas which have been identified by both the PDA auditing framework and the CMMI SE/SW v1.1 fit into one or more of the four organisational areas proposed by this framework. It is worthy to note that the majority of the process areas identified above do fall into the project management category and that this reflects the biases that the PDA and CMMI models have towards certain industrial sectors. It is also worth noting that two areas which were identified by the CMMI model to do with supplier management do not fit into any existing organisational areas identified so far. This is a weakness that would have to be addressed if such supplier management issues were important to the project/organisation being examined. The same would also be true for any other areas which might be project/organisational specific and

deemed as critical to a project's success. Another thing that should be noted is that a number of the processes areas identified, especially in the context of the CMMI model, may map to more than one organisational area. This is especially true for the project management organisational area which contains process areas like requirements definition that are both part of stakeholder expectations and an integral part of any IS methodology. This duplication should not cause any issues as it just reflects the pervasive nature of project management and the types of issues that it deals with.

The remaining question to be addressed is whether or not these frameworks work in helping an organisation achieve a more successful system. This is an interesting question and one which is fundamental in determining if an organisation will achieve any benefit from undertaking such an evaluation. It is also a question which is extremely difficult to answer empirically. The main reason for this is that the activity of undertaking an IS audit or review is not just a single event to which a direct improvement cost can be attributed to, but as with the CMMI model, it is always accompanied by a process improvement program which may very well help improve the success of an IS system over time. In terms of the CMMI framework, the actual evaluation for a maturity level is not the single direct variable which helps to improve the success rates of an IS system, but rather, it is the incremental improvements associated with having a more informed/mature process that can help boost the chances of a project being successful. For example, the various achievements reported on the CMMI website (see footnote 16 above) were the results not so much of achieving a higher maturity rating, but rather, due to the incremental work necessary to gain and maintain those ratings. What can be said therefore, is that although using an evaluation framework itself does not provide a guarantee of increasing your chances of having a more successful IS system, it does provide a way of identifying those issues with an organisation's development/support process which - if dealt with - can help lead to improvements in the chances of IS success.

To summarise then, the goal of this section has been to examine two IS audit frameworks which have been used in industry for a number of years, identify the process areas that these frameworks cover and map them to the organisational areas that have been identified from the research. The reason for doing this was to help identify any areas that might not be covered in the proposed framework and also, to help determine what individual process areas other evaluation frameworks deem as being important as a basis for comparison against what this research identified.

2.6.4 Evaluating IS Methodologies – Why use the framework?

As has been argued above, the development process which is used to deliver an IS system is one of the primary weapons against combating the risk of IS failure. It is the development process which is responsible for specifying the system requirements and the detection and correction of any faults or flaws that might occur. As such, it is logical to assume that an organisation would want this process to reflect the needs of the IS system under development in every way that was reasonably possible. As has been previously stated however, IS methodologies come "pre-packed" with their own assumptions and viewpoints of the world that might - or might not - accurately reflect the priorities of the organisation or the system under development. This is the same for formal IS methodologies such as *SSADM* or even, informal development processes that may have arisen over time. Each of these development methodologies - whether formal or informal - will contain tools and techniques that capture and monitor entities based on their own unique assumptions, and as such, may not accurately reflect the needs of the specific system under development. In light of this, the goal of this research is to develop a framework that can help in identifying what critical success factors or entities are important to the success of a system, and then manifesting them in such a way that can better enhance the success of the development process.

The role of the framework being developed therefore is to help provide a basis through which these success factors can be both identified and validated, so that they reflect a more accurate picture of the system being developed. So far, this chapter has examined models of success and failure and looked to identify key areas that this framework would need to examine. These areas, which are discussed in section 2.7.1, reflect what this research views as critical components that contribute to any definition of IS success. Central to these areas however, is the role of the development process in providing the mechanism that monitors such success factors - hence the focus that has been placed on the notion of the IS methodology as a tool for evaluation. If the fit of this methodology is out of synch with the requirements of the IS system, then as commented on above, the effectiveness of that methodology to detect problems is going to be affected. As such, this framework is intended to help combat this risk by looking to manifest in a concise way what methodologies need to control. The next section of this chapter is concerned with a more detailed examination of how such a framework could be constructed.

2.7 CONSTRUCTING AND EVALUATING DEFINITIONS OF IS SUCCESS

In section 2.6, the importance of the role that the development process has in delivering a successful IS system was examined, and previously to that possible weaknesses in some of the existing IS success models in not evaluating this process was raised. The role of this section is to expand more on this point. It will consider how it might be possible to identify entities or factors deemed critical to the success of a system and how such entities could be evaluated with regards to the development process.

2.7.1 Identifying Factors that are Potentially Critical to IS success

So far, this thesis has discussed how the multidimensional nature of the IS success construct has given rise to many different and potentially conflicting viewpoints on how such a construct can be evaluated. As part of this discussion, this thesis has aimed to examine both models of IS success and failure and distil some requirements that could be used to enhance both the definition and evaluation of such success constructs. The argument being that the more ecologically valid the evaluation mechanism used is, then the greater the chances of producing a successful system. What has not been considered so far however is the question of how this goal can be achieved. To be able to define a success construct such as that envisaged above requires the presence of two main prerequisites. The first of these is a definition of those areas that will form the basis for a unit of analysis within which the investigation for success factors will be scoped. The second is the definition of a methodology that will allow these areas to be investigated. It is the role of this section to discuss these two prerequisites.

With regards to the first of these, the discussions held previously regarding the differences between success and failure models identified four candidate areas that could be used as a basis. These were: -

- *the IS development process or methodology* - which is defined as comprising the management processes used to direct and control the mechanics of an IS project.

- *the expectations and attitudes of the stakeholders involved* - who are defined as both those groups who are end users of the system, and those who expect that system to fulfil some sort of strategic or tactical goal.

- *the organisational context which supports the IS project* - which is defined as the structure, culture and environment in which that organisation operates.

- *and finally, the technology itself* - which is defined as the technology used to implement the IS system.

This list reflects the priority of importance that was derived from the models discussed and forms a basis for the unit of analysis in which the investigation for success factors will be scoped. This list however, only defines the areas that an organisation potentially needs to examine it does not state what factors need to be considered or how such factors can be identified. To do this requires a methodology or framework that can be used to analyse each candidate area and identify any possible factors that might be regarded as being important. One such framework that is worth considering for this purpose is the use of the CSF concept previously discussed.

The critical success factor concept (CSF) attempts to make explicit factors that are tacit or contextual in nature. It is an interpretative approach that looks to capture an individual's subjective world-view and operationalise those factors that might be necessary to obtain that world-view. The appropriateness of using the CSF concept as a suitable vehicle for studying IS systems development is based on the argument that the outcomes of the development process are heavily influenced by the social actors that affect that process (Butler and Fitzgerald, 1997; Kumar and Welke, 1992). This argument is based on the proposition that the actions of social actors within an ISD process are teleological in nature, and are thus best captured via a research approach that characterises this (Visala, 1991; Butler and Fitzgerald, 1999). Teleology itself, is the study of goals, functions, ends and purposes, and tries to explain a social actor's behaviour in terms such as "*A wants **p**; A knows that without doing **a**, he cannot obtain **p**; So A sets about doing **a***" (Visala, 1991). So, if **p** is stated as the goal, the action necessary to obtain that goal is **a**. In terms of the CSF methodology, **a** is the CSF which is necessary, according to **A**, to obtain **p**, and as such, shows how the CSF approach can be used to operationalise the identification of such goals. Furthermore, various researchers (Visala, 1991; Kanungo, 1993) have argued that a hermeneutic approach[17] is necessary to study some of the phenomena related to the IS development process, which when looking at the interpretative nature of the CSF methodology, indicates that utilising the CSF approach to understand how people define IS success is a valid approach. While Butler and Fitzgerald - amongst others - do caution that a

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[17] The art of interpretation, mainly concerned with the interpretation of intentional human action (see Bruns, 1992).

hermeneutic approach is only part of the answer, the use to which this research intends to put the CSF concept does not exclude the use of other more structured approaches as well.

The CSF approach however does have some issues. As stated above, the CSF concept is entirely subjective in nature, and thus will identify factors that are highly biased towards the opinions of those being asked the questions or those performing the analysis. As such, unless some form of validation process is applied to factors identified, there is a serious risk of those factors being too biased towards one specific viewpoint or another. This validation process therefore will have to be a step in any framework which is finally proposed. However, while this requirement is important, it is first necessary to examine how an organisation can arrive at a list of suitable success factors and some of the issues that might need to be addressed during this process. The exact specifics of how the CSF concept will be used are detailed later on in this section. The rest of this section however is primarily concerned with examining some of the issues regarding the CSF methodology itself that may need to be addressed.

Originally, Rockart applied CSF analysis by asking senior management within an organisation a series of pertinent questions which attempted to get them to identify those areas most critical to an organisation's success. The same sort of questioning concept has also been employed in more recent re-incarnations such as the so-called "balanced scorecard" technique (Kaplan and Norton, 1992), and has also enjoyed wide use in both academic and practitioner circles (Williams and Ramaprasad, 1996). However, despite such usage there have been a number of fundamental concerns that have been raised by researchers such as Williams and Ramaprasad regarding the very nature of this technique. As commented on earlier, the CSF approach uses questions or similarly focused techniques to identify opinions as to what factors are critical to deliver success. However, the definition of criticality and the implied casual relationship to achieving success is something which has raised quite a few concerns. It is argued that the level of critically that a factor has will be entirely dependent on an individual's or group's world view, and as such, unless these interpretations are rigorously validated, then that bias may affect the usefulness of the technique. In addition, just because a number of factors have been identified this does not mean that achieving those factors will automatically guarantee success, or even that they will capture all the necessary variables/attributes that they purport to do. However, while such concerns may be valid, they are only reflections of the interpretative nature of IS systems. With regards to this research, the usage of the CSF approach to materialise factors such as stakeholder expectations is entirely appropriate given the subjective nature of such expectations. While it is true that a

validation stage will be necessary, this is something which is already being catered for, as will be discussed later on in this section.

As well as the issue of validation discussed above, there is also the potential problem regarding how such factors can be grouped together in a meaningful way. As has been mentioned previously, the CSF methodology by itself does not have any implied classification or taxonomy that can be used to group factors. This means that without additional analysis the priority or importance of each factor in relation to its appropriate stage of the development process will be unclear. Or in other words, success factors by themselves mean little unless there is an associated context that gives them meaning. This is not something that CSF analysis by itself provides.

A symptom of this issue can be found in the numerous examples of different ways in which researchers utilising the CSF principle have attempted to catalogue success factors. These include factors identified on a single issue basis (Rockart, 1979), causality and criticality (Williams and Ramaprasad, 1996), organisational and process level (Rockart and DeLong, 1988; Jenster, 1987) to name but a few. Each categorisation used entails its own opinion as to how CSFs should be grouped. Within the scope of this research however, CSFs will be scoped in two separate ways. The first of these will relate to the candidate area that the CSF is applicable to, and the second, will relate to the nature of the factor/entity itself – i.e. whether it is tangible or intangible. This separation is intended to reflect both the need for having a context in which success factors can be placed and also, the underlying nature of the factor identified. This separation is also intended to reflect the arguments presented by Visala that the ISD process is driven by social actors after specific goals and that these goals can be either personal, organisational or process driven.

The intention of this section has been to review and comment on both the unit of analysis that the evaluation framework will use and on the CSF methodology that will implement it. As part of this review, some of the limitations of the CSF methodology relevant to the framework have been identified. Of these limitations, two main points have been made. The first of these is that given the highly subjective nature of CSF analysis there must be some kind of validation process that can be used to counter any strong biases. Secondly, that there is a need for some kind of classification or taxonomy that can be used to group factors together as this is not something that the CSF methodology provides. These two issues will be discussed further in the next two sections as a methodology to operationalise the proposed framework is detailed.

2.7.2 The Success Package – A more precise construct of Success

At the beginning of this thesis, some of the problems related to defining what would make a system successful were introduced. The main concern that was raised was the idea that IS success is a construct that potentially has many different dimensions and can be affected by many different issues, some of which may not be under the control of those responsible for the system. As was commented on by Molla and Licker, IS success is generally perceived as something which cannot be defined in a generalisable way. While there are some factors which may be generic in nature, there are also others which are specific to the environment in which they occur and as such, may be ignored by more general definitions of success. In relation to this point, this research has proposed that one way of defining an IS success construct is as a package of potentially unique success factors, which when taken together, present a definition of success that is more ecologically valid than a generic model. The advantage of this being that there is a much tighter fit between those factors that are scrutinised as part of the IS development process and the actual requirements of the organisation.

The key assumption underpinning the idea of the success package is that if an organisation can construct a list of those entities/factors which they believe will be critical to the success of their system, then they will be in a much better position to monitor those entities during their development process. The benefit being that any potential flaws will be discovered much earlier in the development cycle. However, while this goal sounds admirable, the methodology used to construct such a package must be able to focus on those areas that are going to have a realistic impact. It is no good proposing a package of success factors that are so diverse and ineffective in nature that the resulting success construct is itself unmanageable. Those factors that are nominated for inclusion into the package must be those which are believed to be vital to that system which in turn implies that some form of vetting based on criticality must be done. When Rockart first defined CSFs back in 1979, he described them as being 'the limited number of areas in which results, if they are satisfactory, will ensure successful competition performance' (p 85). This idea of limited factors is also stressed by Williams and Ramaprasad (1996), who used the concept of criticality to propose a taxonomy for CSFs. Drawing on work by authors such as Einhorn and Hogarth (1986), they suggested that CSFs could be graded according to the strength of the causal mechanism between a factor and the required goal. These were stated as the *criticality based on a known causal mechanism, the criticality based on necessity and sufficiency* and finally, the c*riticality based on association.* To formalise the concept, Williams and Ramaprasad proposed three pairs of dichotomous attributes that could be used to classify CSFs: -

- *Standing and instigating factors* – where a standing factor is one which is present over a long period of time and whose presence is contributory for a system's success. Einhorn and Hogarth described such factors as those which were part of the background noise but still contributed to success. Such factors could include environmental elements or those specific to a team. While an instigating factor on the other hand, is a factor which is specific to a project or temporal period – a factor which is in the foreground and provides the trigger for success. An example being a piece of technology that gives a product a distinct advantage over its competitors.

- *Enhancing and inhibiting factors* – the present of a factor can arguably either enhance the success of an IS project or inhibit it, so it makes sense for an organisation to be able to identify both. Flowers, for example, as detailed earlier in section 2.4.2, identified a number of critical failure factors (CFFs) whose presence would have a negative impact on the success of an IS system. There is no reason why such failure factors cannot also be included in the success package. As the concept behind the package is to be able to get a clearer definition of what the organisation needs to monitor in order to lower the level of risk, including those factors whose presence may increase such risk also makes sense. Although organisations may not like contemplating failure or analysing why past failures occurred, one of the main benefits from undertaking this activity can be simply stated as those who do not learn from their mistakes, are doomed to repeat them. If an organisation can highlight what peculiarities of its environment will inhabit the success of a system, then corrective measures can be put in place to monitor the impacts of such detrimental factors and deal with them.

- *Direct and indirect factors* – a direct factor is a factor that is directly related to success, while an indirect factor is something that may affect success through its influence on a direct factor. Examples of such indirect factors could include group norms.

The reason for including this taxonomy of success factors here is that it gives an indication of the types of factors that both researchers and practitioners have identified when utilising the CSF approach and thus what types of entities/factors may need to be considered by the questioning framework.

So far, this thesis has identified a number of possible areas that may need to be examined for possible success factors and a way in which these factors can be classified based on type and organisational areas. However, what has yet to be addressed is how these entities or success factors are to be identified in the first place. A number of techniques used by previous researchers have been mentioned, including the balanced score card technique, meta-

analysis and the questioning of CEO(s) or other critical people. The technique that will be utilised by this research is something called the questioning framework. This framework is intended to aid the identification of success factors/entities by proposing a number of pertinent questions that may aid the organisation in drawing out what such factors might be. These questions will be based on each of the four areas previously identified and are intended to draw out from those asked what they believe are critical for their system to be successful. These results can then be used as a basis for building a more ecologically valid success construct for that particular project. Once such a construct has been defined it can then be used to aid in the evaluation of the fit for an IS methodology. The following sections focus on how such a success package can be constructed and then evaluated.

2.7.3 Constructing the Success Package

In the opening objectives of this thesis, one of the goals that was mentioned was the development of a so-called questioning framework that would be used to help identify possible entities which might be deemed critical to the success of an IS system. In short, this questioning framework is a set of questions based on those areas identified in section 2.7.1. These questions are not intended to be fixed, but rather, constructed and refined dependent upon the context in which the IS system occurs. The role of this section is to discuss what the requirements for such a framework might be, identify some possible questions which could be used, and lastly, consider some practical reasons why an organisation would want to use such a framework. Note - a more detailed breakdown on suggested procedures for operationalising the success package is discussed in section 3.5.2.

2.7.3.1 Identifying who to question

The primary aim of developing this framework is to be able to elicit from a given environment those people, factors and expectations that will have a genuine impact on the success or failure of an IS system. This means that those people who are most familiar with the issues under investigation need to be identified and have their opinions sought as to what such possible factors might be. To do this however requires that such people are known before hand and that the questions which are asked are appropriate to their job function. When Rockart originally wrote about the concept of critical success factors in 1979, the questions that he formatted were aimed exclusively at the CEOs within the organisation. Later, in conjunction with Bullen (1981), he extended the concept to include other levels of management within the organisation with the aim to aggregate a generic set of CSF(s) that could then be applied to the organisation as a whole. When Butler and Fitzgerald (1999) used a similar technique to construct a candidate set of generic CSF(s) for Telecom Eireann, they used both documentary evidence and individual interviews as their sources of information.

Those people that they interviewed included job functions such as development managers, developers, project management, IS functional management and user representatives. For Butler and Fitzgerald, the aim of this broad spectrum of coverage was to gain a thorough understanding of the environment in which the development processes took place, the world views of those involved and lastly, as suggested in the Ives *et al.* research framework (1980), the company involved. In comparison, another more focused approach to defining who should be questioned was taken by Nandhakumar in 1996. Instead of using a cross-sectional approach like Butler and Fitzgerald, Nandhakumar opted for a more longitudinal study, focusing exclusively on one project group. The aim of this approach was to gain a more thorough insight into the interactions of the key social actors who participated in the development process. This knowledge however came at the cost of a more limited understanding of the wider issues involved and less generalisability of the results generated.

With regard to the samples of previous research such as those given above, a number of comments regarding how to identify key players can be made. The first of these is that a good understanding of the context in which the development process takes place is essential. As has been argued by Visala and others, IS development is a social process that is driven by the interactions of key social players, and as such, identifying who these players are is a necessary first step. However, unlike Nandhakumar, this research would argue that this identification process needs to cover a much wider scope than just a single project group. Developing IS systems includes many functional areas and as such, each of these areas may need to be consulted. While the exact composition of the people involved will depend on the specific nature of the IS project, this research would argue that as a minimum, the following people should be considered: -

- *IS developers and project managers* – those who are both familiar with the development process and responsible for managing that process,

- *User representatives or those who are intimately aware of the expectations of the stakeholder(s) involved* – while the term *user* is used here, the focus is more on those who are the stakeholders, i.e. whose who have an expectation, either strategic or tactical, that the system is supposed to be satisfying.

- *Representation of executive sponsorship or a committed project sponsor* – several studies (DeLong and Rockart, 1992; Fitzgerald, 1992; Rainer and Watson, 1995) have noted the importance of a visible project sponsor in achieving a successful IS system. Such a presence can help to clarify the goals of the project, provide a clear point of decision and if necessary, clarify the more strategic expectations that are held for the project.

- *Representatives for each of the functional areas that may be involved* – it is important to recognise that more than just developers will be involved in the successful conclusion of a project. Other such areas as testing, consultancy and helpdesk may also have an important contribution to make to the system's success and as such, should be consulted.

The point of this section has been to try and identify potential key players that it might be necessary to consult and briefly review a couple of approaches that other researchers have taken to this issue. To summarise, this research takes the opinion that it is necessary to question enough people so that both a good understanding of those areas directly impacted by the development process can be achieved, and in addition, a wider understanding of the organisation as a whole can be gained. The reason for this is that to understand both the nature of the organisation and the external pressures that may be involved, the investigator needs to look beyond the development process. While this might be possible with such people as those listed above, it might also be necessary to broaden this scope to include other functional areas as well.

One final comment that is worth making is that identifying this list of people has an additional benefit. This research has mentioned the need for a vetting process which allows any success factors identified to be clarified for potential biases. This group of people represents a source of expertise that could be used to drive this vetting process. This means that any controversial success factors identified could be referred to members of this group for clarification if necessary. Once this group has been defined, the next requirement is to identify questions that these people are to be asked. This is the role of the next section.

2.7.3.2 Identifying the questions to ask

Once the people who have the knowledge have been identified, the next key step is to design the questions that need to be asked. This process is perhaps one of the most problematic areas that needs to be addressed mainly because the validity of the success factors identified are wholly dependant on the types of questions that are asked. Guidance as to how these questions might be constructed is available from a number of different sources. The first of these is the list of candidate areas that were identified in section 2.7.1. These four areas represent the prime unit of analysis that these questions will be focusing on. In addition to these four areas, the categorisations of success factors that were discussed at the same time provide an insight into those types of factors that these questions should be focusing on. The two categorisations of most relevance are those designed by Williams and Ramaprasad, and the distinction between tangible and intangible entities. The Williams and Ramaprasad's taxonomy is primarily concerned with classifying success factors in terms of their criticality

and how they manifest themselves in the environment under investigation. By looking at this taxonomy in relation to tangible and intangible entities, a number of possible areas for investigation come to light. For tangible entities for example, this question of criticality could be used to identify those functional requirements that were absolutely necessary for a system to deliver. Usually, such functional requirements will have a sliding scale of priority, and identifying those which are generally regarded as a "must" is a necessary part of any success construct. For intangible entities however, this relationship to criticality is less clear and other directions must be sought.

Apart from criticality, Williams and Ramaprasad's taxonomy also discusses the notion of how a factor manifests itself in the environment under investigation. This categorisation of a success factor is much more relevant to the nature of intangible entities and could even be said to have been used by Flowers when he identified the presence of organisational norms that he believed inhibited IS success. The aim of looking for questions from this perspective is to identify possible factors in the organisational culture, or working practices, that might influence the success of the system. The only real guidance that the taxonomy gives however is the distinction that Williams and Ramaprasad make between factors that are specific to a particular time and place (instigation factors), and those which are present all the time (standing factors). In terms of the framework, such questions would be looking to identify those practices whose presence in someway either inhibits or enhances the IS development process. Some specific examples might be a fear-based culture (standing), good working relationships within a team (instigating), a clear project direction (instigating), or a close knit working environment (standing). While identifying such factors will not be easy, it is these sorts of intangibles whose presence may need to be taken into consideration.

Besides from looking at categories of success factors for sources of questions, other possible guidance could be found by looking at models of IS success and failure such as those previously discussed. One such model of IS success which may be of interest is that which was proposed by Bailey and Pearson in 1983. While not discussed previously, this does mention one additional area of interest that may need to be investigated – that of service quality. This is an element which is looking at the quality of the system in terms of the after service care that the company provides, e.g. helpdesk and consultancy. In terms of IS failure and stakeholder expectations, such after service care can be pretty fundamental in determining elements such as repeat purchase, maintenance revenue and meeting stakeholder expectations. This area highlights the importance of identifying any post-delivery support services that might also contribute to a system's success.

By taking on board those comments made above, what follows is a sample of questions that the organisation might consider for use in identifying possible success (and failure) factors.

- *What are the tangible deliverables that this IS system has to provide?* This question is aimed at identifying and clarifying at a high level, the tangible deliveries of the IS system. As was argued earlier, there will be a set of functional requirements whose presence will be *necessary* for a system to have any chance of being deemed successful. This question is intended to capture such requirements.

- *What are the critical resource issues, bottlenecks or dependencies that may affect the development process?* Essentially, this question is aimed at investigating or even auditing the existing IS development/support processes and trying to identify any dependencies either in ongoing commitments, reporting structures, or organisational practices which may impede the delivery dates promised by the organisation. The area of scope that this question is attempting to assess is the organisational context in which the development process is taking place. It is trying to identify up front any factors – either tangible or intangible - that will enhance or inhibit the chances of delivering an IS system within the required time and budget. In a more traditional sense, such factors should include project management elements like identifying key people for inclusion in project teams and providing critical delivery dates for each phase of the IS project. However, in a wider sense, this investigation could also include some kind of high-level auditing process with the goal of determining the fit of existing working practices with the envisioned needs of the IS project. While it is beyond the immediate scope of this research to discuss models of IS audit, the goal of an audit process is to assess the quality and maturity of software development processes and make recommendations that could help improve the successful implementation of future projects. Research into the effects of IS auditing by authors such as Jin and Jeong (1999), suggests that such process audits can have a positive affect on IS quality and implementation. The use of such audits is however left up to the discretion of the organisation.

- *Who are the primary stakeholders for this IS system and just what are their expectations?* This question may seem to be a bit obvious, but is asked with the intention of clarifying just who the system is being developed for and what are their expectations. This question is being proposed because the IS system is not just a vehicle for addressing tactical business needs, but may also have strategic goals that are nothing to do with documented user requirements. One possible example of this could be using an IS system to achieve a visible presence in a target organisation from which either further sales or marketing

presence could be generated. In such a situation as this, those sponsoring the system may not be so much focused on the functionality that the system provides, but rather, on the "success story" that is generated. In such an example, the "success" of the IS system is more dependent on entities such as promotion and marketing message, then strictly on satisfying user requirements.

- *Does the environment or organisational context in which the IS system is occurring have any issues that may need to be captured?* This question is aimed at trying to identify any issues related to the organisation or market environment that may affect the success of the IS system. This could include both the organisation that the IS system is being developed for and the organisation that is responsible for developing that system. Take for example the differences in business models that organisations may have. An organisation which has a standard product support lifecycle of two years will have a very different set of business goals and working practices from an organisation which is geared to support a product for a minimum of five years – e.g. organisations in the defence or air traffic control industry. Factors such as this may not be initially considered when an IS system is being committed to, and yet, may have major implications on product maintenance and after-sales support. Other possible examples could include split development sites, over commitment of resources and unclear project priorities.

