Process Mapping Software: Vendor Business Benefit Claims

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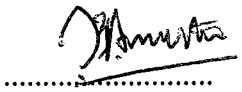
Declaration

I hereby declare that this submission is my own work and that, to the best of my knowledge and belief, it contains no material previously published or written by another person nor material which to a substantial extent has been accepted for the qualification of any other degree or diploma of a University or other institution of higher learning, except where due acknowledgement is made in the acknowledgements.



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Abstract

Globalisation has forced organisations all over the world to rethink their business strategies. Organisations can no longer sit and wait in the illusion that their market share will remain intact. Often organisations are faced with threats from far and wide from other organisations who adapt to every move that the market makes. The payback has been for organisations who adapt and those who manage them to be in a state of readiness and to always ensure that they are able to react to every move that their competitors make. Some organisations are well aware of the fact and often prefer to make the first move.

The need for the documentation of business processes have increased dramatically. An increasing number of organisations have realised that Business Process Improvements (BPI) is one of the most effective forms in which an organisation can not only improve the output but also sustain growth. In the quest for documenting business processes organisations have turned towards software tools which aid the documentation of business processes. Some organisations utilise these tools in their quality initiatives while others use the software as the quality initiative. Whatever the utilisation the question still remains, do the users of these software tools truly achieve the benefits stated by the vendors? What are the factors contributing to the success of these tools? Does the implementation impact on the utilisation and the effectiveness of the software?

In this study it is proposed that the customers of a process mapping software vendor are to be surveyed in order to understand the claims made by the vendors from a customer perspective. The survey is to be constructed to provide both reliable and valid data that will be analysed further using confirmatory factor analysis. The results of the analysis will show the significant impact of the satisfaction or otherwise of adoption of the software in the organisation. It will reveal the impact which the implementation of the software has against end user satisfaction. It will also look at the factors contributing toward the successful implementation of the software. These factors include the existence of a quality initiative in the organisation. The

organisation culture and if it fosters a culture which strives towards the improvement of the organisation and its business processes. The acceptance of the software by its users is to be measured. It is important to identify the context in which the software is being used. The frequent use of the software to instil, maintain and develop the quality efforts of the organisation.

It is hypothesised that the relationship between the implementation of the software and the benefits achieved by the users of the software relate to the proper implementation. This should have a significant impact on realising the user expectations. The study showed that the acceptance of the software by its users as one of the most important factors towards the successful implementation of the software. While the relationship between the existences of a quality framework and the implementation of the software had a positive effect it was not identified as the dominant factor towards implementing the software with success. When implementing the software organisations should take measures to ensure that the software is well accepted by its users and the implementation framework adopts a best practice methodology which would enable the organisation to gain the benefits which they desire.

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List of Abbreviations

ABC	Activity Based Costing
AGFI	Adjusted Goodness of Fit Index
ANOVA	Analysis of Variance
BPI	Business Process Improvement
BPR	Business Process Reengineering
CMM	Capability Maturity Model
CMMi	Capability Maturity Model Integrated
COBIT	Control Objectives for Information and related Technology
GFI	Goodness of Fit Index
IS	Information Systems
ISO	International Standardisation Organisation
IT	Information Technology
ITGI	Information Technology Governance Institute
OCG	Organisation Government Commerce
PM	Project Management
PMI	Project Management Institute
PRINCE	Projects In Controlled Environments
PVA	Process Value Analysis
QMS	Quality Management System
RMSEA	Root Mean Square Error Approximation
SEM	Structural Equation Modelling
SPSS	Statistical Package for Social Science
TFI	Tucker-Lewis Index
TQM	Total Quality Management

Chapter One

INTRODUCTION

1.1 BACKGROUND

Since the 1960's organisations in the western world have been involved in an ongoing effort to improve the performance of their businesses with little effect (Deming 1982 p.2). These organisations soon felt the consequences of growing international completion. This competition mainly came from the Japanese who have relentlessly strived to achieve quality since the late 1050's. When it almost seemed like they were losing market share to the Japanese, the organisations realised the problem. They realised that the problem effecting these organisations was not related to the tasks performed by their employees but the business processes in which the tasks reside (Hammer 2001 p.180). This made the modern organisation more competitive. The organisations turned towards Business Process Improvement (BPI) as the answer to their problems.

Once the organisations realised the extent of competitiveness displayed by international organisations it became clear to them that the efficient management of business processes were key to their long term survival (Unga 2006 p.400). Hence it was realised that to understand a business process they must first document it as the management of the process is dependent upon how well the process is understood. Process documentation has become the most commonly used tool in BPI throughout the world (Unga 2006 p.400).

Matsumoto, Stapleton, Glass, and Thorpe (2005) discussed in their paper that process maps can be used in the documentation of not only technical documentation but also the compilation and presentation of management reports in the form of management briefing sheets. These sheets were designed to provide the managers with an understanding of each and every stage in every project which the organisation was involved in.

When the organisations realised the importance documenting it's process they commenced the quest for methods in which they could active this with ease and with the maximum benefits.