This section has looked at some of the considerations that are necessary to operationalise the concept of the success package. It has focused on two main issues. The first of these is concerned with identifying those critical players whose opinions need to be captured, whilst the second is concerned with the construction of the questions actually used to capture those options. By itself, the concept of the CSF methodology does not provide the necessary guidance with which to address these two issues. Therefore, this section has looked to provide some information as to how they could possibly be resolved. However, one major point that must be raised is that these comments and sample questions are only at an initial stage. The point of this research is to take these proposed questions and develop them within the context of a live environment to determine if they do indeed provide any help. As part of this validation process, these questions will be tested and refined to reflect any new areas that may become known.

While the identification of a possible list of success factors is one vital part of the construction of the success package, it is also necessary to construct metrics that can then be used to evaluate these factors. This construction process is the topic of the next section.

2.7.4 Constructing the Evaluation Metrics

As was mentioned in the opening chapter of this thesis, the effectiveness of any evaluation process is fundamentally dependent on the validity of the measurements that are used to enforce that mechanism. So far, this chapter has only dealt with the question of how to identify those factors that might be critical to success, this however is only part of the solution. Without a means of actually evaluating the progress of such factors, the organisation cannot know if they are making any headway towards achieving them. To do this, any factors which are identified within the success package should be materialised in such a way that they can be reliably monitored. What follows is a discussion of the steps which are necessary to achieve this goal.

- *Identification of tangible entities and the attributes associated with them*

  To be able to measure a factor or an entity, that factor must first be expressed in terms of properties or attributes that can then be used as a medium to represent that factor. For tangible entities or factors, this identification of attributes should be straightforward as the nature of such factors by definition is related to visible or logical representations of deducted objects. In the case of intangibles however, this identification is much more open to interpretation and is dealt with in the next section.

  Once the attributes representing a nominated factor or entity have been defined, then these can be used as a basis for defining potential measurements. For example, in the case of financial return, an ROI or CBA calculation can be used both as a means of identifying such an entity and as a way of measuring it. For less obvious ones however, the organisation could define a number of measurable properties which, when taken together, could be used to represent that entity. An example of this might be representing an entity such as a saving in man-hours. This entity could potentially be measured in terms of an ROI and as a release of resources that can then be invested in other projects – two properties that those evaluating the IS system might better be able to understand.

- *Identification of intangible entities and the attributes associated with them*

  The identification of attributes and possible measurements for intangible entities is something which is much more open to interpretation and may require a more detailed debate to define. The definitions of such entities like 'anxiety' are difficult to quantify, and yet, may well have an impact on the system that needs to be evaluated. As with tangible entities above, such intangibles will also have potential attributes that could be used as a basis to represent that factor or entity. However, the identification of these

attributes may need to be done in terms of the impacts that they have rather than simply nominating attributes as was suggested above. In the example of anxiety, some such impacts could be an increase in job stress, manifestations of conflicts between groups, or a lack of willingness by end-users to help with the development process. While defining such entities or factors by their possible impacts is not ideal, it is perhaps the simplest way of generating a list of properties by which such entities can be evaluated. Indeed, as such intangible entities are by definition latent in nature, this is perhaps the only way by which such properties *can* be identified.

- *Identification of the temporal nature of a factor/entity*

As well as identifying ways in which nominated success factors or entities can be evaluated, it is also important to give consideration as to when in the development process such factors are going to be most important. This point is raised with the consideration that success factors will have an associated criticality that may change as the development process progresses from one stage to another. In the examples given above of return on investment or savings in man hours, the validation of these factors would be most relevant to the feasibility stage of the project rather than the testing stage, because by then it is too late to do much about it.

- *Validating the suggested measurements*

As has been argued, no measurement, no matter how well researched, will ever be truly free from all biases. However, the effectiveness of any given measurement in quantifying specific success criteria is fundamentally dependent on how ecologically valid that measurement is. The organisation therefore needs to ensure that any proposed measurement(s) are rigorously examined in order to make certain that they are a valid expression of the criteria that they are purporting to represent. To aid with this process, the organisation could consider using three tests proposed by Straub (1989) that examine the validity of such measurements from a number of different perspectives.

The first of these tests, content validity, is aimed at checking if the proposed measurement is a true representation of all the possible measurements that could be used to represent that criteria. Straub, drawing on work undertaken by Cronbach (1971), suggests that this test could be performed by subjecting the proposed measurement to iterative reviews by panels of experts who are familiar with the content universe being examined. However, for practical reasons organisations may need to limit the effort they invest in this review process to only those measurements that are deemed the most

controversial, for example, those representing intangible entities. Such a panel of experts could be formed from those individuals identified as a result of the actions undertaken in section 2.7.3.1.

The second test is to consider the validity of the construct, or process, which is used to implement the proposed measure. This test is aimed at ensuring that the results from how a measurement is implemented are not an artefact of that implementation. That is to say, that the measurement used is not biased by any implementation issues. For example, if the organisation were to propose several alternative ways of implementing the same measurement and each came up with different interpretations of the same effect, then this will inevitably introduce a bias that may very well invalidate that result. Straub suggests the use of multitrait-multimethod[18] techniques (MTMM) to test the suitability of any proposed measurements. However, the time invested in such techniques is left to the discretion of the organisation. It is the opinion of this research that as long as the bias is known to be present, then the organisation can compensate for this bias if necessary. The third and final test is to ensure that the measurement used gives a reliable result on a consistent basis. This test could be achieved by employing techniques such as repeated measures.

Although these three tests are more specifically aimed at validating research instruments and would require a great deal of further work in order to refine them for use with IS success measurements, they still do however, provide some useful guidelines that the organisation should consider when seeking to check the validity of the measurements that they have proposed.

To summarise, each entity or factor, whether tangible or intangible, will have a number of attributes that can be used to potentially identify it. These attributes will define how this entity manifests itself within the environment under investigation and also some possible ways in which it can be evaluated. What has been commented on above is one possible set of steps that could be used to take the factors identified in a success package and manifest them in such a way so that they can be monitored. If such factors are not monitored then an organisation will have no clear idea as to if such factors are indeed going to be achieved successfully.

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[18] For more information on such techniques the reader is directed to an article by Campbell and Fiske (1959) that details how such techniques work, and how they can be used to test the correlation of results from different measurements.

2.8 DISCUSSION

The role of this chapter has been to discuss in more detail the concepts of IS failure and success, and through this discussion identify some of the potential pitfalls that organisations face when trying to achieve a successful project. One of the primary aims of this discussion has been to critically examine some of the success constructs that have been proposed and identify potential weaknesses that such constructs have. It has been argued that because IS success is a construct which is dependent on so many contextually unique factors, that organisations will find it worth while investing time in constructing a package of success factors that can then be used to enhance any evaluation mechanism that an organisation might already have in place. The reason for this is that the IS evaluation mechanism has been argued to be one of the key weapons for helping an organisation combat IS failure because it allows any potential issues or faults that might arise during the IS development process to be detected and corrected. In addition, the more ecologically valid an evaluation mechanism is then the more effective it will be. If such a mechanism is significantly out of step with the context to which it is applied, then it has been argued that this will have a negative impact on the effectiveness of such a mechanism to identify and/or correct faults early on in the development process. The later such faults come to light, then the more costly it is to resolve them.

In examining how such a potential mechanism could be constructed, this thesis has compared and contrasted some of the more notable definitions of IS success and failure and proposed four main key areas that might need to be investigated. These were the IS development process, the expectations and attitudes of stakeholders, the organisational context in which the IS project takes place and finally, the technology itself. However, identifying potential areas that might need to be investigated is relatively easy, the difficult part is to determine just *what* within these areas are vital to success and *how* these factors can be described in such a way that will allow the organisation to tackle them. In examining potential techniques that could be used, this thesis has considered a number of factors. Firstly, as described in a number of places, IT/IS systems are socio-technical systems and as such, will be dependent on both tangible and intangible factors for its success. In looking at the four areas that were identified for investigation, each of them will have entities that could fit into these categories. Indeed, over the years quite a good deal of research has been done into investigating what such potential factors might be. However, as commented on in previous sections, much of this research has been done on a case study basis so the generalisability of factors identified is limited. With regards to this research, the CSF approach was selected to capture these factors because it has been used by previous researchers and it also gives a vehicle which is wide enough in scope to capture both objective and subjective elements.

There are however a number of problematic issues with the CSF approach that might affect its usefulness within this research.

As the factors or entities that might be generated as a result of using the CSF approach are potentially so wide and varied, it is vital that the correct people are identified and the correct questions asked as early in the analysis process as possible. If the people identified for questioning are perhaps not the most suitable, or the questions that they are asked are misleading, then the success factors or entities that are subsequently identified will not be as valid as they could be. The process of identifying such people and questions will, like any new process, require a degree of trial and error before an organisation is successful. This learning process is however an initial investment which once undertaken may not need to be re-performed. As commented on in section 2.5.6, critical success factors can be seen as existing at two levels. Arguably, once any generic factors to the organisation have been identified for one project (i.e. those which are 'core critical'), the investment of time necessary to identify success factors for the next project will be significantly reduced. In addition, with each new subsequent project these success factors will be further refined until the organisation ends up with a library of metrics that are specifically tuned to the nature and characteristics of that organisation. The advantage that will be gained from this is that these metrics will be used to enhance the effectiveness of more standard evaluation criteria, and when organisations are investing thousands to millions of pounds into a project, then any additional advantage that can help lower the risk of failure is worth pursuing.

The concept of the success package is not intended to be used as a substitute for other evaluation or development methodologies, but rather to enhance the effectiveness of such methodologies in two possible ways. The first of these is to help identify any additional areas or entities that more standard methodologies or evaluation practices may have missed. While the second is to help audit or evaluate the fit between existing development practices and the requirements which are necessary to support those success factors the organisation believes are critical to their system. An example of the first scenario is where an organisation - for one reason or another - might be constrained in how they design or evaluate an IS system. If, for example, an organisation has a policy of using business cases and financial criteria to evaluate an IS system, then the use of the success package concept might be beneficial as a way of both validating the contents of the business case and then moving beyond it to state a more realistic set of evaluation criteria. The second scenario is more true to the planning methodology that was originally behind the CSF concept in that it is attempting to identify those areas which are critical to the success of a system and use this information to enhance existing development practices to better support these success factors.

As was commented on in section 2.6, each IS methodology or development process focuses on one specific set of assumptions regarding what factors within that process needs to be controlled. The concept of the success package allows the construction of a list of independently identified factors that can then be used to clarify any shortcomings in those assumptions. Even where the use of a methodology is mandated, there is no reason why the success package concept cannot be used to enhance the effectiveness of that methodology by identifying factors that would normally be outside of its scope.

While some of the practical reasons for why an organisation might want to use the success package has been discussed, what has not yet been addressed is what, if any, original contribution to the understanding of IS success this research will make. As has been shown in some detail in this chapter, there have been numerous attempts at trying to define just what is "IS success" and provide a mechanism that allows an organisation to evaluate it. However, many of these definitions are lacking in one respect or another. What this thesis has looked to do, is to compare a number of success models against definitions of IS failure and highlight a framework that would be of some use in helping to resolve some of the potential conflicts that were identified. While the concept of using the CSF approach is not unique, this research has built on previous insights into the nature of success and failure, and used these to construct a process through which such insights can be operationalised in order to help reduce the risk of IS failure from occurring. The next step that this research must take however is to take the concepts that have been proposed and subject them to detailed validation and further refinement. What must be undertaken is a development and validation process that can test the assumptions upon which the framework is built and more importantly, help development the framework into a tool that will be of practical use. To undertake this process, a number of key areas for investigation need to be tacked: -

- Validating the four candidate areas nominated for investigation. This will be aimed at clarifying the scope of the proposed unit of analysis that the success package is aiming to investigate. This work will be the initial step to verifying the usefulness of the success package concept and is aimed at identifying if the four areas proposed are enough to capture the multidimensional nature of IS success.

- Investigating who is necessary to answer any questions that may have been identified. Possible suggestions for this have been made based on previous research, but these suggestions need to be further vetted against both other research and practitioner opinion.

- Enhancing and validating the potential questions that need to be asked. This is a critical step because it is only through these questions that opinions as to possible success or

failure factors can be identified. If these questions and the guidance that is given to develop them are wrong, then this will severely impede any use that might be made of the success package.

- Enhancing the concept of how factors and entities are to be manifested in such a way so that they can be reliably evaluated. This is perhaps the trickiest part in operationalising the concept of the success package. If the metrics proposed are neither ecologically valid or truly represent what they claim to represent, then the purpose that the success package is aiming to achieve is undermined.

One of the things that this research will not undertake to pursue is to empirically measure if the use of the success package actually does have a positive influence on the success of an IS system. The reasons for this are several. Primarily, *this* research is aimed at developing and validating those assumptions that have gone into the concept of the success package. Without this activity to determine if the assumptions underpinning the success package have any merit, then such empirical testing would be useless.

The priority for this research is twofold. Firstly, to develop the concept of the success package as outlined above, and secondly, to prototype some of the findings of this development process in a live environment to validate that the success package does indeed have some practical use. The role of the next chapter therefore is to discuss the research methodology that will be used to achieve these two goals and identify those issues and research procedures that will be followed to implement it.

3. Research Design and Methodology

This chapter is intended to discuss in more detail the research design and methodology that was used to implement the research goals covered in this thesis.

3.1 Chapter Overview

The goal of this chapter is to describe and justify the research design and methodology that was used to implement the research goals outlined at the beginning of chapter 1. This will include a description of the research paradigm that was used, a brief justification as to why this paradigm was selected and finally, a discussion of the research issues that were tackled during this research. As part of this discussion, the case study protocol will be detailed that describes how this research was implemented.

3.2 Description of the Research Problem to be Investigated

As was stated previously, the aim of this research is to produce a framework that can aid in the identification of success factors deemed critical to the success of an IS system. As such, the goal of this research is not to identify specific instances of success factors for a given organisation, but rather, develop a framework that can aid in the identification of such factors/entities in any given development environment. The mechanism that has been proposed for capturing such factors is called critical success factor analysis[19] which uses questions to identify opinions as to what factors are vital to IS success. To use this methodology effectively however requires that the opinions which are identified focus on the correct areas, are asked of the right people and give rise to factors that can be objectively measured. The areas that need to be tackled by this study therefore are to take the framework outline that was proposed in the previous chapter, validate the assumptions on which it was based and finally, develop sample questions that will allow such success factors to be identified. This will involve both refining the procedures that were proposed to support the framework and then prototyping them to ensure that the contents which they embody will work in a live development environment.

3.3 Which Research Paradigm to Use – Quantitative or Qualitative?

Throughout this thesis, IS success has been referred to as an uncertain construct containing factors that are both rational and interpretative by nature. In addition, the proposed

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[19] See Rockart (1979)

methodology that will be used to identify these factors is based on a research philosophy (teleology) which is primarily concerned with identifying an individual's intentions and expected outcomes within the context of a given environment. As such, the nature of the research problem under investigation is mainly an interpretative one which would best lend itself to a qualitative approach rather than a quantitative one. Support for this perspective can be found in the comments made by researchers such as Keen (1987), Mumford (1985), Butler and Fitzgerald, 1997; Kumar and Welke, 1992, Visala, 1991; Butler and Fitzgerald, 1999 regarding the nature of the IS development process and the methodologies necessary to understand that process. This research is aiming to develop a framework for capturing the worldviews of key social actors within the context of any given development environment. To do this, an approach is being used that is primarily concerned with interpreting people's intentions and manifesting them in a measurable way. Because intention, like any other subjective factor, needs to be understood in terms of the environment and the person that gave rise to it, a quantitative approach may not be able to capture the necessary level of contextual based information to achieve this level of understanding.

In light of such points, a qualitative research design has been selected as the most appropriate research medium to use. The next section will discuss a number of possible methodologies based on the qualitative paradigm that could have been used and detail the one that was eventually selected.

3.4 SELECTING AN APPROPRIATE METHODOLOGICAL APPROACH TO USE

This section examines a number of potential methodologies that could be used for this research and examines the merits and limitations that they have to offer.

3.4.1 Case Study Methodology

A case study based methodology is essentially an approach to research that attempts to understand a specific phenomenon within the context of the environment that gave rise to it. The case[20] being examined is subjected to an in-depth, multi-perspective analysis that draws upon multiple sources of data which, when collected together, allows a much more thorough understanding of both the phenomena and the environment in which they occur. The reason for using this approach is that it examines the same events from multiple, independent perspectives, that both complement each other and provide insights that might not otherwise

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[20] a "case" is defined by Stake (1995) as being a specific, uniquely bounded system that can include such phenomena as a program, an event, a person, an institution or social process.

be possible. However, as is widely commented on within the research community, the major weakness with this type of research is that the generalisability of any results or conclusions drawn is severely limited (Tellis, 1997). This common criticism however, is strongly refuted by Yin (1984) who, in a detailed argument, differentiates between analytical generalisation and statistical generalisation. Analytical generalisation he defines as the use of a case study to provide empirical evidence against which templates of previously developed theories can then be compared. Whereas statistical generalisation assumes that a sample of cases are drawn from a large universe of cases, and as such, is a definition of generalisation which is inappropriate to this approach.

In the context of this research, it is issues related to analytical generalisation rather than statistical generalisation which will take priority. The framework that is being developed is a result of research that has been based on a number of previously identified theories of IS success and failure. As such, the findings that are generated are going to be used to test the suitability of the generic areas that these theories have identified as being important to IS success. In other words, following the principle of analytical generalisation, generic themes of success and failure that this research has identified will be tested via a case study to determine if they have any validity. The results from this will then be used to refine these themes to arrive at a better understanding of the nature of the IS success construct.

3.4.2 Action Research

Action research is a research paradigm which is primarily about participative research design and inquiry. It is concerned with generating practical knowledge where those who are involved in the research process are not just observers and participants, but are both - actively exchanging their worldviews so that a better understanding of the problem domain under investigation can be obtained. The reason why this paradigm is worth considering is that the nature of the research problem under investigation is one which requires a high degree of participant involvement in order to understand the issues and social actors involved. As has been argued in the previous chapter, this "insider" perspective is potentially critical in identifying and understanding how the interactions between the social actors and the organisational culture will impact on the success of the IS project. This level of understanding may not be able to be obtained from just an examination of data sources, but may instead involve the researcher actually becoming part of the development process itself so that an intimate knowledge of the worldviews and the social constructs that support those worldviews can be obtained. There are of course a number of potential limitations – both practical and theoretical – that need to be considered if this type of research approach is taken.

As commented on above, action research is a participative, emergent process, in which both the researcher and the participant move forward together in order to understand the problem domain under investigation and to reach a practical solution to those issues that may have been identified. As such, the research process is not just observing the problem domain, but is actively involved in interventionist techniques so that when insights are gained, action is taken to implement them and the results evaluated via reflective learning. Support for this type of interventionist approach can be found both in comments by researchers such as Baskerville and Wood-Harper (1998) who state that the "...discipline of IS seems to be a very appropriate field for the use of actions research methods..." and work undertaken by Checkland (1991), who defined a process model by which such action research could be implemented. The concern however with undertaking this type of research is twofold. Action research itself is based on an emergent, iterative process, which is essentially dependent on the context of the environment involved. Because of this, there might be concerns with both the generalisability of the results gained and the reliability, or repeatability, of the questions within the framework that the research process generates (Kock, N.F., McQueen, R.J., & Scott, J.L., 2000).

While the lists of factors/entities that make up a success package are arguably unique, this research is primarily concerned with developing and validating the framework that is used to uncover these factors. As such, the framework needs to have a level of what Yin (1994) referred to as analytical generalisability - both in the areas that are being investigated and the methodology that is used to implement it. Creating a framework explicitly from one particular environment may negatively affect this level of generalisability. Unlike an approach such as case based research, action research is entirely dependent on the environment that is used to develop any theories or conceptual structures and as such, those theories are uniquely tied to that environment in a way that undermines this goal of analytical generalisability. In addition to these theoretical concerns with this approach, there are also a number of practical issues that must be considered as well.

With using this type of research paradigm all the players that are involved – the organisation, the participants, the researchers – they must all be dedicated in both time and effort so that the research process can go through the iterative steps necessary to develop and refine the framework. Action research is reliant on both the organisation and the researcher being able to take the time to understand a problem, implement a change and then do the same thing all over again. For an organisation which is up against practical deadlines, this potentially unending process might be unacceptable. In addition, as these iterative steps require a period of process change, then reflection, followed by more process change, there is

the potential for continual major impacts on an organisation's working practices that may limit the willingness of such organisations to partner in this type of research. As such, if this research process was selected, then there would be serious issues, both practical and theoretical that would need to be resolved. In the context of a small to mid-range commercial organisation, this research approach is just not feasible.

3.4.3 Grounded Theory

The last approach to be considered, grounded theory, is essentially aimed at generating a theory from data which has been collected regarding a specific area. It is described by Glaser (1992) as being "...a general methodology of analysis linked with data collection that uses a systematically applied set of methods to generate an inductive theory about a substantive area" (p16). It is an interpretative approach that aims to collect data from multiple sources, analyse that data to find possible linkages and then from these, develop a theory that fits the data. The argument for this approach is that when a theory is developed and evidence gathered to support that theory, that this can sometimes unintentionally limit or even bias, the data that is collected. By gathering the data first and then grounding the theory in that data, is it argued that the resulting theory will potentially be more accurate, reflecting the biases and norms already within that data.

In the context of this research, grounded theory might be a useful approach to consider because one of the goals of this research process is to identify those categories which arise in people's minds that contribute to IS success. By applying the bottom up approach of grounded theory, it would be possible to develop categorisations of success factors that could then be used to help validate those candidate areas already identified. In addition, such research could help to refine the framework to incorporate new areas that might not have previously been identified in chapter 2. There is however a possible conflict between this intention and the philosophy originally behind the use of grounded research.

As stated above, grounded research is based on the assumption that the researcher is approaching their study with no pre-determined notions or priori schema towards the research problem. However, this study is approaching the question of IS success with a pre-conceived definition of what areas are of primary interest. As such, this study is undertaking research on a framework that was developed via deductive mechanisms, rather than inductive which are fundamental to the grounded approach. It would be difficult to argue therefore that this study was using grounded research when the assumptions for the study have already been constructed prior to the research being undertaken. There are also more practical concerns

with grounded research in that the time and resources that the target organisation is willing to invest make it impractical to use in this case.

While grounded research is not the same as action research, they do nevertheless share many of the same conceptual approaches on how to address the research problem under investigation. Both are concerned with using emergent, iterative approaches to develop a theoretical model to explain a phenomenon that is occurring within a specific environment. While in some ways this is desirable, it means that the issues raised above for action research with regard to analytical generalisability and the practicality of the research approach apply equally well to grounded research, and as such, the same arguments with regard to the applicability of its use for this study apply.

3.4.4 Selecting the Methodology

In the sections above, three possible methodologies for undertaking this research have been considered. Most of the concerns that have been raised are to do with issues of generalisation and the practicality of undertaking emergent research. While it is true that this research is aimed at developing a framework that can help identify unique success factors, the assumptions underpinning the framework, such as the areas that are being investigated, do need to have some degree of generalisability else the concept of the framework as a practical aid is not going to be achieved. The emergent nature of grounded theory and action research, while useful for obtaining a better understanding of a problem, may give rise to a framework that is too rooted in the biases of one organisation to be of any use outside of that context.

Case-based research on the other hand, while also aimed at understanding the specific issues within an environment, does so with a more pre-determined model in mind. It is more of a deductive paradigm rather than an inductive paradigm. As such, it allows both a detailed understanding of the problem domain under-investigation and the ability to test the data against a theoretical model that is more generalisable in nature. While the results may not be as ecologically valid as those developed via an emergent process, it does mean that the framework and the assumptions underpinning that framework can be based on previously developed theoretical models. As such, this provides the framework with a level of analytical generalisability that allows it to be tested in more than just one context. In addition to these theoretical concerns, the environment(s) which will be used to develop this framework have practical limitations that make the use of repetitive, interventionist techniques difficult to pursue. Because of these issues the case study methodology was deemed as the most appropriate research approach to use.

3.5 THE CASE STUDY METHODOLOGY – DESIGNING THE CASE STUDY

Prior to undertaking any case study research, Yin (1994) strongly advised the design of a case study protocol. This protocol details how the case study will be implemented and also, helps to lay out a procedure by which the reliability, and thus, replicability of the case study can be tested. Yin recommended that this protocol should include the following sections: -

- *An overview of the case study project* – this was to include the project objectives, any possible case study issues and a description of the topic under study,
- *Field procedures* – a description of the procedures to be used and details of possible data sources that were consulted,
- *Case Study questions* – the questions that must be kept in mind by the researcher during the collection of any data, and lastly,
- *A Guide for the generated report* – the layout and format of the resulting report into the case.

The following sections will address the design of this recommended protocol.

3.5.1 Overview of the Case Study Project(s) and Organisations

Originally, the intention of this research was to concentrate on several projects running live with the target organisation[21] and also, to supplement the data from those projects with data that came from secondary sources such as customer site reports, defects, requests etc[22]. This data was going to be collected from development sites across the global organisation thus ensuring that the data collected had a degree of generalisability within the scope of that organisation. However, during the middle of the data collection period around about the beginning of 2004, it was announced that the organisation – *study1* - was being taken-over by a company in much the same market space known as *study2*. *Study2* also sells to the software development community, but has in the past been more focused on the "mainframe" type of

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[21] As the target organisation used for the research wished to remain anonymous it shall simply be referred to as 'study1' or 'study2' or the organisation depending on the context.

[22] For a fuller description of the original research plan, please see the research proposal for this project.

organisation[23]. As such, the development processes and sales practices used within study2 were based on significantly different assumptions to those of study1. As part of the merger/takeover, a six month project was undertaken by both project management and development management to review the existing processes of both companies and come up with a new process that would then be the standard. As this change happened in the middle of the data gathering phase it was necessary to step back and review how this merger would affect the data gathered so far. What eventually resulted from this internal review was a development process that was very similar to that used in study1. The customer facing elements however such as Support, Consultancy and Sales/Marketing did undergo a radical reshape which affected the data that had been gathered up to that point. This structural change however did not invalidate the data already gathered or the methodology that was being used. As such, the following paragraphs define the overview of the case study as recommended by Yin.

3.5.1.1 The goals of the case study

In short, the goal of undertaking this case study was to develop and test the viability of a proposed framework to identify those factors – both tangible and intangible – that may be critical to the success of an IS system. This has been achieved by selecting a number of development projects within both study1/study2 and working with the main social actors in those projects to try and understand what, in their opinions, have been the critical areas affecting the perceived success or failure of that project. The projects that were selected for study incorporated two mainstream development projects and several lesser SLA[24] projects. The two mainstream development projects were chosen primarily because of the following criteria: -

- One project took place before the takeover by study2 and thus used the "old" IS project methodology, whilst the second project was managed using the "latest" project methodology. This gave a data sample from both project methodologies.

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[23] A term used to denote organisations that work in a more static type of business environment where the software used remains constant over a long period of time – examples might be the banking sector where the back-end software changes very little.

[24] Service Level Agreement – A term which is used to identify a set of standard response times between a customer and a service provider.

- Both projects, or more specifically, the development sites primarily responsible for them have been subject to CMMI and ARC IS audits[25], and this researcher was heavily involved in both.

- Both projects involved using development/project teams from multiple sites around the world plus external contractors (who followed their own unique development practices) thus adding to the generalisability of the results gathered.

- Both projects incorporated the same primary players – something which is both advantageous and a source of potential bias. The main advantage is that these players will be able to provide insight into the inner workings of both projects and the problems that were encountered, but both projects will also be affected by the biases that these people have in how they view projects should be run.

- The final point to note is that both these projects have had their own issues that have affected the perceived "success" of these projects. Some of these issues have arisen from mismatches in expectation and some have risen due to organisational constraints. As such, both projects have experienced and had to deal with aspects of IS failure.

The SLA projects (3 in total) were chosen because they are small, customer driven releases that have a simple definition of what is expected of them and thus, what is the definition of their success. Their lifespan is typically 2-3 months and is focused on delivering customer defect fixes – usually about 90-150.

(Note - for the rest of this thesis the two main projects will be referred to as projects A and B, whilst the SLA projects will be simply regarded as project C. The reason for this is that as the goals for each of the SLA projects are the same, there is no need to differentiate between them – they are only several instances of the same process and definition of success).

3.5.1.2 Issues that arose during the case study

This section talks briefly about the issues that arose during the lifespan of the case study and how these compared to what was originally envisioned in the research proposal. In the original proposal, not much explicit mention was made of the practical issues which might arise during the research discovery process. A number of theoretical issues such as sources of

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[25] See chapter 3 for more details on these auditing methodologies.

bias were mentioned, but nothing to do with the actual process of discovering the information. As such, the majority of the issues mentioned here relate to those that were discovered as a result of actually doing the research and issues that arose out of the unforeseen organisational changes resulting from the merger with study2.

Probably the most important of the issues that arose during the research process was the fact that study1 was taken-over by study2 during the middle of the research. This had a number of direct and indirect effects on the data being gathered and the people involved. The most direct physical effect of this takeover was that the organisation as a whole went through a number of significant changes which affected both the project processes that had been studied up to that time and more significantly, the organisational structural of the Sales and Support business units. The structural changes meant that for data already gathered in these areas, this data needed to be revalidated to match the context of the new organisation. The complicating factor with this revalidation was that the new processes and structures did not solidify until about six months after the initial takeover. This meant that some areas of the data gathering were blocked until this restructuring was complete. However, it is not the intention of this section to go into a detailed discussion of all the changes that took place in the target organisation post the takeover, just to mention that this takeover did happen and as a result, had a number of impacts on the research undertaken.

The physical affects of these process and structural changes only really affected project B as project A was deliberately protected from any potential changes to ensure that the project could be delivered on time, however, despite this deliberate protection, there were still some indirect impacts on the people working for this project due to uncertainties regarding the future and what would happen after the project finished. These uncertainties manifested themselves during the one to one interviews that were being undertaken at the time. It is difficult to directly prove, but a number of the people who were interviewed during this period – for project A, since project B did not exist at this point in time – did reflect opinions that were perhaps more negative than was expected by this researcher. This negativity may have been related to the general uncertainty that was being shown at the time and the rumours that were circulating about job security and the way the new organisation was going to work. This negativity may have introduced a source of bias in the results which might – or might not – have otherwise shown up.

Originally, the intention of the research was to use three different development sites to ensure that some generalisability was possible from the research even though it was being scoped primarily within one company. However, as a result of the structural changes that took place, the nature of the development sites involved in the research changed. The primary

change was that one of the three sites being used was closed down and the associated development moved to one of the other sites in the US. This meant that the development practices which that previous site used were effectively irrelevant for the purposes of the research. The primary reason for this is that while the technology was transferred from one site to another, the people did not. As a result of this, the primary research for projects A and C were sourced from a development site in the UK, whilst Project B involved all the development sites.

3.5.1.3 Field Study Procedures

This section deals with the procedures and sources of evidence that were used during this study. Yin (1994) identified six primary sources of evidence that could be used to support a case study. These six sources of possible evidence are documentation, archival records, interviews, direct observation, participant observation and physical evidence. In the case of this research, the sources of evidence used involved the following.

Source of Evidence	*Description of source*	*Categorization*
SDLC documentation	The SDLC documentation stands for the Software Development Lifecycle and is the company standard for how software is developed. This document mainly describes the high-level checkpoints that each project must follow and what deliverables - plus signoffs - must be done for that checkpoint to pass. While this document is primarily for guidance only, it does lay down some basic rules that every project – whatever it is – must follow. The SDLC however, is intended to provide examples and best-practices. It is not a straight-jacket for defining how each project is to be run. The process can be customised within certain limits.	Documentation
User case history	Most of the defects or enhancements for a product line come from the cases that customers raise. These cases are either bugs which customers have come across, enhancements that they want making to the product set or issues regarding the type of support they have experienced. This evidence is useful because it is qualitative in nature and can be used in conjunction with other evidence. This is especially useful when a good bulk of the evidence which is being gathered comes from subjective sources like interviews. Of course, this material can only help to identify problems or weakness in the features that have been delivered, but this in turn can be used to highlight areas such as weak requirements gathering or quality/usability issues which can indicate success factors that the organisation has failed to pay adequate attention to.	Archival records
Interviews	As stated previously, this was the primary area from which information was gathered. This involved focusing on key stakeholders from within the organisation and taking them through a semi-structured interview that asks them their opinions about the strengths and weakness of the current development processes and what their knowledge of the process areas were. The results of these interviews were then collated and used to generate a summary list of all the factors – both for success and weakness that those interviewed believed were important to both their job functions and for delivering "successful" systems.	Interviews
Sales write-ups	This source of information has typically been under utilised in the past, but was found to be a very good source of failure type information. In analyzing these records, information could be found of why a sale had either succeeded or failed. In a majority of cases that were investigated, the reason for failure to sell into the target organisation was either down to the product not exactly delivering what was promised or issues with the product itself. In cases where a sale was successful, it was primarily the flexibility of the product suite and its customisability that ensured the product fitted in.	Archival records

Source of Evidence	*Description of source*	*Categorization*
Consultant onsite reports and the consultant Knowledge base	This source of evidence actually covered two main sources. The first of this was archival evidence which came from site visits, whilst the second was the knowledge of the consultants themselves. While there was a formal knowledge base of documents, this is not what this source of evidence is referring to. The formal knowledge base is generally regarded by most consultants as a waste of time and is not used by them.	Archival records/Interviews
Meeting minutes	This source of evidence mostly covers what happened during meetings or summary reports that highlight the main issues relevant to a project at that point in time. The use of these documents as sources of evidence is mostly historical – to aid the identification of factors that have led to problems in the past.	Archival records
Metrics	This source of evidence is only really relevant to project B, which was the first time when project metrics were really used on a project. However, as it was the first time metrics were really used, the contribution that they made as a source of evidence was limited. They are mentioned here because they were used by the organisation to help determine a level of stability within the code base and the primary areas which were generating the greatest level of defects.	Archival records
Surveys	This source of evidence was divided into two separate forms. The first of these were surveys that were done by the organisation itself to collect information regarding "clean-up" checkpoints within the project, i.e. at the closing stages of a project to determine what went well and what issues occurred with that project. The second was a survey constructed using http://www.surveymonkey.com/ for the purpose of collecting information on what peoples opinions of success factors and measurements were, and secondly, what processes people believed the organisation used to control its projects and how effective those controls were.	Archival records/Interviews
Critical Incidents	This source of evidence was focused on using critical incidences both from interviews and customer incidents to identify particular failure or success cases.	Archival records/Interviews

Table 3.1 Sources of evidence used for this research

For each of these sources of evidence, a procedure was used to standardize how evidence in that section was identified, collected and analyzed. The following sections will break down each of these sources and discuss these procedures in more detail.

- *SDLC Documentation*

  The SLDC documentation describes the high-level procedures and methods that will be followed when a software product is implemented. It is a company wide standard which details the checkpoints and documentation which must be delivered as part of a

product's development. Versions of this documentation and the notes that come with it can be obtained from a single open source so access to this documentation is easy to obtain. This documentation comes in packs that relate to each main phase of the SLDC process. These are the concept definition phase, definition phase, planning phase, design phase, development, final test/customer readiness and support phases. For each of these phases there were specific documents that were identified as being potential sources of evidence for success factors.

The conceptual phase covers idea definition and high-level approval of strategic direction. For this phase, the deliverable is a marketing requirements document which is produced by Product-Management to define what the market problem is that a product is trying to solve. The SDLC documentation has very little to guide the usage of this phase and so was not regarded as a good source of evidence, other than defining what the physical deliverable should be.

The definition phase follows the concept phase and is used to generate a set of high-level product requirements, development estimates and risks. The deliverable for this phase is a product definition document (PRD) which defines a prioritized list of requirements that the product is supposed to deliver against. As with the concept phase, the SDLC documentation has very little to guide the user how to construct and deliver this document other than citing possible sources of data collection. As such, it is also not regarded as a good source of evidence other than defining what the deliverables should be.

The planning phase follows on from the definition phase and is used to generate detailed plans and schedules, high level designs, unique resource requirements[26] and a list of committed product requirements/features. The SDLC documentation is much more useful for this phase and gives a lot more guidance on not only what the deliverables are, but also, how those deliverables are to be constructed. As the deliverables for this phase are much more "mechanical" in production, i.e. require much less high-level thinking, then this is probably to be expected, but for a first time user of this phase, the SDLC documentation is a good source of guidance. As a source of evidence for best practices and success factors, it was reasonable only. This is because although it gives some usage guidance, it does not give best practices or good examples.

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[26] Resources that the company does not have internally

The design phase follows on from the planning phase and is used to generate all the necessary detailed design documents and project planning assets for all the project teams involved. The SDLC documentation for this phase is pretty much the same as the planning phase. There are a number of templates and usage guidelines that would help the initial user, but nothing substantive. As with the planning phase, this was a reasonable source of evidence only.

The development phase follows the design phase and is supposed to be the major checkpoint for defining when development of product features is complete. While the SDLC documentation gives a number of deliverables for this phase, there are no examples of what these deliverables show look like or details on how to generate them. There are also a number of implicit deliverables which one only knows about if one has gone through this phase. As such, the SLDC documentation is a poor source of evidence on how to be successful in getting *feature complete*[27] on time, covering all the elements you need to, for example, QA plans.

The final test/customer readiness phase is used to get the organisation ready for transitioning the product from the development phase to the customer delivery phase. It covers installing the product in-house, ensuring product consultants and support have had the necessary training to support the product in the field, all the marketing material etc is in place to support the launch of the product and all severity 1 or 2 issues have been resolved or marked as valid exceptions. The SDLC documentation for this phase is limited to only a few sign-off presentations that apply to project management and as such, have virtually no use to anyone else. As a source of evidence, the SDLC is of little or no value at this phase.

Overall, the SDLC cannot really be regarded as a good source of evidence for this study other than helping to identify what the key checkpoints are, what the deliverables for those checkpoints were and some guidance on how to deliver on those checkpoints. It contributes little directly to this study other than a definition of the development and maintenance process that the organisation follows.

As the full details of the SDLC were on the organisational intranet, the procedures used to capture this data were very simple – download the documents. The procedures used to analyze this data were based on the principles of the coding

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[27] A term used to indicate that all the planned features have been delivered.

technique facet analysis. In brief, facet analysis was a technique devised by Ranganathan (1967) for the categorisation of documentation assets based on terms, entities, processes, properties and agents etc which can then be clustered and used to create classifications. In terms of analysing the SDLC, the documents that were used were the guidelines available for each of the stages (not the templates) and the actual documents that were produced for each of the projects referenced above (where applicable). Each of these assets was examined and their details categorised according to the following: -

- What were the primary tasks and processes being performed for that stage?

- Who were the primary stakeholders for that stage, i.e. who were the primary agents providing the necessary input into that stage and who was the primary consumer of the outputs?

- What were the primary forms of data or entities being processed by that stage, i.e. what were the inputs being considered and evaluated?

The results of this analysis are documented in the next chapter.

- *User case history*

User case history refers to archival data which is logged by the Support or Consulting organisation when customers contact the company with issues, defects or suggestions for product changes. The data that is recorded is similar to any other customer support system in that the customer provides information on the issue that they have and a log is kept track of any correspondence or analysis that takes place on that issue over its lifespan. If the issue is critical and is blocking them in some way, then they can raise what is known as an escalation for that issue. This escalation does not necessarily have to be because of a product issue, it can also be because of a customer situation or internal issue. Escalations are closely watched by a specific team and weekly reports regarding those escalations are sent out to most of the senior management team.

The user case history was analysed using both quantitative and qualitative techniques. The information that was desired from this case history was the following: -

- *Product areas that have had the most defects raised against them* - This information is important because it can help identify areas that have product quality issues and indicates where more testing needs to be performed or the development processes are potentially weak.

- *Product areas that have had the most enhancements raised against them* – This information can be used to indicate areas of the product where there is either more scope for functional or revenue growth, or the use case analysis performed did not identify certain types of usage by customers.

- *Product areas that have had the most defects and enhancements raised against them on a four monthly basis* – This information can be used to indicate those product areas that have the most churn of issues. This information can be used to indicate potential quality issues or highest usage rates. The period of four months was used based on recommendations by support engineers.

- *Product escalations that have been raised* – This information can be used to determine what product escalations have been raised and why.

- *Product escalations against product area* – This information can be used to determine what product areas escalations are raised against.

All the above information is quantitative in nature and is focused on analysing the user case history to determine what areas of the product have issues that customers are experiencing or areas that do not fully meet their expectations.

The procedure for gathering and analysing this information was straightforward. The information is held on a centralised data repository where people with the correct access rights and relational database understanding can write specific reports which can collect together the base data and summarise it using date ranges. The majority of the reports indicated above are simple trend analysis reports that operate against specific input criteria – like date range - and can be constructed with either database query languages like ANSI/SQL or reporting tools like CrystalReports. Analysing the data is simply a matter of ranking the results.

The qualitative data that was gathered was done so by critical incident analysis and by looking at a selection of the escalations that had been raised

during the period June 2004-2005. This selection came from the three areas that had been identified as the most troublesome for escalations. This analysis was done by speaking with those support reps and consultants who had been involved with the escalations and from there identifying the types of issues that were present. The data gathering for this source was performed by asking the reps and consultants the following questions: -

- *Why was an escalation raised?* – This question was asked to determine the exact reason why an escalation was raised for this particular issue. The reasons for an escalation are many and could be related to blocked revenue, particular project deadlines or people getting fed up with the product.

- *What were the details of the escalation?* – This question was asked to determine the details of the issue that was raised. In this case the details of the escalation were to understand what the defect or enhancement was about and why it was so critical for the customer at that point in time.

- *How the escalation was resolved?* – This question was asked to determine how the escalation was resolved. In most cases, the resolution would have been the delivery of a patch or workaround to the problem.

- *What was the situation like afterwards?* – This question was asked to determine what the situation was like afterwards. If an escalation was raised and a patch or workaround was delivered, then this does not guarantee the situation was resolved or that the customer was happy afterwards. This question was aimed at determine what sort of strategies were played out after the escalation was resolved.

- *Was the root cause of the escalation, where applicable, ever identified?* – This question was only applicable to escalations for which the root cause was not known and was a very infrequent case.

The affected reps and consultants were identified from the details of the escalation. These reps were contacted to determine if they would be interested in taking part in the research. Those who indicated that they would were either interviewed over the phone or in person. For the 21 escalations that were identified of interest (see chapter 4 for more details) 11 escalations resulted in people being interested in giving interviews. Of those 11 however, 5 were

primarily interested in only giving written feedback to the questions via email. For the purpose of keeping the analysis the same for each of the interviews and the email responses, only the information related to the specified questions were used.

The analysis that was undertaken on the responses was factor analysis. Responses for each question were grouped into common statements and/or causes and once this was done, the results fed back to support reps/consultants to ensure that they agreed with it. The results of the analysis are detailed in chapter 4.

- *Interviews*

Interviews are the major source of qualitative data for this study. The interviews were run using a semi-structured approach with a recording taken where allowed. The questions used depended on both the job function that the interviewee had and the direction that the interview was taking. In total, detailed interviews took place with 40 people whose job functions differed in the company and five people from outside of the company who either used the product or whose companies did IS software development as well. The goals of the interviews were to understand: -

- the job functions that people did,
- the types of success factors that they believed were important to that job function,
- their understanding of success and how it is measured,
- their understanding of the target organisations processes for evaluating project status and taking corrective action if needed,
- the key business areas that, in their opinion, contribute to IS success.

Within the target organisation, the primary job functions that were covered are listed in table 3.2 below. Table App 1.1 in the supporting volume details the questions that were targeted at these job categories.

Job Name	*Description*
Account-manager	This refers to a sales person or sales team that is primarily responsible for an account. An account might be a new customer, an existing customer or a potential customer. This team will (or should be) the primary point of contact between any customer and the organisation.
Consultant	This refers to product consultants who are primarily responsible for going on site and helping customers with tasks like installing the product, customising features to meet customer's expectations, advising customers or helping with end-user training.
Developer	This refers to individuals who are responsible for developing products and/or customisations to existing products.
Development-manager	This refers to individuals who are responsible for managing the developing of products and/or customisations to existing products.
Executive-management	This rather sweeping category refers to those individuals who are director level and above – regardless of the areas that they are primarily responsible for.
Marketing	Whilst there is commonly a distinction made between marketing and sales as separate disciplines, in the case of the target organisation the function they perform is mostly sales with a bit of product marketing. This is being made clear because although they are referred to as marketing within the organisation, the function that they do is mostly sales and sales co-ordination. Most of the actual marketing – as defined by market research etc – is mostly carried out by product management with input from Marketing.
Product-management	This refers to those individuals who are primarily responsible for the direction of a product. These people will define the defects and enhancements which will be put into a product release. It is also their responsibility to define which customers are important for a specific release, so in a way, it is also them who have an influence on customer satisfaction ratings. Product management use a methodology called pragmatic marketing (http://www.pragmaticmarketing.com/) to capture market requirements and implement these as product requirements.
Project-manager	This refers to those individuals who are primarily responsible for managing and co-ordinating a project. They are also responsible for co-ordinating the management of the SDLC and recommending changes to this process if needed.
QA	This refers to those individuals who are responsible for the definition and control of product quality. They are responsible for defining the integration and system testing that takes place on a product and for signing off a product when it is regarded as being fit enough for a release.
Support-engineer	This refers to those individuals who are responsible for supporting a product once it is out in the field. This support might include taking customer calls, resolving issues raised by customers and going on site to investigate customer issues.
Support-manager	This refers to those individuals who are responsible for managing support staff and resources.

Table 3.2 Job Functions

The spread of people interviewed in each job function is listed below.

Job Name	*Number of People Interviewed*
Account-manager	5
Consultant	5
Developer	5
Development-manager	2
Executive-management	2
Marketing	4
Product-management	2
Project-manager	3
QA	5
Support-engineer	5
Support-manager	2
Total number of people	40

Table 3.3 Job Functions interviewed

It is important to note that in the spread of the people above – five came from outside of the target organisation. This was in the area of 1 consultant, 1 project-manager, 1 developer, 1 QA engineer and 1 marketing manager. These people were personal contacts known to the author of the study who kindly gave some of their time to take part as well.

The procedure for each of the interviews was the same. A time was arranged a week or so in advanced that was convenient to both parties. At the beginning of the interview, the interviewee was given a copy of a standard interview process form and explained the nature of the interview, what it was for, what the nature of the research was and any questions answered regarding confidentiality or issues with recording the interview. Most people did not have issues with recording the interview, but where individuals did, notes were made during the interview process to ensure the necessary information was captured. The questions asked during the interview depended on the way the interview went and the time available. The general goal of the interview was to at least cover the questions described above, but this was not always possible due to time or other constraints.

To analyse the results of the interviews, they were transcribed to files and then codified using the candidate areas suggested for the success factors. This codifying was done using Nvivo and by hand. For more information on this analysis, please see chapter 4.

- *Sales write-ups*

Sales write-ups refer to reports which are intermittently written by Sales or consultants when a sale is either successful or fails. The idea of this report is that it is supposed to identify what went right or wrong in a sale and is available for future analysis or sales leads. Over the years however, these reports have either not been done by people or have been done in an inconsistent fashion, so the information which is captured by them is patchy. As of this thesis write up, these reports have been discontinued, but they were used as a source of evidence, so it is necessary to mention them here.

The procedures to obtain and analyse these write-ups were as follows. Firstly, using known contacts within Sales and Consulting, details of accounts were sought where the products under the scope of this investigation had been sold into, or attempted to sell into over the period of 2003-2005. The product under investigation has a typical sales cycle of 3-6 months, so it was necessary to scope the unit of investigation over that period of time. Once these accounts had been identified, they were split into those that worked or failed and the geographical region that account fell into. The regions covered are Europe, the Far East and North America. It is interesting to note that the amount of successful sales in North America was far less than anywhere else. There were also fewer write-ups from these sales - either successful or failed – that could be analysed to determine what the reasons for this disparity were. Once write-ups – if available – were obtained, they were codified into success or failure factors and follow up questions asked of the sales staff (where possible) to clarify any additional details or issues. The nature of these questions were very specific and focused on those areas of concern. The answers to these questions were then used to supplement the codification.

- *Consultant on-site reports and knowledge base*

  When each consultant goes on-site they are supposed to write up a report which goes into an online knowledge base that anyone in Support or consulting can look at. However, while this might be the theory, the practice on the ground is something quite different. The consultants interviewed stated that the knowledge base was either out of date or so difficult to use that typically this was not regarded as a good source of information. This was confirmed when trying to use it. The source did have some good information, but was very out of date and the type of information captured in it was inconsistent. As such, this source was regarded as a weak source of information and only used to help backup other information sources where useful. The other information source which was referred to here is the knowledge base that the consultants share amongst themselves. As one consultant put it, the key to their job is not what you know, but who you know. The consultant was referring to the fact that they need to know who is the subject matter expert in a particular area or who has done similar solutions already to what the consultant wants to implement. This interpersonal data source however was analysed as part of the interview process and not as part of the consultant knowledge base.

  The procedures used to gather and analyse the evidence from this source were as follows. Following a site visit, each consultant is supposed to write up a site report that details what they did and what sort of issues or problems they encountered/resolved during that visit. As has been detailed previously however, these site reports are often neglected or cover so few details that they are practically useless. All these site reports are then supposed to be logged into an online knowledge base for other people to use, but again, this practice was only half-heartedly followed. As a result of this, this data source contains information which is either vague or patchy at most. When trying to use this knowledge base, the search capabilities or ability to link reports was so inadequate that this knowledge base was discontinued as a viable source of evidence and the consultant interviews used to replace it. For information on the data gathering and analysis techniques used for the interviews, please refer to that appropriate section within this chapter.

- *Meeting minutes*

  When reviewing the types of meeting minutes that were available in the organisation it was found that standards differed vastly between sites and different business units. In most cases, meetings were either not minuted or kept down to a simple summary

of what went on during that meeting and notes of any actions that were undertaken. As such, the majority of minutes were of little use and disregarded for the purpose of this study. One major source of useful data that was identified however was the minutes of the so-called internal "clean-up" meetings that take place after a major project has gone out. This meeting tries to go over the major mistakes or issues that arose during a project and propose suggestions to try and ensure that they do not happen again. These minutes were extremely useful in identifying common failings or issues that have plagued a project and showed a number of common trends that kept repeating themselves with nearly every release. As such, this was an extremely useful source of evidence that was used heavily.

The procedures used to gather and analyse this data were as follows. The main problem that needed to be tackled when using this data source was firstly to identify where the data sources where held. The target organisation had a number of separate repositories that were used by different parts of the organisation. These repositories held different types of minutes for each of the projects that were investigated. For the majority of these projects, these repositories were limited to two or three. For the major projects however, the final number of repositories involved numbered ten. The reason for this was the number of groups that were involved in those projects – most of which used individual standards and repositories.

Once the groups producing minutes and the types of minutes were identified, clearance to obtain these minutes - where possible - was gathered and samples of the minutes viewed to determine if they were of interest to this study. The classification of minutes fell into the following major categories: -

- *Development design meeting minutes* – these were primarily from design meetings which took place during the product design processes. These minutes are of little interest to the scope of this study because they cover issues that are outside of this study's remit.

- *Weekly status meeting minutes* – these minutes were generated from weekly meetings that took place during the life-span of each project. These meetings discussed status and blocking issues that needed to be resolved. These minutes were of some use because they identified factors that arose during the project that needed to be monitored and resolved.

- *Checkpoint meeting minutes* – these minutes are generated at the end of each major checkpoint in the SDLC process. Although a number of these minutes are generated for each project, only the one which results from the project cleanup was found to be of any real use. The others were mostly ignored.

- *Project review meeting minutes* – these minutes comprise of a single document which summarizes the status of all current active projects. This document is produced every week by project management and lists all the activities in progress, blocking issues and project status. This document is useful in that it can be used to provide a history of what has happened over a project's life-span and the types of issues that seem to commonly arise.

Once the documents that were of use had been identified, they were then codified for factors that were inhibitors to the project's successful delivery, e.g. risks, and also for factors that were seen as useful or positive for that delivery.

- *Metrics*

Within the target organisation, there are two types of metrics that were examined for this study. The first of these metrics are referred to as Support metrics and are created by the Support side of the organisation. These metrics have a long history and are used to indicate what products have the most support effort logged against them. These metrics are used to identify documentation and/or quality issues that need to be addressed. The second type of metric are called QA metrics and are the responsibility of the QA part of the organisation.

These QA metrics are separate from the Support metrics and are simple number ratios and averages. These metrics relate to the pass/failure rates for the various suites of automated tests and the number of defects which are raised per turnover. At the time of this study, these QA metrics had only started to be generated and as such, there was very little history associated with them and no results that were reliable. As such, these QA metrics were discarded as not having enough reliability as a data source.

The Support metrics however have a long standing history that makes them a reliable source of data that can be used to identify problematic areas. Following discussions with the Support reps about what type of metrics they had, it became clear that there was very little difference between how these metrics would be analysed and the analysis of the user case history already covered above. The source

data is effectively the same and the use of this data to identify problematic areas would achieve the same result. As such, for the purposes of this research, these two data sources will be regarded as the same.

- *Surveys*

Within the context of this study, surveys were used in two major places as sources of evidence. The first of these was drawing on surveys already conducted by project-managers within the organisation as part of the "cleanup" stage of the SDLC, whilst the second, was surveys carried out by this researcher to follow up themes identified through the interviews.

The procedures used to collate and analyse the data were slightly different in each case. For the first type of survey, the data itself had already been collected. This researcher was aware that these surveys already existed because he had participated in them. As these surveys had been constructed and performed by project-management, there were certain restrictions on the use that could be made of them. The raw data itself - due to confidentially issues and age - was not available for analysis, but the findings and the summary of these findings were, and it was these that were used as input into the analysis process. The questions that were used in the surveys were also available.

For the surveys performed by this researcher, the procedures used to construct the survey and collate the results were as follows. For this study, two surveys were performed. The first of these was a pilot to determine how respondents reacted to the questions and to clarify any issues with them. The questions themselves were constructed with the aid of members of the project-management group and a smaller focus group who had expressed an interest during the interview process of helping with the survey. The questions were aimed at collecting a range of information primarily focused on the key areas below: -

- Who was the respondent?
- What was their knowledge of the internal company processes like?
- What was their understanding of IS "success" and the factors that might contribute to it?

- What was their understanding of the best ways of identifying and controlling such factors?
- What was their understanding of IS methodologies?
- What was their understanding of evaluation practices?

These themes were chosen because they focus on the key ideas behind this research. Each key area had a number of questions that ranged from multiple choice, ranked selections and free text. To try and ensure that the individuals answering the survey responded to as many questions[28] as possible, the use of free text responses was kept to a minimum.

The method used to distribute the survey to the organisation as a whole was to follow the same standard procedure as that used by project-management. The survey was constructed and prototyped on Survey Monkey (http://www.surveymonkey.com) using templates and accounts available to project-managers. Once the prototype had been constructed and the flow tested, the URL for the survey was distributed to a pilot team who ran through the survey to test out the questions and provide feedback on issues that had not previously been spotted. Once the pilot team had completed this run, corrections were made to the survey and it was rolled out to the targeted teams on-mass.

The procedures used to analyse the results from the surveys run by the project-managers was to focus on the findings and categorise these based on common results between each of the surveys. As the format for the presentation of these results was the same, the analysis was done in terms of these presentation categories[29]. For each category, the main findings were summarised into the key factors identified. This summary was reviewed with the project-management group to ensure that they confirmed this summary was a fair and accurate representation of the data. Once this summary was done, the key factors were split into the organisational areas that this researcher – and various project-managers – agreed was the best fit for that key factor. The factors were also classified in terms of what effect that they might have on the success of an IS system and also, if they were direct or indirect factors. This

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[28] The actual questions themselves are detailed in the supporting volume.

[29] See chapter 4 for more details.

classification was arrived at by discussion between this researcher and the various project-managers who were taking part in this activity.

The analysis of the results gained from the survey performed by this researcher was carried out in much the same way. The responses from the survey were summarised into the key factors that had been identified for each question. Because this research was only interested in the *critical* factors, only the top half responses from each question were used as input into the analysis process. The analysis of the other set of results is an activity which is beyond the current scope of this research. Once these results had been collected, they were categorised into organisational areas and the type of factor they might be – direct/indirect, enhancing or inhibiting. This classification was performed based on discussions within a focus group that include project-managers and various other interested individuals from both Support, Development and QA. Most of the decisions on how to categorise a response were unanimous, however, where no firm agreement could be reached a majority view was taken based on the discussions presented.

- *Critical incidents*

Critical incidents fall into two primary categories. There are those which are defined and tracked by the organisation as critical incidents or escalations and the more commonly regarded definition which is those incidents that people remember the most when asked about specific situations. Within the target organisation, the definition of a critical incident is a situation with an account which - due to either a product issue or a situational issue - has gotten to a point where things are going badly wrong and need to be handled outside of the normal support process. It is the task of the escalation centre to keep track of these situations and ensure that they receive the attention that is necessary. A weekly list of escalations is produced with a brief description of the issue and its current status. As a source of evidence, this list was fairly useful in that it was able to provide pointers to areas where issues had arisen. This source of evidence is very similar in nature to the customer incidents referred to above and as such, can be subjected to the same form of analysis to identify common factors which might have helped contribute to that escalation.

The other form of critical incident analysis undertaken was to ask interviewees during the interview process what situations they remember the most that highlights for them examples of IS success or failure. Of course, this type of analysis is purely subjective and is rooted in each individual's personal definition of success and

failure. It can however be useful in defining what factors people attribute to success and failure and what types of situations have arisen over the years that led to such constructs being formed. The value in this type of evidence is that it can uncover opinions and factors which might not be found in other forms of evidence and secondly, that it can help to add more contextual details to sources of evidence like escalations or support incidents that might not otherwise be available.

In the context of this study, the value of this source has been mixed. It has been useful in identifying peoples concerns with the current SDLC process and how the organisation deals with some situations that add further risk to IS projects. It also helped to add context to a number of cases that featured in other evidence.

The procedures used to collect and analyse the critical incidents depended on the type of critical incident described above. The first type of critical incident was collected from the weekly escalation reports raised by the escalation centre. These escalation reports were collected over the same period as the user case history – June 2004-June 2005. These escalations were then analysed via their assigned root cause where the root cause is from a list of pre-defined organisational standards[30]. For the second type of analysis, this data is purely qualitative in nature and as such was analysed using codification techniques. The data was mostly gathered during the interview phase and as such, the processes used are described in detail in that section above.

3.5.1.4 Protecting the data integrity

In looking at data collection, Yin suggests three principles that can help to maintain the integrity and reliability of any data collected. These include using multiple sources of evidence, creating a case study database and finally, maintaining chains of evidence. Using multiple sources of data, such as this study is doing, allows the results of any analysis to be triangulated[31] in order to improve both its validity and help identify any

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[30] See section 4.2.4 for more information.

[31] Denzin (1984) identified four different types of triangulation covering data, theory, methodology and investigator. Triangulation is a process where each area of interest is analysed from different perspectives in order to maintain the integrity and validity of the research process. See Denzin for more details.

potential biases that might be present. Secondly, once this data has been gathered, a case study database can then be used. More details on these steps are given below.

3.5.1.4.1 The Case Study Database

In this study, the case database was organised initially around the development projects being undertaken, job functions and the four candidate areas that were identified. As the analysis proceeded however, this categorisation was enhanced to include success/failure factors and the areas that they related to. The case study database was implemented using a custom designed database schema that incorporated the following identified entities: -

- *Job names and functions* – These entities were used to capture the jobs and job functions of people questioned. As the same job functions can be shared between many different jobs, the job titles and functions were captured and held separately.

- *Categories* – This entity was used to capture the main categories around which the questions were focused. These categories were identified in chapter 2 and were environmental context, developmental and support processes, stakeholders, technology and others (unspecified factors which cannot easily be classified).

- *Questions* – This entity was used to track the questions that were developed and their history. Separate database entities were used to track the categories that questions fell into and the job names those questions were targeted at. Additionally, as many of the questions fell into common meta-areas, a separate database entity was also used to track these meta-areas as they were identified.

- *Data sources* – This entity was used to track the data sources that were used, the assets that were identified and which assets belonged to which data source.

- *Factors identified* – This entity was used to track the factors that had been identified and what sources identified them.

- *Evidence comments* – This entity was used to track any comments relating to evidence.

- *Interviews* – This entity was used to track those interviews where permission was given to record the interview. In these cases, the interview text was also stored.

- *Metrics* – This entity was used to store any metrics that were gathered.

The case database was custom implemented by this researcher using Oracle 10g RDBMS and ANSI/98 SQL[32].

3.5.1.4.2 Chains of Evidence

Chains of evidence were maintained to allow an outsider to be able to audit the derivation of evidence from the initial research problem identified through to the conclusions that are eventually reached. These chains of evidence were stored in the case study database and consist of annotated comments on areas of interest.

3.5.1.4.3 Triangulation

The data sources that have been identified include both quantitative and qualitative sources. The reason for this, as stated above, is to allow the results of the analysis to be triangulated with each other. In most research projects, this triangulation is aimed at analysing the results of the research, in this study however, it is not so much the results that matter, but how those results have been identified, i.e. the questions that were used to gain them. To do this, the triangulation of the results is being used to determine if the questions that were asked and the results of the metrics identify the same areas of weakness. In the case of the metrics, these areas of weakness are primarily product quality and usability as these are the only areas where solid metrics are available. Product quality is primarily represented by the numbers of defects being raised, whilst usability is represented by number of enhancements raised against an area.

3.5.1.4.4 Case Study Questions

This section of the protocol is designed to summarise the types of questions that this study looked to address as it proceeded through the data collection and analysis stages. In terms of this research, the main questions asked in the interviews and the quantitative collection phases were focused on the following areas: -

- Understanding the types of development and support processes that went on within the organisation and from that understanding trying to identify the critical entities or factors being controlled by that process.

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[32] The schema for these tables is include in the appendix

- Understanding the organisation's definition of "success" as a construct. How that construct was perceived by different parts of the organisation and how it was measured.

- Understanding the factors that contributed to that definition.

- Looking at what were the key areas that were believed to contribute to the success of a project and thus the most critical to monitor.

- Looking at what are the key organisational practices present for evaluating and controlling the IS development process, and if it was monitoring the "correct" things?

- Historically speaking, what were the main problematic areas that have caused issues in the past, and are they problems which seem to frequently occur? This question is aiming to identify potential problem areas that are frequently reoccurring within the organisational environment.

- Is the assumption that monitoring critical entities will better enhance the chances of project success a valid one to make in the opinions of those questioned? And if so, does the extra burden in evaluating them seem acceptable?

- Are the procedures described to operationalise the framework acceptable or are there issues that may need to be considered?

These questions were asked to determine if the areas identified were valid candidates and if the assumptions made about monitoring factors and the potential benefits that it brings were shared by a broader base of practitioner opinion. The sources for potential answers to these questions were drawn primarily from the experiences and opinions of those people who were interviewed.

For the actual questions that were asked, please refer to the appropriate source of evidence previously detailed in section 3.5.1.3.

3.5.1.4.5 Guide for the Report

This section of the protocol outlines the reporting format that was used to present the data collected and the results that were found. According to some researchers however, this guide is often omitted because as each case study is potentially unique, a fixed reporting

format is often not appropriate (Tellis, 1997). In the context of this study however, the report format used was the standard report format for a PhD dissertation.

3.5.2 Guidelines for Operationalising the Success Package

This final part of this section discusses potential guidelines that could be used to operationalise the generation of the success package. Essentially, the goal of this framework is to generate a library of questions that could be used to help identify those factors which might be critical to the success of an IS system and propose measurements that could track those factors. As such, there are a number of primary stages that would need to be followed in order to generate the success package. These are as follows: -

- *Determine if the success package framework is right for you*

  This might be an obvious statement, but the first step in any project would be to determine if the notion of the success package is a right fit for the IS project that is being implemented. As stated in the introduction, the success package is aimed at a certain type of IS project and as such, it should be decided if the framework would be useful to a project before just using it. The main types of IS project for which the framework would be useful are projects where

  - some sort of IS development methodology is used,
  - the organisation undertakes a significant part in developing the requirements or code for that IS system,
  - the organisation is performing significant customisation to already existing software to make it meet their specific requirements.

  If any of the above is not the case, then the success package might not be worth the additional effort for the organisation to use.

- *Determine the types of areas that need to be focused on*

  The framework suggests a number of areas that should be focused on when looking for success factors. These areas are based on priorities suggested by the literature and research that has been done into IS success and failure. However, this does not guarantee that the areas being monitored by this framework match the exact environment into which the success package maybe used. As such, it is worthwhile

validating these areas to ensure they cover the needs of the IS project. If adjustments are needed, then these should be made.

- *Determine who to ask*

  As was discussed in the previous chapter in section 2.7.3.1, identifying who is best to provide answers to any questions that might have been constructed will be key to determining the usefulness of any factors identified. The types of candidates identified are those roles that have direct responsibility for management of the project deliverables, resourcing, development and requirements generation. These are the roles who will be most familiar with the types of factors that will promote or detract from the success of the IS system.

- *Identifying the initial candidate set of questions*

  If the success package framework has not been used in the organisation before, then the first step that must be undertaken is to define possible questions that could be used. These questions should start by reflecting the types of issues that the organisation has had to face in the past. There are a number of challenges about the construction of such questions that must be tackled. The first of these is to identify possible sources of evidence that can be used to identify past factors that have affected success. The sources of evidence that were used in this study are discussed in the next chapter and could form the basis of possible future sources.

  Once such sources have been identified, they should then be analysed to determine the factors that have promoted or inhibited the success of past IS projects. The type of analysis that is done will be determined by the type of evidence that is being examined. Examples of possible methods are also discussed in the next chapter, but some examples might be

  - questionnaires that focus on seeking what went right and wrong with past projects,
  - interviews with key stakeholders in previous software development projects,
  - retrospective brainstorming sessions with key stakeholders to look for ideas of process weaknesses or areas of improvement,
  - undertaking process audits using frameworks like the CMMI to identify potential improvements.

The goal of this analysis would be to identify factors that inhibited the success of past projects and also those that were seen as being beneficial.

Once these factors from past projects have been identified, then their criticality and impact needs to be assessed. Different methods of classifying factors were discussed in chapter 2, but what needs to be examined here is the type of impact the identified factors may have on the success of an IS project and the importance of tracking that factor. The suggested mechanism for doing this is to create a small review team of key stakeholders who are intimately involved with the development process and have them review the possible factors that were identified and determine how critical those factors are. One possible way of doing this is for the team to discuss each of the factors using the following criteria:-

- *Did the presence of this factor contribute to the success of the IS project?*

  This question is aimed at establishing if the presence of this factor helped promote the success of the IS project or not. If it did, then it can be classified as *enhancing*.

- *Did the presence of this factor harm the success of the IS project?*

  This question is aimed at establishing if the presence of this factor helped promote the failure of the IS project or not. If it did, then it can be classified as *inhibiting*.

- *Was this factor something the organisation had direct control over?*

  This question is aimed at establishing if the factor was something the organisation could control and directly influence. If it was, then it can be classified as *direct*.

- *Was this factor something the organisation had little or no control over?*

  This question is aimed at establishing if the factor was something the organisation had little or no control over or if they could influence how it impacted on their project. If they had little control over it, then it can be classified as *indirect*.

- *How critical was the presence of this factor to the success or failure of the IS project?*

This question is aimed at establishing the criticality of the factor and its impact on the IS project. If factors are deemed as being of high importance to the success or failure of the project, then they should be put forward as candidates for being tracked. If not, then they should be removed from the consideration list.

- *How unique was this factor to a particular project?*

If the factor was unique to a project and was deemed as unlikely to occur again, then it should be removed from the consideration list.

Once each of the possible factors identified has been through these questions, then the team can focus on those factors that are viewed as being both generic and critical in nature. These are the factors which would form the basis of the questions that would be asked.

- *Constructing the questions*

Once an initial set of factors has been identified, then the next step is to construct a set of questions that could be used to track those factors. The exact nature of those questions would need to be determined by the type of factor those question(s) were trying to manifest. What follows however, is a suggested procedure that could be used to construct them.

Using a review group similar to the one suggested above, the factors identified should be examined one at a time and questions proposed that could be used to represent those factors. Each factor may have a number of questions that have been proposed to track it and it will be the task of the review group to vote on these questions and come to a consensus about the ones best to use.

- *Test the questions that have been constructed*

Once the set of proposed questions has been identified, then they should be tested on a small scale to determine if they can be easily understood and generate answers that represent the intention for which they were constructed. This testing should be small scale and performed with a number of people who are representative of the target audience at which the questions will ultimately be aimed. The purpose of this testing will be to identify and correct any issues of understandability or usability with the questions before they are used in the real environment. Any issues that are identified at this stage should be resolved before proceeding.

- *How to use these questions in a live project*

The questions constructed above will reflect issues and success factors that were deemed to have a significant affect on past projects and provide ways in which those factors could be tracked. The process for using these questions in a live project is to ask key stakeholders at certain points in that project to provide answers to these questions and determine if they identify any issues or factors that need to be tracked. The exact timing of when to ask these questions will depend on the nature of the questions identified and the stage that the project is in, but here are a few examples that could be used.

In the target organisation where this framework was tested, one of the common issues that was identified from past projects was the issue of unrealistic timescales in which given features were to be delivered. The critical failure factors that were identified from past project retrospectives were: -

- Estimations were not realistic or well researched.
- Complex features were not broken down enough and designed in advance to give good estimates.
- Senior management set release schedules and features without enough prior analysis into feature costings.

From these failure factors, a number of simple questions can be constructed: -

- Have the features you are intending to deliver been properly broken down and costed?
- For the features you are looking to deliver, have design documents been generated and reviewed?
- For the features you are aiming to deliver, do you have documents that describe the user interaction and expected results that those features are supposed to have?
- Before committing to senior management has all the necessary design work, costing and contingency analysis been done to ensure that dates are achievable?
- Do you have sufficient project resourcing to ensure your milestones are still achievable?

These questions are present to try and ensure that before the project schedules are committed to, that the features which are aimed for delivery with that project have been properly analysed and costed. As such, these questions need to be answered by key stakeholders such as project managers, development managers, product-managers and product architects. The answers to these questions will give a gauge as to how confident these stakeholders are about the features that they are designing and when they can be delivered. If the questions identify that there are features which are not quite as well estimated and broken down as others seem to think, then this has identified an issue that needs to be investigated further before the project is committed to. It might be that further investigation will identify risks that have not been clearly communicated or hidden from the greater project team, risks that might not have become visible until well into the project lifespan.

If the above questions did indeed identify a number of issues that had not previously been known, then the impact of these risks on the project needs to be determined and mitigated for. The process for doing this could be much along the same lines as that used for determining which factors might be useful for questions to track. Firstly, a small review team that is familiar with the issues identified needs to examine them to determine their potential impact on the project. If their impact is negligible, then the issue can be tracked, but not necessarily mitigated for. If the potential impact is something that does raise a concern, then plans can be adjusted to mitigate for those impacts.

The importance of any factors identified and the need to address that factor must be gauged by the impact that this factor will have on the potential success of the IS project. This sort of classification can only be done by a review team of the necessary stakeholders. A possible procedure to use to classify this impact is for the review team to briefly speculate what would happen if the factor under consideration were to be left "as is" and predict the potential costs verses benefits of addressing that factor. In the case of the example given above, this analysis might look something like the following:-

- *Potential Consequences of not completely analysing feature X?*
  - The development of the feature requires more time and resources than originally planned for which impacts on the release schedule and project cost.

- The development of the feature has more impacts on other features than originally planned for which impacts on the release schedule and project cost.

- The development of the feature is as expected and comes in on plan.

- The development of the feature may have major issues that mean it may not be possible to implement without significant investment of time and resources.

- *Cost to correct the issue identified*

  - Another week of design effort is needed to fully breakdown and cost the feature.

  - Resources used for this design work will mean delays to other work they would otherwise be doing.

  - Schedule needs to be adjusted to absorb the impacts.

- *Benefits to completing the design work*

  - Feature X is well known and the costs and impact to the product of developing it have been clearly determined.

Using this sort of information, the review group can make a reasonably informed decision about whether or not to address the factor identified and the potential consequences that might arise as a result.

Once the questions have been constructed and tested, they should be available for use in a live project. They should be used along side existing project methodologies and be seen as a supporting aid to those methodologies and not as an alternative.

- *Reviewing and updating the questions at regular intervals*

To ensure the questions are kept relevant and up to date, there should be regular reviews of the questions and the factors that they represent to ensure that they are still useful. This review can also be used to ensure that additional important factors that might also need to be tracked can be added and less important factors removed. It is suggested that this review is performed on an annual basis or after any significant event in either the

organisation's structure/culture or the environment in which it operates that might mean such a reappraisal is necessary.

This section has focused on what steps might be necessary to operationalise the proposed framework. The points raised above have focused on a number of main steps – identifying which areas are important to the success of the IS system, identifying key stakeholders, identifying potential questions from factors arising in past projects and lastly, using these to track factors or issues that are most relevant. The intention of this has been to provide some guidance on what an organisation may need to do to put this framework in place and the types of issues that they will need to look out for.

3.6 DATA GATHERING, ANALYSIS AND VALIDATION

This final section will build on the case study protocol described above and outline in more detail some of the issues to do with how the data was gathered, analysed and validated.

3.6.1 Collecting the Data that was used in the Study

In the protocol outlined above, several different sources of data were identified. These were in-depth interviews, documentary evidence and past defects or enhancements. Each of these sources of evidence however had a number of limitations that needed to be catered for during the data collection phase.

The documentary evidence for example, was useful in identifying those factors that the target organisation deemed as being critical to their own internal development processes and how those factors were being monitored. This evidence however was limited in that it only provided information on one aspect of the IS development process. As has been argued previously, an IS development process is more than just a formal lifecycle. It is a process driven by the actions of key social players. As such, it is necessary to understand the behavioural patterns and attitudes of these people. Interviews are one of the better ways of gathering this kind of information. Such interviews however, are subject to the bias of both the person being questioned and how the interviewer interprets the information they are given. To help counter these concerns a number of practical things can be done.

The first of these is to use multiple sources of data which can help validate some of the responses that interviewees give. These multiple sources might include using the responses of other interviewees to cross-validate answers or using secondary sources of evidence such as documentary evidence. Once such sources as these have been gathered, they

can then be used to triangulate the data[33] in order to identify what potential biases may need clarification.

Another approach that can also be used is to utilise the investigator's knowledge of the environment under study. While this approach is not as desirable - because the investigator's knowledge is also biased - in those places where the interviewee data reflects possible inaccuracies, then the investigator is able to make an informed judgement which can then be added to the case study database. In this way, the chains of evidence underpinning the study can be maintained.

3.6.2 Conducting the Interviews

As mentioned above, those people who were interviewed were selected mainly on a basis of job function. This selection was influenced by the candidate areas that were identified in chapter 2 and was intended to represent those individuals who specify the requirements of the software, develop the software, support the software, manage the software development process and lastly, who are responsible for the long-term goals of the software. While these choices of job functions did reflect the specific functional groupings within the target organisation, it was also based on the areas of interest that were identified as a result of the literature review in chapter 2.

The interview sessions were open-ended and semi-structured in nature. They followed the protocol outlined in section 3.5.1.3, and questioned the interviewee with regard to the following information: -

- The job functions that the interviewee undertakes.
- Processes that are undertaken to support these functions.
- The documents or information produced during these processes that might be relevant to the study.
- The interviewee's understanding of what a "successful" IS system actually means and what factors they believe the organisation monitors to support that "success".

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[33] Data triangulation is used to compare data gathered from different sources to help improve construct validity -see Denzin (1984) and Patton (1987) for more details.

- The interviewee's involvement with the IS development process and what they saw as being the key checkpoints within that process. This included details of any formal/informal ISD that the organisation followed.

- Any particular incidents or cases of IS failure that the interviewee was familiar with and the circumstances that gave rise to it.

- The acceptability of the procedures used to operationalise the framework.

- The interviewee's opinions with regard to some of the assumptions underlying the arguments within this study. This was mainly focused on the candidate areas defined, the usefulness of monitoring factors with regards to IS success, how such factors/entities should be monitored and finally, the importance that the IS development process has towards the eventual success of an IS project.

These questions were aimed at helping to assess the interviewee's function within the organisation, their knowledge of the organisation's practices as a whole, their opinions as to what IS success and failure actually means, and finally, how they felt about the assumptions underpinning this study. This is the primary information that was used for the study.

3.6.3 Analysing the Data Collected in the Study

The majority of the data that was collected in this study was qualitative in nature, and as such was analysed using techniques that can identify common themes or classifications within that data. With regard to analysing data collected during a case study, Yin discusses two general strategies that could be used. The first of these is to analyse the data using the theoretical perspectives that led to the case study being designed in the first place, while the second is to develop a case description framework which can be used when such theoretical perspectives have not yet been defined. In either case, the purpose of these evaluation strategies is to define patterns or themes which will be looked for when the data is finally analysed. In terms of this research, these theoretical propositions have already been described and relate to the four candidate areas that were investigated. As such, the analytical strategy that was used was to look for factors and themes within the data that could help establish a level of construct validity for the theoretical framework proposed. In addition, it also aimed to identify any themes or areas that were missing from the framework or questions that could be used to better identify success factors.

When looking at possible analytical techniques that could be used, Yin outlines four dominant modes. These are pattern-matching, explanation-building, time-series analysis and

program logic models. Pattern-matching is a technique which is primarily intended to compare an empirically based pattern with one that has been predicted (Trochim, 1989) and as such, is of especial interest when studying theories which contain explicitly stated dependent or independent variables. Explanation building on the other hand, is more of an inductive approach and is especially of interest when building an explanation of a specific case. It is an iterative process that takes a theoretical explanation and revises it based on the data identified. Time-series analysis is a technique used primarily for experimental and quasi-experimental studies where the dependent and independent variables are monitored over a given time period. Lastly, program logic models are a mixture between pattern-matching and time-series analysis. In the context of this research, the most applicable model was pattern-matching as this technique allows the theoretical framework to be compared against the evidence gathered as a result of the study.

In order to do this, the data which was collected was analysed in terms of the common themes or areas that appeared to be manifesting themselves within that data. These themes were identified through the use of thesaurus construction techniques, such as facet analysis or Nvivo, and then related back to the relevant areas within the framework. These themes were also validated using a review group of stakeholders from within the target organisation. Once such themes were identified, they were compared against the framework and the results of this comparison used to revise the framework as appropriate.

3.6.4 Validation

The last issue that needs comment on is the issue of validation. This is essentially about taking steps to ensure that any biases which might arise during the data collection phase are kept to a minimum or noted in the case study database. In this chapter, a number of techniques have already been mentioned that can help with this validation. These were using multiple sources of data, keeping a case study database to maintain chains of evidence and lastly, using more than one environment from which to draw evidence. These procedures are in place to ensure that the construct validity, reliability, and external validity of the framework proposed can be tested in a suitable way. These tests are necessary to ensure that any results or data collected can be independently scrutinised and accurately reflect the research process. Table 3.4 below summarises how this study tackled these issues of validity.

Test	*Reason for Test*	*Tactics used to enforce test*
Construct Validity	• to ensure that the framework developed uses "correct" measurements for the concepts being studied	• use multiple sources of evidence in the data collection stage • have key informants review and comment on the ideas/assumptions behind the study • use chains of evidence to allow outsiders to audit the case study database and the results found
External Validity	• to establish which domains the study's findings can be generalised to • to ensure that the framework developed does have some applicability outside of the immediate environment that gave rise to it	• draw evidence from more than one environment • using a framework drawn from previously developed theoretical concepts rather than one developed inductively
Reliability	• to ensure that the case study operations can be repeated with the same results	• using a case study protocol to describe how the case study data will be collected and analysed • maintaining a case study database to detail procedures used and any issues that arose
Data Triangulation	• to ensure that the data gathered is "valid"	• as mentioned before, Denzin (1984) defined four types of triangulation which could be used to enhance the validity of both the data gathered and the resulting conclusions. Of these four, this study will be using data triangulation, which is when a researcher draws on multiple sources of data to investigate the same phenomena. In this study, these data sources will be documentation and interviews.

Table 3.4 Tests for Validity

The issue of validity applies to both the data and the framework which is based on that data. The data which is being analysed for this study is focused on identifying product or process issues which affect the success (or failure) of a specific IS system within the target environment. As such, the validation of the framework – and the areas it is focusing on – is highly dependent on the validity of the data that is gathered. The data needs to indicate that the candidate areas which have been selected for the framework are valid ones to use. The tests for validity described above are thus not just validating the data that was gathered, but also the framework that is being developed using that data.

3.7 SUMMARY

The role of this chapter has been to detail the research methodology that was used to implement this study. It was decided that a case study based approach would be used because the data that was gathered was primarily qualitative in nature and that the inductive approaches of qualitative methodologies, such as grounded research, were inappropriate. In light of this, this chapter has described the case study protocol that was used to perform this study. This protocol discussed the types of data that were gathered, the data sources that were used, how the data was analysed and finally, the methods used to ensure the validity of results.

The aim of the case study was to examine evidence from a number of development environments and develop a framework that can aid in the identification and measurement of IS success factors. This development was aimed at validating the four candidate areas that were detailed in chapter 2, formulating questions based on these areas and lastly, testing the usability of a mechanism that could be used to operationalise the framework. What is not covered in this case study protocol however is a test of the final framework itself. As has been mentioned previously, this study was not aimed at confirming if the framework proposed actually helps contribute to the eventual success of an IS system, but rather, was focused on developing the framework itself. To be able to test the practical use of the framework would require an additional set of longitudinal studies following the development of an IS system from conception through to delivery and after. This is not something this study was focused on. Until the concepts that the questioning framework embodies have been tested and refined, there is little point embarking on using that framework as the areas and procedures that it utilises might not be correct. So, in light of this, the initial priority for this study was to ensure that the candidate areas chosen and the procedures proposed were both theoretically sound and practical to implement. It is this which the study was primarily focused on.

4. Results and Discussion

This chapter is intended to detail the results of the research process that was undertaken and discuss how these results apply to the research problem that this thesis was aiming to investigate.

4.1 CHAPTER OVERVIEW

The goal of this chapter is to detail the results that were gathered from this research project and discuss how these results relate to the research problem that was being investigated. The chapter is split into two main sections. The first section deals with the results of the research that was undertaken, whilst the second focuses on discussing the issues that were found and potential ways to resolve them.

For details of all the supporting evidence and analysis results, please refer to the second volume of this thesis. References will be made to tables of results which are contained in that second volume.

4.2 ANALYSING THE RESULTS OF THE RESEARCH PROCESS

The goal of this section is to discuss the results that were gathered during this research project and their associated analysis.

4.2.1 The Types of Data that were gathered

Before discussing the results of the research that was undertaken, it is worth providing a brief summary of the data sources that were used in this investigation and the types of data that was analysed. In the previous chapter (section 3.5.1.3), a number of data sources were cited as to what types of information were going to be used in this research. These data sources can be summarised as follows: -

- *Company standards documentation* – This source was archival and refers to company standards.
- *User case history* – This source is archival and refers to product defects and enhancements raised by customers.
- *Interviews*- This source refers to interviews with primary stakeholders.
- *Sales write-ups* – This source refers to sale write-ups.

- *Consultant reports* – This source refers to reports and knowledge-base articles generated by consultants.

- *Meeting minutes*- This source refers to minutes from meetings.

- *Metrics* – This source refers to internally generated metrics.

- *Surveys* – This source refers to surveys that were carried out both by this researcher and by the target organisation as part of its standard practices.

- *Critical incidents*- This source refers to critical incidents that people remember and those that fall within the target organisation's definition[34].

As can be seen, the sources of data used were both quantitative and qualitative, but the focus of the research was on data gathered from qualitative sources – especially archival and interview.

The next section will focus on reviewing the results from these sources one by one, discussing any issues encountered while gathering or analysing the data from these sources and lastly, summarising how these results relate to the research project.

4.2.2 SDLC Documentation – Company Development Standards

This archival data source details the general company standards for the processes used to define requirements, produce design specifications, implement products and lastly, maintain those products. It defines a lifecycle that each product must follow and provides a set of standardised development/maintenance practices that teams should adhere to.

The goal of analysing data from this source was to determine those factors which the organisation believes are important to success. This analysis was undertaken by reviewing the SDLC process and from the deliverables of each stage, determine the types of entities being tracked. As stated above in chapter 3, the available SDLC documentation was not regarded as being a particularly good data source. The information and guidance that it gave was very incomplete and as such, only high-level entities and measurements could be found. Table 4.1 in the second volume details for each stage within the SDLC what these entities and measurements were.

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[34] The organisation defines such critical incidents as escalations

As already stated, the official SDLC documentation covers very little of what is actually undertaken for each of the SDLC stages. The majority of the real information was captured via the interview process. The assets that the SLDC documentation mostly deals with are formal sign-off sheets and planning documents. As all the entities and measurements detailed in table 4.1 are coming from the target organisation's project processes, they can all be assigned to the project management candidate area. Some of the entities identified can also be fitted into other candidate areas as shown in table 4.2 in the supporting volume.

In the context of the SDLC documentation, none of the entities or measurements identified was seen as having a positive or negative affect on IS success and as such, are regarded as neutral in nature. These entities must be present for the product to move through the SDLC lifecycle, but their presence - or lack of presence - is not regarded as being critical to the success of the IS system by the target organisation. This opinion was also shared by the project-management team.

4.2.2.1 Analysis Results for this Data Source

This data source was analysed to determine the types of entities and factors that the current development process views as being important. As can be seen in table 4.1, the entities, measurements and processes described relate to a standard water-fall type of model. Each stage has a number of outputs relating to the assets necessary to support that stage and the approvals needed to complete that stage. The entities and measurements captured at each part of the SDLC process reflect these assets. While the process requires that these assets be present for a stage to be exited, these assets themselves were not viewed by stakeholders as having a promoting or inhibiting affect on the overall success of the IS development process. The documents that are constructed are mostly summary documents for work which has already been performed at that stage. As such, it is the quality of the detailed work that has been done which will promote or inhibit the success of the IS project, not the summary documents themselves.

The SDLC is supposed to assist the organisation in performing a realistic analysis of what is needed in terms of time and resources to deliver a quality solution to a set of product requirements. The information obtained from this data source however, shows that the SDLC process does little to practically assist with this goal. This is an area of weakness that needs to be addressed.

4.2.2.2 Constructing questions and measures for the proposed framework

As the entities and measurements that were identified from this data source are seen as being neutral, then the questions that might be developed for the questioning framework would have to be focused on simply identifying if they were present. However, what really needs to happen is that the questions constructed need to identify issues and weaknesses with the SDLC process. There are questions of this nature already specified in the survey detailed in section 4.2.9.2. The aim of such questions was to do the following:-

- Identify what areas and factors are tracked by the organisation,
- Identify the strengths and weaknesses of the existing processes,
- Identify what needs to improve within the context of the existing processes,
- Identify what is missing from the existing processes that people believe need to be tracked.

As questions already exist in section 4.2.9.2 that cover the above points, then no further development is needed for this data source. The same statement is also applicable to the measurements that could be used to track the results from these questions.

4.2.3 Sales Write-ups

This source of data is qualitative in nature and was constructed around write-ups performed by sales/consultants when a sales opportunity either succeeds or fails. The issue with these write-ups however is that they are undertaken inconsistently and the amount of useful information that they contain is sketchy. At the time of this thesis write-up, these documents were no longer produced, but similar information was captured online at http://www.salesforce.com. Access to this new source of information however was not available to this researcher as it was restricted.

As these sales write-ups were inconsistent in the information that they captured, analysis of these reports was dependent on the types of information that they contained. Write-ups had to be obtained from personal contacts within the Sales and consulting organisations, because there was no reliable central repository in which the information was stored. The reports obtained were broken up by sales region. For Europe, the number of reports obtained was 22. For the Far East, the number of reports obtained was 9 and for North America the number of reports was 14. This made a total of 45 reports. Of these 45 reports, 11 were detailing failures whilst the remaining 34 dealt with successful sales. Once the

reports were obtained, they were codified based on the stated reasons why the sale was successful or not. Contextual information - when provided in the report - was used to help with this codification, but given the nature of some of the information supplied[35], this was not always possible. When looking at the types of information that the reports contained, the following categories were used to help codify the data: -

- *Needs and motivation* – This category was looking at the motivational needs as to why the client organisation was after the software. The idea behind this category was to identify the types of precursor events that made an organisation consider the types of software that the target organisation offers. If such events could be identified, then better tracking or support for such events should be part of the success package. Also, these events could be used as additional information to help validate the types of questions that were aimed at Sales, Marketing and Executive management.

- *Opportunity* – This category was looking at the events or factors that generated the opportunities for this sale.

- *Promoters* – This category was looking at the events or factors that happened during the sales process that helped promote the sale occurring.

- *Inhibitors* – This category was looking at the events or factors that happened during the sales process that negatively impacted on the sales effort.

For a factor to be placed into these categories, it had to be mentioned in more than just one report. Where clarification on a factor or event was necessary, the sales or consulting staff were asked for their opinions. The final set of categorisations was also shared with the appropriate staff to ensure that they agreed or could clarify any issues raised. Where such people had left the company, then the existing codification was kept. The results of this analysis are shown in table 4.3 in the supporting volume.

4.2.3.1 Analysis Results for this Data Source

The point of analysing this data source is that it can be used to identify factors that have led to a sales opportunity occurring or factors that have promoted or inhibited a sale from being closed. In identifying such factors, steps can be taken to maximise those which promote sales

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[35] Some of the details provided were confidential and could not be used. Other information was inaccurate or incomplete.

opportunities and minimise those which inhibit a sale being closed. This data source represents a sample of the sales which took place over the period of 2003-2005 and shows a number of factors that could be tracked by the success package as things necessary to better promote the success of a sale.

The first classification that data was collated into was why the customer wanted to buy the software in the first place. This classification is very useful because it shows both the market needs that the product is being examined to satisfy and the profile of customers that the sales organisation should be focusing on. By examining the data sources it was clear that the main reasons companies examined the target organisation's software was to implement company wide configuration management standards, the need for specific functionality only present in the target organisation's software and the need to upgrade software versions. This indicates that if sales individuals can identify such organisations or convince organisations that they have such a need, then more sales opportunities could occur. These factors may not be directly relevant to the software development process, but they are key drivers that could be used to identify organisations to target the sales team at.

The second classification used was to collate those factors that led to a sales opportunity occurring. Again, these factors are not critically relevant to the software development process, but are key drivers that can help identify where opportunities to promote the software occur. The key factors that promoted a sales opportunity were those that came from other sales individuals passing on information to others that identified where an opportunity might be occurring, getting positive reviews in respected journals that led to the product being shortlisted and the movement of individuals who were already familiar with the software to other organisations and projects. As with motivational needs above, this analysis identifies a number of key factors that should be used to help the sales team generate more opportunities for sales to occur. As such, focus should be given on how these factors could be promoted within the organisation.

The third classification – promoters – identifies factors that promote a sales event being closed. The factors identified here are relevant to the sales process and also, the product itself. These factors primarily show that the wide range of technical/customisable features that the product has and the respect that it has earned in the market place are the key reasons that help a sale close. As such, these are distinct competitive advantages that the product needs to promote and maintain.

The last classification was for those factors that were regarded as being inhibitors to the sale being closed. This category is of especial interest because it identifies issues that the

organisation would need to ensure do not occur. Of these factors, the primary ones that were identified were that the product architect is old and needs fundamentally updating, the product was too difficult to setup and needed too much support to do so and lastly, that the GUIs the product offered were too difficult to use. These all relate to key product architecture issues that need to be addressed.

As can be seen from the above, this data source has identified a number of key factors from real sales examples that have either helped or hindered the sale process. These factors are exactly the sort of thing which can be put into the success package to monitor. These are not factors that are tracked by existing development processes or lifecycles and so need to be placed into something like the success package so that steps can be taken to ensure that they have visibility.

So, in considering how this data can be used in the success package, there are several points to consider. The first of these is that – for the target organisation - sales write-ups were a useful source of data in identifying factors that can generate sales opportunities and factors that can help promote, or inhibit, the success of that sale. The second is that whilst some of the factors that were identified can be measured in obvious ways, this was not true for all of them. In chapter 2 – section 2.7 – it was stated that the success package had to focus on those factors that have a criticality based on a known causal mechanism, or in other words, a factor that has a distinctive and measurable impact. For a number of the factors identified above however, this might not be possible and such factors need to be classified as standing or indirect. The presence of such factors was seen as helping the sale, but could not be directly controlled or measured.

Table 4.4 in the supporting volume summarises the factors that were identified in this sample and relates them – where possible – to one of the four areas proposed in the questioning framework. When considering motivational or instigating factors, this relationship has been done in the context of the buying organisation. This is to examine why they are buying the software in the first place. For example, do they have a project management need to address?

One of the possible weaknesses with the areas that were originally proposed for the success package is that they focus mostly on the internals of the organisation developing the IS project. This internal focus does not map well to factors present in buying organisations or enhancing factors present in the external environment. Although such instigating factors can be mapped to areas within the current framework if the context is considered to be the purchasing organisation, this is not a good approach if mixing such external factors and those

internal to the selling organisation. This is a weakness with the proposed areas that is commented on later in section 4.4.

4.2.3.2 Constructing questions and measurements for the proposed framework

When looking at possible questions that could identify and track such factors as those which came from the sales write-up, it was felt by this researcher, that valid questions already existed in the context of those created for the interview process. As sales-write ups were created by either consultants or sales personnel, the questions targeted at the consultants, account-managers and marketing profiles were reviewed and judged to provide thorough coverage of the factors that the sales write-ups had identified. This approach was later validated by comparing the factors that came from the sales write-ups against the factors that were identified by the interviews. While they were not exact matches, the factors generated from the interview process did address the same concerns as raised above, so as a result, questions and measurements created from the interview process were judged sufficient to cover this data source.

To conclude, the sales write-ups do present some good information about factors that can help promote or inhibit a sale being made. It has also identified some areas that the questioning framework does not currently consider as well as it perhaps should.

4.2.4 User Case History

This archival data source was used for two different types of analysis. These were problem areas in the product and reasons for critical incident escalations occurring.

4.2.4.1 Analysis of Problematic Product areas

The analysis of problematic product areas used the target organisation's customer case database to identify those product areas that had the greatest number of defects or enhancements raised against them. This analysis was done to identify - from a customer perspective - those product areas which had the greatest number of usability issues or defects. This analysis was performed using reports already available within the tool managing this database and produced the results summarized in table 4.5 in the supporting volume.

The results from the analysis show that a total of 1920 defects and 698 enhancements were raised during that year. However, from a research perspective, the results that are most relevant are those functional areas which have had the most defects and enhancements raised against them. To identify these, only the top six areas were considered. The reason for this is that when they were taken together, the top six areas accounted for about 63% of all the

customer defects and usability issues that were raised. As such, they covered those areas that were most critical to the product's success from the customers' perspective.

This analysis shows that the three most critical areas to the product's success are the GUI clients that the product offers (function N, O and I) - accounting for over 75% of the cases raised for the top six product areas. As such, this analysis indicates that making the GUI clients as defect free and user centric as possible must be a critical success factor that the organisation has to monitor.

As well as this annual analysis, there was some additional analysis done once every four months. This analysis was performed to breakdown the yearly figure to determine if the same results were true for each separate time period. The months analysed were June 2004-September 2004, October 2004-January 2005 and lastly, February 2005-May 2005. The result of this analysis is shown in tables 4.6-4.8 in the supporting volume. They show that the same areas of the product consistently have the highest number of defects and enhancements raised against them.

From this data, it is possible to state that support-engineers are having to spend the greatest amount of their time fielding calls on these three areas. It has been estimated that each call costs about $2000 (USD) worth of time and effort to answer, process and investigate and as such, the number of issues in these areas are consuming a significant amount of budget. Making use of this data as a success criterion could obviously help save valuable revenues if steps were taken early enough to try and reduce the issue turnover rate for these three primary areas.

As well as the number of issues that have been raised, it is also useful to look at the product areas that have had the highest number of severity issues raised against them. This information is useful as a source of evidence, because high severity issues usually imply – if the severity is high enough – that a customer is blocked and an urgent patch is necessary to resolve that problem. Producing patches or hot fixes[36] is costly as it requires both development, QA and support resources to fund the effort, so the fewer such issues that there are, then the less the drain on organisational resources. Tables 4.9-4.11 in the supporting volume list the five highest product areas that have had severity 1 or 2 issues raised against them. The definitions of severity 1 and 2 issues are as follows: -

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[36] A term used for a very limited patch.

- *Severity 1* – This means that a customer is totally blocked and the issue needs to be resolved as soon as possible - either by patching or someone going on site.

- *Severity 2* – This means that a patch is needed to resolve an issue, but it is not something that has to be done immediately as the customer has a viable workaround.

What this analysis shows is that functional areas I and O have repeatedly required patches to be produced for blocking issues. This indicates that questions should be put into the questioning framework that tries to identify why this is occurring. Such questions could consider things like test coverage, use case coverage and root cause analysis.

4.2.4.2 Analysis of Critical Incident Escalations

Escalations are raised for customers when a specific situation within a specific company has risen to a point where the target organisation must focus particular attention on that issue or else. This situation might be related to a product issue or it might be related to some sort of organisational issue, but whatever the cause, it needs to be tracked outside of the normal support process. The escalations used in this research were those that were raised between June 2004 and June 2005 and were analysed to determine - where possible – the root causes for those escalations.

Table 4.12 in the supporting volume lists the escalations and root causes that were identified for the period under investigation. The root causes shown are based on a list of standard root causes already defined by the target organisation. (Note - a technical escalation refers to what is perceived to be a product issue, while a situational escalation refers to any other non-product issue).

The results from the analysis were used to identify those root causes that were most responsible for customer escalations being raised. The top three selected account for 83% of the total escalations created. What this analysis shows is that product defects and mismatches in customer expectations (enhancements) accounted for a significant number of the escalations that were raised. (Note - the last of these root causes can be misleading as a patch request must be raised as a matter of process before any urgent patch can be made. As such, a patch request is simply present to note that an escalation has been resolved by a patch being delivered).

To make use of the above information, it is also necessary to determine - where possible - the functional areas affected by those escalations. This was not always possible because the data was either not present in the escalation report, or the contact name given was

no longer employed by the target organisation. However, where the information was available (for 32 escalations), the results in table 4.13 in the supporting volume show the primary causes for the escalations analysed. The results from this analysis tell a different story from the functional areas previously identified in section 4.2.4.1. This however, is not overly surprising as the escalations result from defects or enhancements that need immediate resolution due to critical customer pressure. As such, this analysis is always subject to skewing by major accounts or sales opportunities screaming for attention. What this analysis does show however is that the functional areas having the highest number of escalations need questions constructed which can identify why so many escalations are occurring in those areas and what can be done to better improve the situation. Such questions should consider things like test coverage and use case coverage as defects and mismatches in customer expectations are the main causes for such escalations being raised.

The usefulness of information gathered by examining the escalations raised during this period was mixed. The main concern about using escalations as a data source was that the escalations being raised are skewed by accounts that routinely raise escalations or by major sales opportunities that are blocked by product issues. The information however is still useful in that it helps to identify areas where the use case or test case coverage might not be as good as it should be. To address this, questions and measurements could be added to the questioning framework to track these concerns.

The last of the analysis that was done for this data source was on the background of the escalations and following up on what happened after they were resolved. This analysis was performed by interviewing the support reps and/or consultants who were involved in that escalation. The escalations that were used for this process were the 21 that fall into the three product areas that had the most escalations raised against them. As stated, of the 21 escalations raised, 11 had support reps and/or consultants who stated they would like to supply further information relevant to the research. The information gathered from these respondents was focused on the questions list contained in table 4.14 in the supporting volume.

The results from these questions were subjected to codification in order to create common themes for each of the responses. Where applicable, the theme identified was also classified in terms of the causal affect that it was viewed as having on the success of the IS system in the customer environment. The classification system used for these themes was based on those proposed by Williams and Ramaprasad in section 2.7.2. These were: -

- The causal affect that the presence of the theme was thought to have on the IS system – direct or indirect. The presence of a direct (or sometimes referred to as instigating) factor is viewed as having a causal/measureable impact on IS success, whilst the presence of an indirect (or standing) factor has an affect, but one that cannot be directly measured or attributed.

- The enhancing or inhibiting effect that the presence of that factor has on the success of an IS system. Enhancing factors are seen as making a positive contribution to the success of a system, whilst an inhibiting factor is seen as making a negative contribution to that success.

This classification was however, only performed for themes relating to why the escalation was raised. This was done because the factors that caused the escalation in the first place are the ones that most impact the success of that IS system in the customers' environment. The results of this analysis are also shown in table 4.14 in the supporting volume.

What the analysis shows is that the two primary causes for escalations being raised were either regressions or customers withholding payment for one reason or another. The analysis also shows that for the majority of cases, once the escalation was satisfactorily resolved, then the customer became "happy" once more with careful monitoring.

Overall, the user case history was a useful source of evidence. It helped to identify the main product areas that are causing customer issues and showing that defects and mismatched customer expectations are areas that need to be addressed if customers are to better regard their IS systems implementation as being "successful". The main use of this analysis for the success package is that the analysis of this data source has identified issues with the product's quality and usability that are impacting the success of the product and costing the target organisation money. These inhibitors are not mentioned in any of the existing target organisation's development processes and as such, never get resolved. This is thus a perfect example of how the success package could be used to track such additional inhibitors. The next section looks at taking the results from this analysis and proposing questions and measurements that could be used to track it.

4.2.4.3 Constructing questions and measurements for the proposed framework

In terms of the questioning framework, the results of this analysis indicate that questions focused on this source of evidence could be beneficial in identifying critical success and failure factors. Issues that were identified in the above analysis show that there are certain

product areas that could benefit from more use case coverage and test validation. Example questions that could be added to the framework to help with these issues might be: -

- What level of test coverage does each product area have? Measured via percentage of functionality covered.

- What level of use case coverage does each product area have and have the use cases been reviewed by a customer proxy? Measured via percentage of functionality covered.

- Is information kept on customer usage of product areas and is this information used to generate test cases? Measured by the existence and detail of knowledge articles or test articles.

Other more specific process questions might be: -

- How do you record customer issues? As this is a general process question, there is no specific measurement that can ideally track this question. Such measurements could however, be constructed from the results of the question as this would probably identify entities that could be used.

- When you record customer issues are they logged against standard functional areas or components? The most appropriate measurement for this would be numbers of defects or enhancements raised against particular areas. This measurement is already being used by the target organisation to help indicate risk areas in the product.

- Is any use made of this data to identify problem areas? If so, how? This is a process question; however, depending on the results of the question, appropriate measurements could be constructed. For example, causal events or functional areas could be two such criteria.

- Do you have the notion of escalations or someway of identifying customer critical issues? This question can be measured using something like a priority attribute on a raised customer issue or defect.

- When escalations are logged, what categories – if any – do you use for those escalations? This question can be measured using the categories identified from the question and determining if any potential candidates are missing. For example, such categories might be product defects, product enhancements, configuration issue or documentation issues.

- Is any use made of this data to identify common themes? If so, how? This is a process question and like other process questions above, could be tracked using any results which arise from the question's answer.

As can be seen from the above samples, the questions asked to cover this data source need to focus on capturing what information about issues the organisation collects and how they organise it. If the information collected about user cases is categorised into common themes such as functional areas affected, defects/enhancements, usability issues etc, then this data can be mined to identify common areas that give users problems and this analysis reflected in success factors that are tracked for a project. The construction of appropriate metrics to track some of the questions asked could depend on either interviews with the appropriate support staff or by reviewing the support policies. These could even be the most appropriate way of measuring these questions as support staff are the ones who enter this information.

To conclude, this data source has been useful in identifying a number of problem areas in the product that could be tracked by the questioning framework. For the user defects, such questions could focus on improving the test case and use case coverage of the GUI clients plus the high severity functional areas, whilst for the escalations, questions aimed at use and test case coverage should also be constructed.

4.2.5 Interviews

This source of data is qualitative in nature and was constructed around the responses to the questions detailed in chapter 3. The interviews that were undertaken were semi-structured in nature and followed a set of standard processes that are detailed in the protocol covered in chapter 3. As that protocol stated how the interviews were performed, this section will only focus on the results that were gathered and how they were analysed.

The results gathered from the interview process came from a number of people in different positions in the target organisation - ranging from executive management down to the engineer level. The business units that were targeted included Sales/Marketing, Support and R&D. Table 4.15 in the supporting volume shows the questions that were used in the interviews and the key results that were found.

As the interviews were semi-structured in nature, other subjects were also discussed apart from the specific questions detailed in table 4.15. In many cases, these responses covered a variety of the questions already being asked and as such, where responses were relevant, they were recorded against the appropriate questions. Often, the responses given for different questions were very similar in the topics that they covered. This was due to the fact

that a number of the questions being asked covered the same theme, but from a slightly different angle. This redundancy was planned to help cross reference the responses given and create a level of self-verification into the results.

4.2.5.1 Analysis of the Interview Results

The results detailed in table 4.15 in the supporting volume were produced by codifying the responses from interviewees around the central themes that were identified for each question. Some of the responses given were unique, but the majority of them covered the same points from slightly different perspectives. Many of the themes identified could be seen spanning several of the questions that were asked, but the factors identified from the codification were kept focused around the relevant question. As such, the results detail - for each question - what process points or factors those interviewed believed were most relevant to that question.

However, the point of this research is to identify if the proposed questions or ones like them, can be used to identify success factors and if the organisational areas proposed are valid. As such, the analysis of the interview results did not focus on the data collected for each question, but rather, on determining if that data could be categorised into the proposed four areas and what the affect might be on IS success. The result of this further analysis is shown in table 4.16 in the supporting volume.

The categorisations shown in table 4.16 were derived as a result of discussions by a review panel from within the target organisation who volunteered to examine and categorise the results of interviews, supported by the codification tool - Nvivo. This panel was mostly made up of QA and development staff, but also included representatives from Support and Marketing. The panel discussed each of the results found and then, based on a majority decision, placed it into an organisational area. As can be seen, there were a number of results which the panel did not feel fitted into any of the organisational areas covered by this research. The majority of these were to do with financial/revenue based results or those to do with external market based perceptions of the product. Based on the opinions of those taking part in the interviews, these were important indicators of success and because they could not be captured by the candidate areas it was an indication that more research may be needed to identify how these results could be categorised.

For a large number of the results that were categorised, it was determined that they had little or no impact on IS success. As most of these results were to do with the processes that the target organisation used, such results were marked as being *indirect* with no enhancing or inhibiting properties. The results that were thus marked did not have any further analysis done on them as they were deemed to be not relevant.

What these results show is that asking targeted questions at individuals within an organisation can aid in identifying factors outside of the existing processes that have an enhancing or inhibiting affect on the success of the IS product. As an example of this, the questions identified that there were a number of success enhancers and inhibitors that were not currently being monitored as part of the existing SDLC process. This is a weakness with the target organisation's existing processes that needs to be addressed. This could be done by adding such factors to the success package.

Table 4.17 in the supporting volume was constructed as a result of discussions with the above review group to gauge how well people considered the target organisation currently tracked the factors identified from the interviews. Many of the factors that were identified were felt to be tracked in part by the organisation already, but not in a fashion that the group felt was suitable to use as a measurement. As such, this analysis shows that by using such questions it was possible to identify factors that were not currently tracked by the organisation's existing processes - factors that had caused issues in the past. These factors would then need to be assessed for criticality and added to the success package if deemed necessary for future monitoring.

To conclude, what this section has shown is that factors that affect the success of an IS system can be identified by asking questions which focus on the four suggested organisational areas. What has also been shown is that a number of those factors are not currently tracked by the target organisation and would thus be ideal candidates for the questioning framework. The results also show that the four candidate areas proposed are not enough to capture all the potential success factors that were identified and that as a result of this, either new area(s) need to be added or the definition of existing areas needs to be expanded. What such areas might be will be discussed further on in this chapter.

4.2.6 Consultant Reports

As stated in chapter 3, after initial investigation and discussion with consultants, this data source was dropped as a viable source of information due to its inconsistencies and lack of detail.

4.2.7 Meeting Minutes

This source of data is qualitative in nature and was constructed from reviewing the various types of project minutes that were generated for the projects described in chapter 3. As identified in section 3.5.1.3, there are three main types of minutes that were investigated for these projects: -

- *Weekly status meetings* – These are minutes that relate to weekly status reports for the projects. They track issues and blockers on a weekly basis. With all the various project teams that made up the projects investigated over the 2004-2006 period, 215 minutes were used for the analysis. These minutes covered the development, quality assurance (QA), documentation, project-management, product-management and support meetings.

- *Checkpoint meeting minutes* – These are minutes that are generated when a project reaches a major milestone event in its lifecycle. These minutes are only applicable for mainstream projects and not for SLA projects. As only the major projects were involved, a total of 8 minutes were available for analysis.

- *Project review minutes* – These are meetings which usually take place once every week to review the status of all development projects that are currently in progress. They track the high-level status of each project and any major blocking issues. For the period of 2004-2006 a total of 76 of these minutes were found for analysis.

The use of these minutes as a source of evidence was mixed. They can track either too much project specific information or information which is at too high a level to be useful. Nevertheless, this data source still produced some useful information for the lifespan of the two projects that were analysed.

As stated in chapter 3, the process for analysing these minutes was based on codification. The minutes were taken from the various repositories in which they were stored and the issues that they reported were analysed. It is important to note that the majority of these minutes do not record factors that led to something being "successful", but rather, focuses on those issues that block progress or that need to be resolved for the project to move forward. As such, the majority of the factors or themes that the codification identified were those that inhibited success, rather than those that promoted it.

The codification for the minutes was performed in much the same manner as that for the sales write-ups discussed above. The minutes were reviewed to determine if the content

they contained was useful, and if so, the issues in them were codified into the appropriate themes. If the issues being mentioned occurred only once and could not be fitted into a generic theme, then those issues were ignored for the purpose of the codification. If an issue was mentioned more than once, then it was captured into table 4.18. All the codifications that were performed were also reviewed and confirmed by a representative from the project-management team and the review group. Any changes that were identified from the initial codification were then made. These results are summarised in table 4.18 in the supporting volume.

By their very nature, minutes tend to be tracking issues rather than success items and as such, the themes that they highlight are more negative than positive. They do however, identify some common issues that could be better planned for. Table 4.19 in the supporting volume places the themes identified into the relevant organisational areas. As above, this classification was done with the assistance of the review group and available project-managers that were most familiar with the projects from which the minutes came. As the majority of the themes that were being highlighted were issues that could negatively impact upon the success of the IS project, such themes were classified as inhibitors. Table 4.19 took all the themes that were raised as a result of the analysis and put them into the organisational areas that they are most applicable to. As would be expected from the types of minutes analysed, the majority of the themes were more to do with project specific issues than any others.

4.2.7.1 Constructing questions and measurements for the proposed framework

Relating the above themes back to the questioning framework, there are a number of things that these results can help to provide validation for. The first of these is that the themes identified help to show that the organisational areas proposed are worth focusing on for recognising problems that will affect the successful delivery of an IS project. The second is that it provides examples of the types of issues that the questions being asked in the framework need to consider. Such example issues being resource usage, hardware and software that is needed to build the product, customer problems unrelated to the project that might detract resources from the project, feature and/or platform changes, managing quality in general and the consistency of the project processes being used. In section 2.7.3, one of the types of questions that was being considered was the question "*What are the critical resource issues, bottlenecks or dependencies that may affect the development process?*" This question was aimed at trying to identify upfront those types of bottlenecks or resource constraints that would affect the delivery of a project. While this type of question is at a very high level, it can be shown from the results in table 4.19, that resource issues and bottlenecks - such as the lack

of resources and delayed checkpoints - are an issue that the target organisation needs to consider very carefully. In the context of these results, the more focused questions to consider should be things like: -

- *Are the resources and build infrastructure sufficient to meet the demands that we are proposing to place on it?* This question can be measured by looking at the plans that have been put together for a project and also, examining the assumptions behind any resource allocations.

- *Is there sufficient resource coverage for any unexpected customer escalations outside of this current project?* The same measurement as above applies.

- *Is the resource allocation to the project sufficient to cover the project's requirements? Are any conflict resource needs identified as potential risks?* The same measurement as above also applies.

Questions of this sort are more related to the specifics of the organisation and development process being used and as such, should not be considered to be generic to any organisation. Such specific questions might need to be developed for the organisation once issues have been identified by the more general questions. This is because the generic questions can only identify potential issues at a higher level, but once such issues have been identified, then more specific questions – and ultimately – measurements should be constructed to track such issues. The questions above are aiming to address direct, inhibiting issues that arose within the project management area and as such, should be categorised as direct/inhibiting.

The issues identified in the analysis did contain additional areas of concern that are not covered by generic resourcing questions. These were the areas of requirements control, third party management, process management and quality control definitions. As such, there is a need to construct questions that would also deal with these concerns as well. Such example questions are listed in table 4.20 in the supporting volume. As the questions being asked are aiming to identify factors which could have a direct or indirect inhibiting affect on the IS project, then they are classified as either direct/inhibiting or indirect/inhibiting. These classifications were also reviewed by the review group.

To conclude, the issues raised from this source of evidence helped to validate the areas that were proposed as needing questions to cover them. Obviously, given the nature of this source of evidence, the types of issues raised are mostly those that would be controlled by an IS or project management methodology already, but such methodologies may not give the focus of control that some of these issues might need. For examples, issues of concern like

QA centralisation and the challenges that that brings would be specific to the structure of an organisation, and would need to be catered for outside of the scope of that methodology. This is what the questioning framework would help to support.

4.2.8 Metrics

As detailed in chapter 3, the formal use of metrics by the target organisation is (or has been) very limited. Although QA metrics exist for defects etc, at the time of this study, they were not mature enough to be able to be included as a source of evidence. For the support metrics, these were already analysed in section 4.2.4.

4.2.9 Surveys

This source of data is quantitative in nature and involved two sources of evidence. The first of these was surveys carried out by project managers at the end of a project to determine what went right or wrong with that project and the second one was a set of surveys put together as a result of this research.

4.2.9.1 Surveys performed by Project-Managers

The project-management surveys have a number of draw backs in that they are limited in the coverage of users that they focus on and primarily cover subjective factors that the project-manager felt was important to the project's success at the time. These surveys are also ad-hoc in manner and lack internal validity in their construction. They are useful however, because they identify those factors which the majority of the primary stakeholders involved in the project believed were important at the time. In the course of this research, only two such surveys were available for analysis. This is primarily because only two main development projects were being undertaken during this time and also the practice of performing these surveys was not widespread.

The stakeholders involved in these surveys differed slightly between the two projects. This was because of organisational changes that had taken place between the time spans of the two projects. However, while the people being questioned were different, the make-up of the job functions being covered were as documented in table 4.21 in the supporting volume. Both surveys focused on identifying the following types of issues: -

- Differences between planned and actual activities/dates,
- Product features delivered against what was planned to be delivered,
- Issues with the software release process,

- Issues with the development/QA process,
- Any issues dealing with 3rd party software providers,
- Unplanned activities which came to light during the project lifecycle,
- Lessons learnt with the SDLC process.

It is important to note that due to confidentially issues, the raw data was not available for analysis by this researcher, only the summary of results and the base questionnaires themselves. The number of respondents and their associated job profiles were available however for use.

The two surveys were constructed along similar lines. Each of them had sections that covered each of the major milestones within the SDLC process and used a rating of 1-7 (in the first survey) and 1-5 (in the second survey) to ask the respondent how successful they thought that area was. Additional, a free comment section was also provided for the respondent to put down their thoughts on factors that either hindered or helped with the success of that SDLC stage. Each survey also covered issues encountered when dealing with 3rd party solution providers. The first survey specifically covered a number of 3rd party providers by name and asked for issues to be highlighted and ranked, whilst the second survey merely had a question which asked - on a rating of 1-5 - if the management of 3rd party providers had been any good. In covering planned verses actual, the first survey had a section which - for each of the SDLC stages - asked if there had been any deviations from the planned activities and the activities that actually took place, then queried if there were specific factors that accounted for this deviation. In the second survey, this was primarily covered by job function and a free response section which asked for any issues that hindered planned activities to be listed. The second survey also asked for dates to be provided against each of the planned milestones to show when they were actually achieved.

As the raw results from the surveys were not available for analysis, the analysis that was done had to be performed on the summary results which were made available to general management. The analysis on these results was performed using the categories that the summary was presented in. This was done because the categories used in the two summary presentations were consistent between the two surveys. The results of this analysis are shown in table 4.22 in the supporting volume.

It is worth stating that the findings of these surveys reflect the nature of the projects that they were being run on and the amount of pressure people were under at the time. The

first project was a relatively small project which focused on a medium amount of change, whilst the second project was much larger and involved far more resources and time. It is also important to note that late into the lifespan of the second project, there was a fundamental shift in the base requirements of that project which led to a cascade effect into the other development stages. This context might help explain some of the findings.

Whilst these findings are useful in the context of the projects they were run in, their use in this research comes from what they can say about problematic areas within the process and the factors that need to be monitored. To do this, it is necessary to take each of the presentation categories above and identify the key areas or factors of concern that these surveys identified. This analysis is done in table 4.23 in the supporting volume and was vetted with a representative from the project-management team. Questions and measurements proposed to track these key factors are discussed in sections 4.2.9.3-4 below.

4.2.9.2 Surveys undertaken for this Thesis

As well as the surveys that were undertaken by project-managers, two additional surveys were also undertaken by this researcher for use within this thesis. These two surveys were focused on polling people's opinions about factors that were important to the success of a project and how those factors might be identified and monitored. The first survey was used primarily as a test vehicle to validate the types of questions that were being asked, whilst the second survey was the one that was distributed to the wider world.

As the first survey was mostly used as a pilot, the respondents that it was targeted at were very focused, consisting primary of a few development and support staff. The respondents to this pilot were asked if they would like to participate and thus their identities were known – although, in most cases, the responses themselves were not attributable. The second survey was distributed blind to a larger audience so the responses were not attributable. It is also important to note that while respondents were asked to provide their generic job title and location, not all chose to do so. As such, the second survey does have a number of unknowns who responded. The breakdown of respondents by job function (where known) is provided in table 4.24 in the supporting volume.

Both surveys were constructed via http://www.surveymonkey.com using professional class accounts maintained by the organisation for project-managers. The surveys were put together with the help of a project-manager and QA manager. The questions from both surveys were very similar with the second, more widely used survey, incorporating feedback from the individuals who also responded to the first survey. The questions used for this second survey are detailed in table Ap2.2 in the supporting volume. (Note - As the first

survey was a pilot to help validate the questions, the responses from that survey were not analysed).

The construction of the survey was broken down into seven main parts, which each part having a mixture of multiple choice, ranked choices and free text. The purpose of each of these sections is covered below.

- *Who the respondent was?*

  This section was to get a basic idea of who the respondent was and what their job function entailed.

- *What is their knowledge of the SDLC process?*

  This section was to get an understanding of their knowledge of the SDLC process and what, in their opinion, was its associated strengths and weakness. The purpose of this section was to provide some feedback on the existing SDLC process for the project-managers who helped with the research.

- *What is "IS success" and the factors that contribute to it?*

  This section was designed to get an understanding of what the respondent understood "IS success" to be and factors that contributed to it. The majority of the questions used in this section comprised of ranked responses using information that came from previous analysis and literature research. The purpose of this section was to identify the most common interpretations of a successful IS system and the types of factors respondents saw as either contributing to that success or detracting from it. In addition, respondents were asked to identify how they would best attach a measurement to that definition of success. Wherever possible, both qualitative and quantitative answers were offered. This was to see what types of success definitions and measurements respondents seemed to prefer.

- *What are the best ways of identifying and controlling success factors?*

  This section was designed to identify how respondents felt success factors could be identified and controlled. The majority of the questions used in this section comprised of ranked responses using information that came from previous analysis and literature research. Wherever possible, both qualitative and quantitative answers were offered, but in the majority of cases this was not possible due to the nature of the questions being asked.

- *What is their understanding of IS methodologies and what they do?*

  This section was designed to get an understanding of the respondent's comprehension of an IS methodology, what it did and what it was used for. Rather surprisingly, a large number of the respondents in the initial and subsequent surveys did not understand what an IS methodology was, even when a description was provided in the survey. What was even more interesting was the number of developers who fell into this category. As such, while this section was probably the most theoretical in nature – i.e. requiring the respondent to have some knowledge of IS theory – the response for this section was less detailed than originally hoped. For those who had a grounding in the IS field, the section was present to determine what areas they believed should be covered by an IS methodology and how it should best be done. The section was also intended to test the concept of using additional tools outside that of the IS methodology to help track success factors.

- *What is their understanding of process evaluation frameworks and what they do?*

  This section was primarily focused at those individuals who had experience of being involved in a process audit of some kind. The response base for this section was very low. This was expected as most of the people who answered the questionnaire had never been involved in an audit process. The questions in this section where aimed at identifying why process audits had taken place, which areas had been audited and if the respondent believed that the audit had a positive result in identifying any issues. The questions present in this section were drawn mostly from the results of previous analysis and IS literature.

- *Questionnaire feedback*

  This section was not used in any analysis, but was present to address any issues with the questionnaire and any general comments that the respondents wanted to make that were not catered for in other sections. Very few people filled this section in, but where they did, an effort was made to fine tune the online questionnaire where possible to address any issues they identified.

4.2.9.3 Survey Results and Analysis – Project Managers survey

The two surveys above were created for two different purposes. The first one was created by project-managers as a way of identifying specific issues and recommendations, whilst the second one was developed to help support the questions proposed in this study. As such, the

results from the first survey had already been classified and summarized by the project managers who did that survey. As it was not possible to review the base data used for these project-management surveys due to privacy concerns, the results from these surveys were analyzed in terms of the organisational areas that they were related to and the causal influence that they were viewed as having on IS success. As before, these classifications were constructed with the aid of project-management representatives and the review group. The results of this analysis are shown in table 4.25 in the supporting volume.

This analysis collects the results of the project manager surveys and places the issues that were identified into the four main areas that were proposed for the questioning framework. As can be seen from table 4.25, all the points which those surveys raised can be allocated into the areas proposed. However, in addition to this grouping, each of the points raised also needs to be classified in terms of the type of factor(s) that they were. This classification is to show how the factor identified affects the success of the IS system and also, to evaluate whether factors identified by 3rd party research can also be fitted into the notion of the questioning framework. This classification is done in table 4.26 in the supporting volume.

The main point of using this independently gathered evidence was to help validate the areas that have been proposed for the questioning framework using primary data. The results in table 4.26 show that this is possible and that by looking at these areas it is possible to identify factors and types of factors that will either promote or inhibit success. These factors by themselves however are only a means to an end. The next step is to take these factors and propose questions that could be used to identify such issues in future projects.

4.2.9.4 Constructing questions and measurements for the proposed framework

The best way to reverse engineer questions from the results presented is to start with the areas that they have been grouped into and cross reference these with the classification of that factor to propose questions that best suit the types of points that this survey identified. This process is undertaken in table 4.27 in the supporting volume.

The tables detailed in this section aimed to classify all the issues and concerns that were raised from the project-managers surveys and propose questions that could be used to monitor those concerns. Many of the issues raised should already be covered by the process that the organisation is following, but from the issues identified, it would be fair to say that more rigorous monitoring of these issues is needed. This is a perfect example of how the process could be augmented by using the questioning framework. Issues have been identified from the surveys which need to be monitored outside of the existing process as they have

caused problems in the past. The process that is supposed to be tracking them is - for one reason or another – is failing to achieve all the goals it should be.

The one thing that has not been addressed in constructing the questions is the metrics that would be needed to track them. For some of the questions proposed, constructing a single measurement might not be feasible. However, by constructing a composite measurement, the questions could be monitored. Table 4.28 in the supporting volume takes the questions that were proposed and creates a set of entities that could be used to quantity and measure these questions.

As can be seen from most of the measurements proposed, they are primarily concerned with changes to "firm-up" how project plans, review and approval processes are handled. The questions and measurements that have been constructed reflect the concerns and issues that were raised from the reviews that the project-managers did. These questions and measurements are therefore highly reflective of the issues that the affected projects had. To ensure that these questions and measurements are valid, it would be necessary to perform a similar analysis for projects in the same organisational context and determine if the same sorts of issues are identified. This replication however is outside of the scope of this research and is raised only as an observation going forth.

4.2.9.5 Survey Results and Analysis – Research project survey

The other survey used in this research was put together in order to support the proposed research question. The questions in this survey were focused on the working practices of the organisation being investigated. The questions were aimed at identifying strengths and weaknesses within those working practices and determining what questions could then be constructed to monitor those weaknesses. Table 4.29 in the supporting volume presents a summary of the results that came from the survey.

The questions in the second survey covered a wider range of subjects than those present in the first, but the results need to be analysed using the same mechanisms as far as possible. Some of the questions were neutral in nature, that is to say, they were simply asked to get a better profile of those who responded. The questions that expressed opinions or identified issues were those ones which were primarily used. As the majority of questions were asking for ranked results, the answers that were used for the analysis were the ones that the respondents felt were the most important with regards to that question. This meant that the top 50% results for each question were used as input to the analysis. The lesser 50% whilst not used for this study could be focused on as input into a follow-up study, but that is beyond the scope of this research. Also, for some of the free text answers that were given, the

responses were summarised down to the critical information. This was because some responses were very verbose and difficult to read. Where this was done, the summary was reviewed by a member of the review team to ensure it was correct. The results from this analysis are summarised in table 4.30 in the supporting volume.

4.2.9.6 Constructing questions and measurements for the proposed framework

Table 4.30 collected the answers that were giving by the second questionnaire into the factor classifications that were the best fit for them. However, to utilise the information identified by these answers, it is necessary to propose a number of questions that could be placed into the questioning framework. Unlike the first set of answers that this process was applied to, these results have been generated from specific questions, so the questions proposed for the framework should not aim to be just repeats of the questions in the survey, but must try and consider the factors that were identified by the survey and use these to fashion questions that can track those specific factors. A concern however, is that the questions fashioned are created to fit the results identified and that is not the goal of the framework. The questions proposed should be constructed to identify weakness and strengths with existing processes, as such, they must be formulated with that goal in mind. The results of this construction are documented in table 4.31 in the supporting volume.

The classification of the factors identified and the areas that they were put into were based on the results of discussions with the review group and supported by codifications using Nvivo. The classification was determined based of the types of attributes the majority of the factors identified by a question had. The area that the factors primarily related to was also identified in the same way. While in a number of cases, the results for a question could have potentially fitted into more than one area, only the perceived primary one was selected. This was done to help keep the duplication of proposed questions to a minimum.

To conclude, this section has been focused on taking the results from two surveys – one constructed by project managers and one constructed by this researcher - and using these to construct a number of proposed questions aimed at helping a project manager to identify factors and/or methodologies that might help improve the success of their system. The majority of the questions constructed are more reflective in nature than actually identifying tangible process assets, but the intention is to get the project team to think retrospectively and use past experience to better enhance their chances of success.

4.2.10 Critical Incidents

This source of data is both quantitative and qualitative in nature. The quantitative data source came from a weekly list of escalation reports that were generated over the period of June 2004-June 2005. This data source has already been analysed as part of section 4.2.4 and is referenced here as part of the critical incidents data source. What the analysis from that quantitative data source showed was that the two highest sources of critical incidents were product defects and the need for specific enhancements to be provided. This was also shown by other data sources as product quality and mismatch in stakeholder expectations.

For the qualitative data source, this information came from the interviews which were documented in section 4.2.5. As part of these interviews, some, but not all of the support-engineers, consultants and developers were asked to comment on any singular customer issue that they remembered the most for whatever reason. The incidents that were most recalled by these respondents were then listed in table 4.32 in the supporting volume. Each incident has been summarised by the key events that took place. The exact details of all the product issues encountered and communication events between the various parties however, have not been included due to privacy concerns from the target organisation. The analysis of these critical incidents was performed by looking at the key issues that each incident had and summarising them. This summary is also presented in table 4.32 in the supporting volume.

The key points generated from each of these summaries were then vetted with the appropriate individuals to ensure that they were a fair representation of the main issues that had occurred. What the summaries showed is that for all of the stories, there were a number of common issues that had led up to each incident happening. These were

- *Product quality* – The scenarios in which the product was being used by the end-customer had severe issues or limitations that blocked or hampered the use of the product in that environment.

- *Stakeholder expectations* – For whatever reason – rightly or wrongly – the customer or end-user had an expectation of the features provided by the product which the product did not fully support. In a number of cases, anecdotal evidence provided by the interviewee blamed this expectation gap on two main reasons. The first of these was that the capabilities of the product had been oversold to the stakeholder. This was not thought to be deliberate, but simply not explaining the capabilities of the product in enough detail. The second reason was thought to be that the product documentation was not explicit enough about what the product could or could not do under certain

scenarios. These reasons however were only speculation as there were no other evidence sources to draw on.

- *Product complexity* – The versatility of the product is both a source of strength and weakness. The product can be configured to work in many different ways with the result that not all of these options can be fully tested in all the necessary environments. In addition, as the scenarios can interact with each other in one to many configurations, the possible test cases multiply in an exponential fashion. The issues that contributed to a number of the critical incidents found were caused by interactions between such complex environments. The outcomes between these interactions were not as the user expected or were not always correct. The complexity of these environments also meant that the effort necessary to setup, test and debug such interactions significantly increased the amount of time needed to truly resolve all the identified problems which led to customer frustration.

- *Performance* – Performance relates to product performance and general scalability. This was a hot topic for a number of customers including internal teams. The causes for these performance issues came from a number of different sources, but showed that scalability and performance was an important stakeholder concern.

- *Executive pressure* – In a number of critical incidents, pressure "from the top" to get issues solved was what most people remembered. The reasons for this pressure depended on the context of the critical incident, but the main ones were – customer threatening to throw the product out, the presence of a large proposed sales deal, customer getting into contact directly with senior executive management and lastly, internal teams complaining directly to senior executive management. The executive pressure did mean that issues got more attention than they might have usually done, but interviewees also thought that the pressure skewed other important activities from not taking place and that the executive "card" was over used for some issues that were not that critical.

- *Knowledge* – One area that was identified as an issue for a number of critical incidents was the limited number of people who had knowledge in specialised areas of the product set. The product has a large functional base and there are several areas which require both specialised knowledge and skill-sets. These specialised resources are often in popular demand from a number of areas and when competing issues arise, then often, some requests – including escalations – will have to be rejected or delayed. This can have a severe impact. Other times, the required knowledge set no

longer exists within the organisation. This is often not understood by senior management who have difficulty accepting that some issues cannot be resolved without significant relearning.

- *3rd party management* – The issue of 3rd party management was extremely pronounced in one particular critical incident that both support reps and developers mentioned. This was where product issues with a 3rd party component which was partnered with the main product was causing a number of significant issues for one vocal customer. The incident was remembered clearly because of the severe difficulty of getting any meaningful assistance out of the 3rd party company. As the contracts in place between the two companies were very loosely worded, there was no way to "force" the 3rd party company to assist and as a result, the situation was extremely difficult to resolve.

- *Communication* – This issue was identified as it occurred in two specific critical incidents. The first of these is already covered in the issue of 3rd party management, whilst the second relates to the importance of communicating information when, and only when, it is certain that issues are fully resolved. Communicating too soon can backfire if different issues come to light immediately after the first issue is solved.

- *Legal contracts and their implications* – Although not common, there were two specific critical incidents where legal contracts had an important part to play in what contributed to an incident occurring. As such, the implications of such contracts and what they do and do not cover was seen as being important.

The results of the analysis on the critical incidents that were identified during the interview process show that there are a number of common factors that regularly impact the success of the product. Although not all of the points raised during this analysis are relevant to all escalations, this sample identifies factors that are important to track in the success package. The most relevant issues identified are product quality, stakeholder expectations, product complexity and specialised product knowledge.

4.2.10.1 Constructing questions and measurements for the proposed framework

All the factors identified above have had a direct and inhibiting affect on the successful use of an IS system and would want to be tracked to ensure that their impacts were minimised. Table 4.33 in the supporting volume shows example questions which could be used to help identify aspects of such issues in other projects. The questions constructed in that table are aimed at identifying and measuring factors that have been known to cause critical incidents to occur in

the past. As such, the intention of these questions is to supplement the existing processes in the target organisation to help minimise the impacts of such issues. The nature of the questions proposed cover both specific points and more open-ended subjective options about organisational policy. While not all these questions may be directly relevant to the issue the question was constructed for, the overall intention is to examine that issue from a number of perspectives to determine if improvements could be made that would help.

For example, in the area of product quality, questions have been constructed that query the priority of product quality to the end-customer and how that quality is proved. These questions are intended to help ascertain the focus that the project team needs to place on quality and get them to look at mechanisms that they could use to "prove" it. One of the issues identified from various data sources was the fact that code coverage metrics were not available for various projects. If a project team were specifically asked to provide coverage metrics for products where quality was a concern for the customer, then issues relating to product quality and product complexity could start to be addressed. This is the intention of the questioning framework.

To conclude, this section has focused on investigating the potential causes within either the product or the organisation that led to critical incidents occurring. The quantitative data source – as analysed in section 4.2.4.1 – shows that the root cause for many escalations was product quality and stakeholder expectations. The second qualitative data source – as analysed above – shows that for the sample of cases used, there were a number of key issues that resulted in those escalations turning into the situations that they did. Of course, these reasons should not be regarded as the only possible causes for escalations becoming critical, but they are prime examples of critical failure factors that the target organisation needs to control.

4.3 TRIANGULATION OF RESULTS

This section details the triangulation of all the results that have been identified from the various data sources used in this research. The purpose of this triangulation is to compare and contrast the key findings from each data source and use them to determine any commonalities between them. This triangulation will also help to show if the sources of evidence have identified the same common themes, but from different perspectives. This is important in helping to establish if the themes identified have validity.

4.3.1 How the Data will be Triangulated?

The data used for this study incorporated both quantitative and qualitative sources. The primary data analysed however was qualitative in nature and focused around the proposed organisational areas. As such, the triangulation of the analysed data will be collated in a similar fashion. The quantitative data that was gathered will be used to supplement the qualitative data sources where applicable.

4.3.2 Triangulating the Data for Organisational Areas

The first set of data triangulation will be to collate the key results from each of the data sources that were analysed and determine how well they fit into the proposed areas within the questioning framework. Table 4.34 in the supporting volume takes the key results that were identified and collates them based on the functional areas that were used to categorised that result at the time. Each separate cell in the table represents the key results from a particular data source.

As can be seen from the collation shown in that table, the majority of the results identified from each of the data sources can - based on the opinions of those who assisted with the research and analysis process – be assigned to each of the proposed organisational areas in the framework. There are however, some sets of results that do not ideally fit into the proposed areas. These results relate primarily to revenue related factors and those that involve external marketing activities. In the opinions of who took part in the research process, these factors – especially, the revenue related ones – should be key contributors to a product's success. This was felt to be especially true where the product has been available in the market place for a number of years. As such, the collation shows that there are potential adjustments that need to be done either to the scope of the areas that form the basis of the framework or that more areas need to be considered. These additions could potentially be: -

- *Financial Area* – This area would highlight any financial related aspects of success or failure that are vital to the product, but that fall outside of the context of the development process. Such example factors might include revenue streams, support costs and ongoing product maintenance costs.

- *Market Presence* – This area would highlight any aspects of success or failure related to the product's or organisation's presence in the marketplace. Such example factors might include key analyst reports, general market perceptions of the product and the presence of key referenceable accounts.

This shortcoming of the existing framework will be examined in more detail later on in this chapter.

4.3.3 Triangulating the Data for Critical Factors

The second set of data triangulation is to – where possible – categorise the types of factors and entities found by the impacts that the factor is viewed as having on the organisation. In the context of this research, this categorisation has been performed as documented in section 4.2.4.2 in that each factor which was identified was classified in terms of: -

- The causal affect that its presence was thought to have on the IS system – direct, indirect, instigating or standing. The presence of a direct (or instigating) factor is viewed as having a causal/measureable impact on IS success, whilst the presence of an indirect (or standing) factor has an affect, but one that cannot be directly measured or attributed to that factor.

- The enhancing or inhibiting affect that the presence of that factor has on the success of an IS system. Enhancing factors are seen as making a positive contribution to the success of a system, whilst an inhibiting factor is seen as making a negative contribution.

Table 4.35 in the supporting volume presents the triangulation of factors identified by their given classification. The purpose of this classification however is not to focus on the factors that were found, but rather, to determine if the results gathered can be categorised in terms of the casual affect that they are seen as having on IS systems. The factors that were identified are themselves not critical to this research, because they simply reflect factors or themes which were deemed as critical to this particular target organisation. What is important is that the majority of the themes collected from each of the data sources can be classified in terms of a common framework. Of course, exceptions to this classification were encountered. These relate to factors that are present, but their presence is regarded as being neutral in how they impact the IS system or its environment. Examples of such factors are provided in the table under the classification – *direct* and *indirect*. These factors relate to entities or conditions that are present in the environment analysed, but their presence was regarded as having no discernable impact on the success of an IS system or that its impact could be both enhancing or inhibiting depending on what context that theme was placed. Each separate cell in the table represents the key result(s) from a particular data source.

One of the major issues with collating the data in this fashion is that the factors identified can, potentially, be classified in more than one category depending on the context in which that factor was being analysed. This was a problematic issue when the various

groups involved in this research were trying to determine the impact of the factors identified and whether or not that factor had a positive or negative contribution to IS success. In the majority of the factors that were categorised, the enhancing or inhibiting nature of that factor came from the context of the data source and the opinions of the groups assisting with the research. The benefit of this approach was that the factor had meaning and context to those in the target organisation and as such, identifying that factor as an enhancer or inhibitor meant that the group could understand why that factor was important. These categorisations however are subjective in nature and outside of the context from which they are being analysed it could be confusing to understand what that factor was supposed to represent. One example of this could be the failure factor - *"Improved code documentation and coding standards"* - which was regarded as being indirect and inhibiting. The context of this failure factor was that the lack of general code documentation in both legacy and new code meant that such code was difficult to understand or maintain. While this statement had meaning to the development team and managers when taken in that context, once it was taken outside of that context, the statement itself could be seen as either indirect/inhibiting or even direct/enhancing.

Another issue was that many of the factors being identified were statements of existing processes that themselves were neutral in nature. Such statements might be categorised as either direct or indirect, but there was no context in which to regard such factors as being enhancing or inhibiting to IS success. This was a condition which was found for a number of factors identified, especially, in the context of the interviews. This is an issue which is discussed in more detail later on in this thesis.

The last issue that is necessary to mention with regards to the triangulation performed is that as the data sources have been bought together, it was clear that common factors or themes have been identified from more than one source. This in itself is not an issue, but what is problematic is that the context associated with a factor can be different per data source. This issue is another reflection of the first issue mentioned above. A factor which is subjective in nature needs the context in which that factor was identified to give that factor meaning and in some cases, this is not always available or is unique to a specific environment. This means that a factor can be identified as being enhancing in one context, but the same sort of factor when viewed from another context can be seen as being inhibiting. This is an issue which is discussed in more detail later on in this thesis.

To conclude therefore, using a direct/indirect, enhancing/inhibiting classification method for factors can be problematic when trying to collect factors and construct questions which may be used outside of the environment that gave those factors meaning. However, in the context of the questioning framework, there is a relatively simple way in which this

concern could be potentially addressed. The direct/indirect, enhancing/inhibiting classification was originally used as a mechanism to help the collation of factors in order to give context to any questions constructed. In themselves, they are not critical to the classification of the questions or the measurements that are used. What is more critical is that the questions which are eventually constructed from any factors identified need to be clear and unambiguous about what issues they are trying to highlight. The context of the issue can thus be imbedded into the question itself. One good example might be taking the factor that was identified above - *"Improved code documentation and coding standards"* – and expressing it in terms of a question like this – *"Are any standards in place to ensure that the code is documented in a clear and precise manner to ensure that people who are unfamiliar with that code can easily understand it and maintain it?"* By expressing the question in this manner, it is clear what the intention of that question is and how it can be measured. The issue of context and classification will only become evident when the questions constructed are ambiguous in nature.

4.3.4 Triangulating the Proposed Questions and Measurements

The last set of data to be triangulated relates to the proposed questions and measurements that came about as a result of analysing the data sources used for this research. These questions would form part of the input into the questioning framework that was constructed for the target organisation. The nature of the questions that were constructed for this research are specific to the data sources that were analysed for this organisation, but they do show that there are issues that those who took part in the research feel are not recognised enough by the target organisation's processes and would benefit the organisation if they were tracked independently of that process. As the sources of evidence that were analysed were done so separately of each other, there are many proposed questions that, arguably, cover the same issues but from slightly different points of view. As such, a "next step" would be to refine the questions down to those that are truly unique and also, to reword them such that they overcome the issues identified in section 4.3.3 above regarding context. This however, is not something that will be done in this research as such refinement would be considered to be an issue with operationalising the framework. The results from this triangulation are shown in table 4.36 in the supporting volume.

What the triangulation of the proposed questions and measurements performed in this table shows is that there are factors in the area of revenue streams and marketing presence that the current proposed framework does not track. The framework would need to be extended to address these possible shortcomings. The triangulation also shows that the data

sources used identified a number of common weaknesses with the target organisation's processes that need to be better catered for.

The nature of the questions that have been identified cover issues that are both specific and generic, and would, if they were going to be used for real, need to be refined to cover those specific problems that the organisation felt were more critical to track. Generic questions which cover how a process works or what weaknesses exist within a process are good questions to consider, but need to be targeted at a different profile of consumer within the organisation than those questions which focus on specific project weaknesses. What would need to happen is that the questions which have been identified will need to be grouped into those which deal with the operational issues, i.e. those which are of concern to immediate project teams, and those which are more relevant to the strategic process definition and improvement. Once this grouping has been done, the questions would then need to be reviewed and refined as necessary to make them clear, concise, unique and unambiguous. This is not currently the case.

As well as triangulating the questions that were identified by the research, table 4.36 also deals with the triangulation of possible measurements that might be used to help quantify answers to the proposed questions. As with the questions, the nature of the measurements that were identified range from specific artefacts such as sign-off sheets to those which cannot really be quantified without having an interview session with those people who are most familiar with that issue. There is no reason why a measurement for a question that is generic or process orientated cannot be defined as simply asking someone who knows. In some cases, it is quite likely that there will be no tangible asset or policy which could be easily mined to answer a question or provide a suitable measurement. A good example of this might be a question like – *"Does the organisation actively review the reputation that the product has in the field and put any issues identified in as requirements to be solved?"* This question is something which is best answered by those who are closest to the market and deal the most with customers or sales situations. By interviewing such individuals it should be possible to construct valid measurements which will help, but the issue with using such measurements would be that they are valid only for a specific set of circumstances or time period. In such circumstances, it might be advisable to keep the measurements for such questions in terms of relying on those people who are most familiar with the areas of concern or breaking the high-level question down into further sub-questions that might then be better tracked. This issue will be discussed more in the next section.

4.4 DISCUSSION

The goal of this research has been to examine the concept known as IS success and examine the hypothesis that IS success can more accurately be described as a package of interrelated success factors whose definitions and measurements depend on the context of the organisation in which the IS system is being developed. As part of this research, it was proposed that these success (and failure) factors could potentially be found by examining four main organisational areas and then using the results from this examination to define questions which could then be used to track factors of concern along side existing organisational processes. While the research did not specifically undertake to look at the practicalities of trying to operationalise the construction of such a package, it was intending to highlight any issues that it encountered so that future work might be able to look at such issues and consider how to resolve them. The intention behind this final section of this chapter is to discuss the findings of the research that has been undertaken, whilst the final chapter (chapter 5) will be specifically concerned with highlighting the issues – both theoretical and practical – that would need to be addressed in any future work.

In chapter 2, it was proposed that the search for critical success factors could best be guided by examining four separate organisational areas. These, in priority order, were -

- the project methodologies used to develop and deliver an IS system,
- the expectations that the stakeholders had of that IS system in what it was supposed to deliver,
- the context and values of the organisation in which that IS system was being developed,
- and lastly, the technological aspects of the IS system itself.

As such, each of the data sources that were examined for success and failure factors has been done so within the context of these four areas. The goal was to determine if these proposed areas were valid candidates in the search for success factors or if others were also needed. For the results that were identified from each data source it is possible to say - that for this organisation - the four areas did cover the majority of the success and failure factors that were found. In addition, the numbers of success and failure factors that were attributed to each area also reflected the assigned area priorities. In section 4.3.2, a total of 172 individual factors were attributed to project management, 84 factors to stakeholder expectations, 48 to organisational context and lastly, 43 factors to technology. What the results also identified was that there were success and failure factors that did not relate well to any of the four

proposed areas. These were primarily to do with success factors that dealt with revenue streams and the perception of the organisation – and the product – in the market place. As product revenue streams were mentioned by many during the interview phase as a key success factor – and more importantly, by key decision makers - the lack of an area which these definitions of success could relate to was a concern that needed to be addressed. There is also evidence by other researchers – such as those commented on in section 2.5.6 – that adds weight to the argument that the four suggested areas need to be extended to also cover financial success and failure factors.

As a result of the research done therefore, it could be argued that the four organisational areas proposed, while valid, are not enough by themselves to form a complete definition of IS success. There is one or possibly two further areas that need to be added. The first of these would be a financial area and would be concerned with success factors like: -

- *New license revenue* – This success factor is related to new sales revenue and indicates how well a product sells. Its measurement would be in terms of financial contribution to the company. A successful product would have a positive growth or a stable income, whilst a failing product would have a negative growth.

- *Maintenance revenue* – This success factor indicates the percentage of customers who take out or renew their maintenance contracts and existing licenses. In licensed based software, this is a critical measure of the product's success. If customers are regularly maintaining their contracts and licenses, then the organisation has a relatively guaranteed source of income.

- *Consulting revenue* – This success factor indicates the revenue bought in by consultants who are engaged by customers to either setup a product and/or configure it.

- *Support costs* – This factor indicates the cost that is needed to fund each support call that a customer makes to the organisation. Ideally, this cost is kept as low as possible as the more expensive the cost is, the more expensive the total support bill is for a product.

In terms of the target organisation, these example factors were seen as being critical in indicating both the viable health of a product and how much future investment in that product there should be. Example questions and measurements that might be used to track such measurements are included in the tables mentioned in section 4.3.4 above.

The second area that could be added would be an area relating to marketing presence. A number of the data sources interrogated identified that having a good market presence in

terms of factors like referenceable customers, positive ratings in respected analyst journals and good comments on respected web communities made a positive contribution to the chances of a product being selected by a customer. Although, this is only anecdotal evidence, a number of marketing and sales people interviewed stated that having referenceable customers that prospective clients could interview had been critical to them being able to close significant product sales. They also stated that having the product ranked highly in respected journals had often been the primary reason for customer organisations choosing the product as part of a proof of concept. Viewed in this light, the importance of a good market presence as a sales generator is an important factor for the target organisation. As such, factors related to marketing presence would ideally want to be tracked.

The questions that were constructed from the four areas examined were done so based on the success or failure factors that were identified from each data source. As the intention was to make the questions as ecologically valid as possible, they were constructed in response to actual issues that had been identified in the past or definitions of success factors that key stakeholders believed contributed to IS success. The questions themselves focused on issues that reflected the types of concerns that those who took part in the research had. The majority of the questions focused on how to address specific issues that had come to the attention of specific teams within the organisation and were concerned with operational issues that were encountered as part of their every day activities. Examples of this type of question are things like – *"What metrics are used and recorded to indicate product quality? Are more needed?"* and *"What sort of impact analysis is done on code before it is changed?"* These questions are dealing with specific concerns that team-leads have had in the past and want to address because of the impact they have on software quality. However, there are other types of question that relate more to those who create and define process standards. These types of questions are aimed at those who are focusing on a different set of issues. This type of distinction is important because the success factors that each set of questions is aimed at needs to be separate so that they are only targeted at the relevant consumer. This is not something that the original idea of the questioning framework fully considered, but would need to be addressed if the questioning framework was to be operationalised for real.

When defining the factors that would be used to construct the questions and measurements, a classification based on direct/indirect, enhancing/inhibiting was used to describe the type of affect that a factor was seen as having on the success of an IS system. However, although this classification can be used to describe the factors that were identified, it was found quite early on into the research that using this same mechanism to classify the questions that were constructed had issues. The primary problem with using this classification

is that the affect that a success or failure factor has is only obvious when viewed in the context that gave rise to that factor. If a factor, or question, is taken outside of that context, then the classification assigned to it has little meaning. This was also an issue that was encountered when collating the factors from each data source into a single success package. By removing both the factor and the question from the context of the data source, then the classification of that factor or question can become ambiguous. This should however not be an issue if the question and resulting measurement which is constructed is clear and unambiguous about what problem or action that question is trying to track. The classification was used primarily as a way of helping to describe how a factor was viewed within the context of that data source. This was useful because it helped to indicate what sort of priority had to be associated with that factor. Factors that have direct, inhibiting affects on the success of an IS system, need quicker action to resolve than indirect, inhibiting issues. The classification is also a useful indicator to show what factors the organisation can take action on. Factors which have a direct influence on the success of an IS system are usually under the control of the organisation and can be changed. Indirect factors however, may be behavioural, cultural or external to the organisation's control and are thus much more difficult to control. These classifications are valuable therefore when helping to determine how to construct questions, but may not be so usefully applied to the questions or measurements themselves.

The construction of the measurements which would be used to validate the results from questions was discussed at length in section 3.6.4. The suggested proposition was that a measurement for a question could be materialised in terms of tangible attributes or entities which could then be used as a valid construct to represent that question. When considering the nature of some of the questions that were finally constructed however, it was seen that this type of approach to creating a measurement was not always viable. For questions which dealt with operational issues or problems with the process, then defining an entity which could be used to measure such a question was practical. For example, the measurement for the question - *"What sort of impact analysis is done on code before it is changed?"* – can be materialised from development and QA policies on risk assessment and/or interviewing the key staff involved with that change. However, for questions which are at the higher, strategic level, this is not always the case. These questions are focusing on reflectively reviewing existing policies and seeking to determine what issues or better approaches might be possible. Such example questions might be – *"What problems during the support process in your opinion are currently underestimated?"* or *"Considering the types of features you might be developing and the release schedule that you have, what might be the most appropriate methodology to use? It might be worth considering more Agile approaches if the customer is open to incremental releases."* These types of questions are not something for which valid

measurements can practically be constructed. The nature of the question is too open-ended. The measurements that might be constructed from them are purely subjective and depend on who is answering the question and when. The best potential way to measure such questions might be to define key stakeholders who can express a knowledgeable opinion and then make a decision based on those opinions. For some questions of this nature it might also be possible to collate the opinions gathered and decompose them into factors which could then be tracked by other, more granular questions and measures, but this will not always be the case.

So far, this section has discussed the viability of the proposed areas in the framework, issues with constructing questions and measurements, but has not covered how the success or failure factors were identified or how the initial data sources were nominated. In the original proposal, little comment was made on how data sources for identifying success factors were selected or what the best potential data sources to use were. It was implicitly indicated that data sources within each of the four areas would be identified and that these data sources would then be queried. For the proposed questioning framework to be viable however, more details on the selection of such data sources needs to be provided. The reason for this is that the data sources used for the definition of the success or failure factors will fundamentally affect what the resulting success package is and what questions or measurements are used to evaluate that package. If the data sources selected are not ecologically valid or inaccurate, then the resulting factors that are determined from those sources will be flawed. In the context of this research, the data sources that were used were the following: -

- *Official organisation process documentation* – This archival data source details the official organisational processes that are supposed to be followed for a software project to be released. In the context of the target organisation this data source was described as the SDLC (Software Development Lifecycle) or PLC.

- *Retrospective Sales write-ups* – This archival data source is supposed to detail the history of every sale that took place, the circumstances that led up to that sale, the things that went right during that sale and also, the things that went wrong.

- *User Case History* – This quantitative data source covers the defects and enhancements which are raised by customers and what areas of the product that they cover. It also covers critical customer escalations and the root causes for those escalations.

- *Interviews* – This qualitative data source interviewed a selection of key stakeholders with a number of semi-structured questions in order to identify key processes within the organisation, success and failure factors for those processes, what their opinions were of

the current processes and their general opinions of what key success factors are. The interviewees were drawn from key job functions across the organisation which included, but were not limited to, development, Quality Assurance (QA), Support, Consulting, Sales and Marketing and executive management. As the four areas being investigated covered many of the organisation's functions, it was necessary to interview people from as wide a range of functions as possible.

- *Consulting reports* – As with the sales write-ups, this data source is supposed to be a retrospective on every consulting engagement which is undertaken by consulting staff. It too is supposed to list the best practices that were used, the issues that were encountered and to help provide a knowledge base for other consultants.

- *Meeting minutes* – This archival data source covers the minutes of meetings that are generated for the various meetings that take place during the project lifecycle. As these minutes record issues, status and approval checkpoints they can – if properly recorded – provide a detailed history of what happened during a project.

- *Metrics* – This quantitative data source details the types of defects and enhancements that are logged during the lifespan of a project and what areas within the product they are related to.

- *Surveys* – This data source involved both quantitative and qualitative data and used surveys that were performed by project-managers as part of project retrospectives plus surveys that were constructed for use by this research. The purpose of these surveys was to determine what went right and wrong with past projects and also, to gather opinions on what is "IS success" and factors that contribute to it.

- *Critical Incidents* – This final data source involved both quantitative and qualitative data and focused on ascertaining what potential causal factors had led to those critical incidents being raised.

These data sources were selected based on discussions with key stakeholders within the organisation and were intended to help identify: -

- What were the current processes?

- What were the strengths and weakness of those processes?

- What the key stakeholders involved in those processes thought of them?

- What those key stakeholders defined IS success as being?
- What historical issues with projects there had been?
- What available metrics showed about the quality of the resulting product?

The success of using these data sources was mixed. The available official process documentation which described how the process was supposed to work was surprisingly weak on detail and uninformative. The documentation which was available was too high-level and although it covered the types of assets that needed to be provided for each stage of the process, often, no details of how such assets were to be constructed was provided. As such, the information that was usefully obtained from this data source was minimal. It was only because this researcher had been involved with the process on various occasions that any specific information could be obtained.

The sales write-ups and consulting reports suffered from problems where the write ups were inconsistent and incomplete. The sales write-ups that were available did contain good sources of success/failure factors and highlighted the importance of market specific factors in promoting or inhibiting the successful deployment of the product. As such, this data source made a positive contribution to the research. The consulting reports however were so problematic, that they were dropped as a viable source of information.

Of all the quantitative data sources that were used for this research, the user case history was the most consistent and useful. This data source was used to indicate areas within the product were the end-user experienced the most issues. The reason why this data source was so useful was because it was actively maintained by the organisation and had a consistent history going back over a number of years. As such, the data could be analysed from a number of different perspectives. This data was analysed to determine for each product functional area, which were the most defect prone and which had the most enhancements raised against them. This data was then used to identify the most problematic areas within the product for users. In the case of this data source, the results showed that the GUI clients were the most problematic. The user case history was also used to perform root cause analysis on the escalations (critical incidents) that were raised against the product. What this additional analysis showed was that the most common cause of a critical incident being raised was either a blocking product defect or that the customer required an immediate enhancement to existing functionality in order for them to continue working. Interestingly, the functional areas in the product that were most affected by these customer critical incidents were different from those that were indicated by the user cases. This is useful because it indicates that the GUI clients

might have the greatest number of issues, but that those issues were not blocking customers. This suggests that more effort is needed in examining why those product areas are having such issues and what could potentially be done to resolve them.

The interviews that were done for this research identified the most in terms of process issues and the different factors that were felt contributed to IS success. This was probably the best data source for identifying issues and concerns that people had with the development process and what was felt needed to be changed. What this data source showed is that there were real concerns that were commonly held about some issues that could not be clearly discerned from any of the other data sources. This data source also helped to provide supplementary evidence for issues that had been raised from other sources such as the importance of having good reviews in independent analyst's reports as promoters of sales success.

The meeting minutes that were analysed during this research were useful in that they provided a record of the types of issues that were encountered during the lifespan of the projects analysed. The types of factors that this data source revealed were those that inhibited the every day progress of these projects. As such, the types of questions that were constructed from these minutes would need to be the ones most considered by those involved in the every day running of any projects. It is also worth stating that this data source identified issues that were mostly focused on the project management area and thus, gave rise to a number of useful questions aiming to assess the types of issues that have blocked or delayed projects in the past.

In the context of the target organisation that was used for this research, the role of metrics as a quantitative data source is probably less than it might be in other organisations. This was because the use of metrics as indicators of product quality, performance and areas of risk was only just being prototyped. As such, there was very little "real" data that could be analysed. It was clear from other data sources that the need for such metrics was felt to be necessary by both development and QA groups. The lack of such metrics meant that measurements of quality such as build stability, test coverage and code coverage were just not possible. Their general lack of availability led to a number of questions being constructed to indicate that such metrics were needed to help promote a successful system. If such metrics had been available therefore, it was quite clear that they would have been a useful data source in helping to measure factors like product quality.

There were two types of survey that were used in this research. The first type comprised of two surveys that were put together by the target organisation as part of its

internal processes. The purpose of this survey was to ask key stakeholders once a project had been finished the things that had gone right or wrong with that project. The intention of this is to be able to identify factors that can help with process improvement. These surveys were useful in that they identified problems with the way that projects were run that needed to be resolved. As with the meeting minutes, the concerns that were raised were primarily focused on the area of project management and as such, would be most relevant to those who were starting out on new projects. The second type of survey was constructed specifically to help support this research. This survey was focused on gaining an understanding of what people's knowledge of the organisation's processes were like, their opinions as to the strengths and weakness of that process, how they understood the term IS success and the factors that contributed to it, and lastly, their knowledge of IS methodologies and evaluation frameworks. The intention of this survey was to help complement the results that were gained from the interviews, but focus more specifically on existing organisational processes. Unlike the first survey, the results from this survey were more to do with the strategic direction of the organisation's internal processes and how they need to be improved. The questions that were constructed from this data source would be specifically of interest to those who manage the organisation's processes.

The last data source that was used for this research was critical incident analysis. This data source had two main components. The first was quantitative and was analysed as part of the user case history analysis, whilst the second was qualitative and was gathered as part of the interview process. The quantitative data was based on the critical escalations that had been raised over a set period of time and focused on the root cause of critical escalations being raised. What this analysis found was that the two major causes for incidents being escalated to critical was that customers had either a blocking defect that stopped their use of the product or that they needed a critical new piece of functionality. In terms of resulting questions, this analysis showed that it was possible to utilise this data source to identify areas within the product that blocked customers the most and thus inhibited their successful deployment. The qualitative data that was analysed was based on a number of critical incidents that the people involved – development, support and QA – recalled as being their most "painful" or memorable customer issue for one reason or another. The purpose behind this analysis was to investigate in more detail a number of customer incidents that had, in the terms of one support engineer, "gone horribly, horribly, pear shaped", and from this identify some of the contributing factors that had lead up to those situations occurring. The goal being to try and track such factors in the future.

The reason for going over the data sources used in this research is to show some of the data sources available within an organisation that can be used to identify success or failure factors. In the terms of this study, the data sources selected gave a good view on the success and failure factors that were already known by the organisation and those that were known by key stakeholders or teams, but not necessarily by the organisation itself. These data sources also allowed different levels of factors – and questions – to be identified. The first level which focused primarily on the operational issues of the organisation, plus a second level which focused more on the strategic level. After having completed this research however, there are a number of points that need to be considered about the data sources used.

The first of these is that the majority of the data sources were qualitative in nature and based on the subjective opinions of those who took part in the research. As such, the results obtained were biased towards the perceived understanding of that data source and the context it came from. Ideally, more quantitative data sources would have been used to help improve the triangulation. Although, this focus on qualitative data is inline with the case based research methodology used for this research, if data sources were being selected for use in another organisation, then the use of metric based data sources, such as build statistics, code coverage etc would be recommended. The reason for this is that such metrics can help identify risk areas much more easily than sources like interviews and in addition, they make good measurements for product quality.

In addition to the qualitative nature of the data sources used, there is also a concern that virtually all the data sources focused primarily on factors internal to the target organisation. This can biased the results to those success and failure factors which are internal to the organisation's processes and environment. As was identified by some of the data sources, the success of the product in the field can be strongly influenced by how the product is perceived either by the user community or the market into which it is being sold. Although, this was identified by some of the data sources, there is no specific data source which thoroughly examines the external environment at a suitable enough level. This is something which needs to be improved on. Potential data sources that could be used for this might include end user interviews, analysis of online user-communities or working more closely with marketing and sales staff. This would allow a more balanced view of factors than the results currently show.

The last point to make on data sources is that a number of the sources initially identified, such as sales write-ups and consulting reports were not as productive as they could have been. In the case of the consulting reports, the data available was so limited that the data source had to be dropped from the research and in the case of the sales write-ups, the data -

while available - was more incomplete than originally thought. This means that the representation of the marketing, sales and consulting functions in this research was not as comprehensive as was originally intended. While this was compensated for by some of the other data sources, a more complete representation of these business functions would have been preferable and would need to be considered in any follow up study that was done.

To conclude this section, the research that was undertaken for this thesis was to establish if the notion of the success package and the questioning framework that was proposed in chapter 2 was an ecologically valid way of identifying factors that contributed to the success of an IS system. This research question had several points that it needed to address. The first was if the definition of success for an IS system could be expressed in terms of separate yet interrelated success factors. This was shown as being feasible in section 4.3, where both success enhancers and inhibitors were collected and presented in various different views – by organisational area (section 4.3.2) and by perceived affect on success (section 4.3.3). More work is needed to determine how to better present this data – as discussed in the next chapter – but the results themselves show that it is feasible to express IS success in terms of a collection of ecologically valid factors. The second point was to determine if it was possible to use a framework to define questions that could then be used to help track the success or failure factors that had been identified. This was also shown as being feasible in section 4.3.4 where both questions and possible measurements have been identified for the factors that were included in the success package. As noted above, there are challenges that have to be considered when constructing these questions and measurements, but it is something that can be performed. The third point was to determine if the four candidate areas proposed from the literature review were valid and if the priorities assigned to those areas were supported by the factors found. What the results from the research identified was that the four proposed areas were – in the context of the target organisation – valid areas in which success factors could be found. Additionally, in terms of the number of factors detected in each of those areas, the assignment of priorities also has supporting evidence. The results also showed that, based on the factors identified, more potential areas may be needed. The most pressing was an area that could focus on the financial factors associated with an IS system. In terms of this research, examples of factors that might fit into this area were new license revenue and maintenance revenue. Another potential area for which the supporting evidence was not quite so strong was an area encompassing the market presence of an organisation. Again, in terms of this research, example factors which were found that could fit into this area were referenceable accounts and good analyst reports. Both of these factors were shown from various data sources as being sales promoters, and thus, contributors to IS success.

As stated above, the research undertaken in the context of this organisation does provide support for the notion of the success package and the questioning framework. In the following chapter, the final conclusions for this thesis will be presented and suggestions for the next steps to build on this research will be discussed.

5. Conclusions and Suggestions

This final chapter presents the conclusions that were found from this study and makes suggestions for the next steps that need to be undertaken to resolve any issues found. Overall, the study found that the concept of the success package and questioning framework was a useful tool when used alongside an IS methodology to help track factors not specifically covered by that methodology. The study showed that by mining data sources within the organisation that a more precise package of success and failure factors could be constructed that would then force projects to track entities that they might not have otherwise considered, but that had caused problems for other projects. The remainder of this chapter deals with the more detailed conclusions from this study and how issues that were found with the model should be addressed going forward.

5.1 Conclusion

This research set out to investigate the notion of IS success and examine the hypothesis that IS success was not a static construct, but rather, was best described as a package of interrelated factors that each contributed or detracted from an IS system being successful. This research examined ways of being able to define these success or failure factors and track them in parallel with any existing processes that were already be in place. This was summarised in section 1.2 as the following: -

1. To identify "common" constructs or definitions of IS success and failure that are in use by industry, or that have been proposed by the IS research community.

2. To analyse and breakdown these constructs to determine what "common" areas are regarded as being important for IS success. Then, once these areas have been identified, to define questions that would allow a multi-national organisation to interrogate these areas for success factors.

3. To examine the hypothesis that IS success can be more accurately described as a *package* of individual and unique success factors whose definitions and measurements depend on the organisational context in which an IS system is being developed.

4. To define and validate a potential framework that can help an organisation identify factors that would be part of such a success package.

5. Finally, to identify directions for further research based on the conclusions raised from this study.

The organisation that was used as the basis for this research was a global software house that develops, supports and provides consulting services on a number of different software products around the world. As such, it was an ideal candidate for both testing the hypothesis and determining if the end results from the research were of any practical use to the industry.

The market space that the organisation used for this research primarily caters to is a mature, yet growing market specialising in supporting other software vendors in the development, management and rollout of their own IS systems. As such, it is in a unique position to be able to understand the issues that software vendors have when trying to achieve a "successful" system. It is worth noting however, that due to privacy issues, the software company that was used as the target for this research did not want to be mentioned directly, and as such, was only referred to as the target organisation[37].

Based on the literature review that is detailed in chapter 2, it was proposed that the factors which contribute to IS success could be interrogated from four primary sources within the organisation. These proposed areas (as shown in table 5.1 below) were selected based on the models of IS success and failure that were reviewed. These areas were also proposed based on the types of assets and processes that are controlled by ISDs and IS evaluation frameworks. To support this, chapter 2 included an analysis of two such evaluation frameworks and related the results of that analysis back to the four areas that were proposed. The associated priority for each area describes the importance that was placed on that area by the various success and failure models that were examined.

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[37] The organisation is also sometimes referred to as study1 or study2.

Organisational Area	*Possible Priority*	*Description*
Project Management	1	The processes and management strategies that are directly related to the development and/or running of the IS project.
Stakeholder Expectations	2	The expectations – both future and present – that stakeholders have regarding what a system *is supposed to deliver*
Organisation Context	3	The management and organisational context within which the IS project operates. Does not specifically refer to the management of the IS project itself, but rather the organisational structures
Technology	4	The technology used to implement an IS system

Table 5.1 Examining those areas that may need to be evaluated

Based on these proposed areas, it was argued that the best means to discover success or failure factors was to construct questions that could be used to identify and then measure them. Using this method of constructing questions was suggested as the best approach because it allows the capture of factors that are both subjective – e.g. opinions – and objective in nature. This questioning approach was also consistent with other teleological methods such as Critical Success Factor analysis that was discussed in section 2.7.1. As such, the goal of this research was to test, in the target organisation, if IS success factors could indeed be classified in terms of the four proposed areas and if questions and measurements could be constructed to track such factors.

As this was the first time that such research was being performed in this organisation, the goal of the study was not to focus on the results of the analysis – i.e. the identified success factors – but rather, to determine if such factors could be related back to the proposed areas. The success factors themselves were the means of testing the proposed hypothesis, not the main goal of the research. The reasons for this were several. Firstly, as the notion of the success package states, the success factors themselves are potentially unique to any organisation, so the generalisability of any such factors will be limited. Secondly, this research was being performed to test the mechanism of the proposed framework, not the results from the analysis done to construct that framework.

The research methodology that was selected to perform this analysis was case based research. The reason for this was that this methodology best suited the context specific nature of the factors that would be identified and yet, allowed a level of construct generalisability which was the main goal of the research. Given the nature of the interpretative, context

specific data sources that would be used, it was determined that quantitative research approaches were not the most suitable. In addition, it was also determined that other qualitative approaches - such as grounded theory or action research - would be too specific to the context of the organisation and too impractical to implement given the constraints of working within this particular commercial environment. The target organisation was willing to assist with the research, but not to provide the level of involvement that would be necessary to support these other research paradigms.

Once the research methodology had been selected, data sources needed to be defined that could be used to locate success factors within the organisation. The data sources that were selected needed to represent all the necessary stakeholders and include – if possible – quantitative and *qualitative sources of* evidence. The process used for selecting such data sources involved discussions with key stakeholders to identify what sources were available and which ones were the best to use. The results of these discussions gave the sources listed in table 5.2 in the supporting volume. These data sources were selected to include archival records, quantitative information, interviews and documentation. They were also selected to include information from organisational areas within the company that represented development, project-management, customer support, consulting and end users.

During the research stage of this thesis when the data was being gathered, the target organisation in which the research was being performed merged with another company. The overall effect of this merger was limited, except that the sales write up data source was discontinued and that several of the development and QA groups who had originally provided data were disbanded. However, as the data gathering activities had mostly been completed by this stage, the effects were mostly limited to the inability to follow-up with these groups any queries or issues that later arose.

The data gathered from the various sources was analysed according to the procedures described in chapters 2 and 3. The qualitative data sources - such as interviews, sales write-ups, surveys and meeting minutes. - were analysed using codification techniques on Nvivo and also, in discussions with a review group from the organisation. This group helped review the classifications assigned via the codification process and also, assisted in providing those classifications. If any conflicts occurred between the various classification methods used, then the review group had the final say via majority vote. This process was used because the group understood the context of the organisation and thus were better able to judge the most relevant areas that factors belonged to.

To better understand the context in which these factors occurred, not only was each factor classified in terms of the organisational area(s) they belonged to, they were also classified in terms of the causal impact that a factor was seen to have on IS success. This additional classification was done for two reasons. The first was to help understand the criticality or causal influence of that factor – whether it was direct or indirect - and secondly, to describe the context of that influence – if it was inhibiting or enhancing to success. Adding this additional classification was beneficial in that it helped to provide a priority to each of the factors identified. Addressing direct, inhibiting factors first would give more benefit than looking at indirect, inhibiting ones. The analysis of the quantitative data sources was done using the reporting capabilities of the software that managed the user incident data repositories. This analysis was primarily aimed at identifying problematic functional areas[38] and root causes of customer escalations.

The analysis of these various data sources identified success and failure factors *which* were then grouped into the proposed areas of the framework. These areas satisfactorily held the majority of the factors raised, but there were some factors which both the codification and the review group felt did not fit into the proposed areas very well. These were factors relating to financial considerations and marketing presence. In the context of this organisation, the case for adding a financial area to the four already proposed was strong. There were a number of data sources – especially interviews – where financial criteria as a success factor was highly emphasised. This was also reinforced by the group reviewing the results. The second area dealt with success and failure factors relating to the market presence of the organisation and product. Here, the case presented for inclusion was not so convincing. Some of the factors that might have been candidates for this area could also have been fitted into stakeholder expectations, but this was not true for all of them. Apart from these two particular areas however, all the success and failure factors identified did fit into the four areas proposed.

As far as supporting evidence for the associated priorities that were nominated for each area, this came from the numbers of factors that were categorised into each of the areas. In section 4.3.2, a total of 172 individual factors were attributed to project management, 84 factors to stakeholder expectations, 48 to organisational context and lastly, 43 factors to technology. There was however no further analysis done regarding these proposed priorities

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[38] See section 4.2.4 for a list of the associated product functional areas

and this is something which ideally should be done in any future research which builds on the questioning framework.

Once the success and failure factors from the various data sources had been collated and categorised, these factors were then used to reverse engineer example questions and measurements that could be used in new or existing projects to help monitor those factors. During the construction of these questions what was found was that the nature of the questions themselves - and the measurements that went with them - fell into two primary groups. The first of these was concerned with the operational, every day issues of a project. These questions were dealing with things like metrics to define software stability, appropriate resource allocations, contingency and code documentation standards. The other group was using retrospective questions to focus on areas like process definition, process improvement strategies and product direction. These types of questions - while of interest to individuals like team-leads - are not something that they would primarily be using. This is a finding which was not considered in the original hypothesis and would need further development.

Another consideration with the questions developed was that the categorisation of direct, indirect, inhibiting or enhancing meant very little to the final questions that were developed. To be more specific, the questions themselves - unless carefully constructed - tended to lose the context of the issue that they were defined to track. This may or may not be an issue depending on how it is viewed. The questions, once constructed, may embody a number of success or failure factors and as long as that question is being used, then it is probably irrelevant as to what all the classifications of those factors originally were. This is also supported by the fact that a number of the questions constructed from either the same or different data sources, tracked virtually identical issues, but from slightly different contexts. One example of this was a question relating to the level of unit test coverage available. In one data source, the presence of unit tests was stated to be an enhancing success factor. However, in another data source, the lack of comprehensive unit tests was categorised as an inhibitor. In both cases, the question that could be developed to track unit tests might be something along the lines of – *"What sort of unit test strategy do you have in place for your code base and does it provide adequate coverage for your needs?"* As can be seen, this question can apply equally to both factors mentioned above and as such, has no context in itself. If the context of a factor is important therefore, it needs to be built into the question itself, so that when that question is asked, the reason behind that question is clear and unambiguous. This is also something that was not considered by the original hypothesis and will need further development to clarify.

It was found that the process of constructing measurements was dependent on the type of question that was being asked. For those questions that were targeted at the operational type of consumers, the measurements that should be constructed to track such questions are easy to construct and give a repeatable result. For questions that are reflective in nature however, or targeted at the strategic level, the construction of a suitable tangible measurement was not always possible. The original intention of having a measurement was to define a construct that would have tangible attributes or properties which would allow a factor or question to be objectively tracked via those properties. However, for some of the questions, attempting to define a tangible measurement was seen to be either impractical or impossible as the question called for a subjective opinion that changed depending on who answered it. For these types of questions, it was felt by the review group that the measurement used should be taken from the results of interviewing key stakeholders. Or alternatively, that the question itself needs to be broken down into further sub-questions which could then be measured separately. This however is an area which needs further investigation.

As can be seen from the information above, the research undertaken in the context of this organisation has been able to: -

- analyse models of success and failure,
- propose a set of common areas with regards to those models,
- construct a list of success and failure factors ecologically valid for this organisation,
- test the four areas that were proposed as candidates for the framework and lastly,
- create a set of potential questions and measurements that were based on those factors.

This covers the stated goals that this research had. The research has shown that it was possible - within the context of this multi-national organisation - to construct a definition of IS success that was made up of a package of success and failure factors. Also, that by using the four areas proposed, that it was possible to construct questions and measures that could be used to track those factors. The last major goal to address therefore is to discuss the next steps that this research would need to take in order to make this framework a practical tool for organisations to use. This discussion is held in the next and final section.

5.2 NEXT STEPS

There are a number of issues both theoretical and practical that need to be addressed before the notion of the success package and the questioning framework it supports could be of real

benefit to an organisation. It is not the intention of this last section to address all these issues, but rather, to highlight what they are and based on the findings of this research suggest possible ways of approaching them.

5.2.1 Addressing concerns with the hypothesis

The first of the issues to be commented upon will be those related to the theoretical construction of the framework. The initial issue to be considered is that of generalisability. As with all case-based research, the data which is collected and analysed is scoped to the unit of investigation in which that research takes place, or in this case, the target organisation. This concern has been mitigated against to some degree by the virtue that the target organisation is a cross global company and that the teams who took part in the research came from a number of separate cultures. However, they are all part of the same global company. As such, the next steps for this research would be to go to another organisation, perhaps in a different marketing space, and replicate the results. This would be beneficial for main two reasons. The first is that it allows the results to be validated in a separate environment and secondly, that it allows the framework to be refined and retested with regards to comments on how it can be improved on made in this chapter.

Apart from resolving issues of generalisability, further work also needs to be done to determine if the two additional areas that were identified – financial and market presence – need to be added. This could be done in several ways. One method would be to return to the models of IS success and failure that were used for the initial research and investigate how they view financial definitions of success. It might be that these models are focusing on specific aspects of IS success and that this focus has also been inherited by the questioning framework. Another way would be to consider that the emphasis placed on these two additional areas are artefacts of the data sources used within the target organisation. By replicating the research in another organisation, using slightly different data sources, it might be shown that there is less supporting evidence for the addition of these two new areas. Ideally, a combination of these two approaches should be used to address this issue.

With regards to the questions within the framework, there are a few enhancements that need to be considered. The first of these is that the research undertaken has shown that the resulting questions which are developed can be targeted at many different interest groups. In light of this finding, additional work needs to be undertaken to determine the best way to create a set of profiles that can then be used to better organise the resulting questions for potential consumers. In the context of this study, two such profiles were identified – those who deal with the normal day to day operational issues and those who are more concerned

with the strategic or reflective type of issues. Ideally, the questions that relate to one interest group should not necessarily be exposed to others. As such, work needs to be done to incorporate this into the framework. The definition of such profiles could be performed either by examining the job roles within an organisation and creating the profiles from those or instead, by utilising existing profiles from common IS methodologies. The most appropriate approach would have to be tested.

Another consideration for the framework with regards to questions is the concern of how to define context and criticality. It was found during the construction of questions, that sometimes, questions could be created that lose the context of the situation that they were created to track. This may or may not be an issue, but does suggest that the framework needs to be extended to provide a method of prioritising which questions need to be addressed first. This research used a system of direct, indirect, enhancing and inhibiting, which - as was shown for one example in section 5.1 - does have its limitations. It would be better to use a simple priority system that tells the user those questions which must be addressed first. This is an issue that would need further study to determine the best approach to use.

5.2.2 Addressing concerns with the implementation

The use of the framework in this research gave rise to a number of practical concerns that would need to be addressed before it or the concept of the success package could be used for real. The first of these would be to provide some guidance on how best to select any data sources that were going to be used to define the success package. The data sources that were used in this research would be a good start, but these sources were mostly specific to the target organisation so would not always be available. Based on the experiences from this research, the initial suggestions would be to seek out data sources: -

- that describe the organisation's processes and policies,
- that detail group, team or business unit policies,
- that provide metrics on customer issues, defects, enhancements and escalations,
- that provide metrics on code overage and build stability,
- that provide metrics on test coverage,
- that provide retrospectives on past projects to help determine what went right or what went wrong,

- that allow key stakeholders to express opinions via survey, study group or interview on what factors they believe are important to IS success,
- that allow users - or user proxies - to express opinions about what they think of the product and/or organisation and what needs to be improved,
- that gauges what the marketplace thinks of the product and/or organisation *and what* needs to be improved,
- and lastly, that allows representatives from each of the primary business areas associated with the product to have their say.

The use of the above data sources will allow a rounded set of opinions, qualitative and quantitative data to be gathered about success and failure factors. However, this needs to be tested and a set of best practice recommendations constructed based on the experience of this study.

The presentation of the success package itself is also something that needs to be improved. Although this research was able to construct a list of factors that meets the definition of a success package, the factors gathered are context specific or convoluted in what they are trying to say. As the factors themselves were not the main focus of this study, not much consideration was given as to how factors are presented to the end consumer. Ideally, all the factors found need to be refined and categorised in such a way that they are unambiguous, unique, described in language that can be understood by all stakeholders and lastly, targeted at the relevant consumer. Currently, the success factors found are collated by organisational area, direct, indirect, enhancing or inhibiting classifications. While useful, this grouping does not remove duplicates, profile factors by end-consumer or make them worded in such a way that they can be readily understood by all. A set of guidelines or best practices needs to be created that will allow factors to be presented in a way that can easily be consumed by all. This is not currently the case.

As well as the presentation of these factors, thought also needs to be given into how the process of capturing these factors could be improved as well. Codification and quantitative analysis techniques can be very time consuming and off-putting for commercial organisations to undertake. Further work needs to be done - potentially based on CSF procedures (Rockart, 1979) or Benefits Management (Ward and Daniel, 2005) - to determine if there are easier ways to identify such success and failure factors and then document those procedures or best practices for easier use.

The last area to consider would be the definition of guidelines that would help with the construction of valid measurements. As stated in section 5.1, the process for constructing measurements can be difficult for questions that are reflective in nature or trap subjective opinions. In the context of this study, it was suggested that the measurements for these types of questions could be constructed either by seeking out the opinions of key stakeholders, consulting policy documents or by breaking the questions down into lower level sub-questions that would then be more measurable. This is an area where more work needs to be done on validating which of these approaches works best.

To conclude, this research has given support to the hypothesis of the questioning framework and the IS success package that it is aiming to support. There are areas that need to be addressed – both theoretical and practical, but these can be resolved by replicating the use of the success package and questioning framework in one or more additional environments. This will allow both the theoretical questions to be resolved and best practice guidelines to be created as described above.

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