Organisations soon turned towards graphical software in order to document the processes in pictorial formats. They believed that once the process has been documented in the pictorial format it can be easily analysed and improve to achieve the optimum results for the organisation (Gourishanker 2003, p.104).

Hence the process map became a part of the organisational quality initiative. The meaning of the word quality changes from organisation to organisation depending on the nature of the business which they are in (Deming 1986, pp.169-170). This presents an interesting question as to what initiative these organisations utilise in their quality management programme. Understanding these initiatives provide the user with the ability to take advantage of the opportunities presented by them.

Process mapping software has enabled businesses to adopt business process improvements as part of the quality initiative in organisations where a quality initiative such as this could not exist. The ability to document business processes may not seem like a task that requires a lot of effort. But what organisations don't realise is that the diagrams and flowcharts it provides an insight towards the heart and soul of the business. Equipped with the appropriate resources an organisation can transform its business overnight from an organisation which struggles to achieve targets to one which excels in customer satisfaction.

It is also important for businesses to be in a constant state of readiness. This will allow these organisations to develop products and strategies which will permit them to compete increase productivity and improve the competitive position in the market (Deming 1982).

Understanding the issues relating to the implementation of software and systems has been undertaken by business organisations as well as academia. But the fact remains that the pace of business and the increasing challenges faced by modern businesses the development in technology and methodologies have failed to keep up with it. The thirst for knowledge in this area has not been quenched by the research and developments in these fields.

1.2 MOTIVATION

The impact of the implementation of the project on the satisfaction of the users have been the topic of discussion in many widely published and acknowledged journals. These include DeLone and McLean. (2003, p.9); Standish (1999, p.4); Young and

Jordan (2005, pp.55-61) to name a few. While the issues published relate to practices of project management and more specifically the implementation of software it is important to note that similar constraints apply towards the use and the implementation of process mapping software and quality frameworks. The research conducted by investigating various key aspects of implementation projects. These included the project methodology, top management support, user involvement, high level project planning and the abilities of the project staff.

It is also believed that in spite of a sound project management methodology projects still fail to succeed. Where project success rates are stated are as low as 30% the question can be asked if the project management methodology actually does contribute towards the successful implementation of software (Young 2006, pp.60-61).

The other factor which contributes towards the cusses of the implementation is the use and the satisfaction of the users. As discussed by DeLone and McLean (2003, p.9) information quality, system quality and service quality greatly contribute towards the satisfaction of the users. For the purposes of this research these factors are investigated under user expectations. It is believed that once the desired benefits have been fulfilled the system would have achieved end user satisfaction.

Alongside the implementation framework resides the governance framework. Governance is described by the World Bank (1991, p.i) as an exercise of power, authority, control and management. Chartered Institute of Management Accountants (Brand and Boonen 2004, p.14) describes it as a distribution of rights and responsibilities amongst roles in the organisation. It is the intension of this structure that the employees of the organisation abide by the governance structure to ensure the accurate execution of the business processes.

The most important reason for the implementation of a process mapping software is the potential cost savings. Organisations endeavour to reduce costs in the business process in the organisation. As discussed in an article published by Beischel (1993, p.23) the motivation of the organisations to adopt process improvement as profit. Where the practice of Activity Based Costing (ABC) is applied in a simple principle called Process Value Analysis (PVA). Where the documentation of the process contribute towards a cost analysis which impacts on the profitability of the business process. Utilised properly these measures will also provide the organisation with adequate measures to determine operational efficiency. However what needs to

be realised is that a combination of measures can be used under varying circumstances to determine the operational efficiency of an organisation.

The technology measure of the performance of the software can also be measured in a similar manner to cost. This is discussed by model (Staples and Seddon, 2004 p.17) in the technology to performance model. The model can also be utilised as a measure for operational efficiency. Though it is a more direct method describing the functionality of the technology, as discussed in other studies it will certainly complement any other measures.

The financial gains which an organisation may look forward to gain can be summed up by one simple statement. It is that less work is required. As discussed by Deming (1982, p.1) the development of processes and the efficiencies which arise from the business processes the more work the employees would have to do. This would increase the productivity and the ability to adopt quality practices in the business process.

Hence the discussion and the evaluation of the vendor claims of process mapping software vendors would contribute towards a better understanding of what is required to implement the software successfully. It will enable the organisation to optimise the implementation and customise it to the specific needs of the industry. This by itself would provide the organisation with unparalleled gains in the implementation project. The research would provide guidance towards the potential problems which the organisations face in the implantation. Finally it would also provide the organisation with a understanding of the requirements of a quality management framework as well as a governance framework. This in turn would ensure the sustainability of the BPI initiative.

1.3 STRUCTURE OF DISSERTATION

Chapter 1 introduces the motivational factors relating to the study of the vendor benefit claims of process mapping software. It will also look at the main as well as sub objectives of this study. Chapter 2, involves a review of literature relating to similar studies in the various aspects relating to the vendor benefit claims of process mapping software. The vendor benefit claims are asses from the customers perspective as end user satisfaction. Where it is deemed that when the end users

achieve the desired benefits claimed by the vendor that their objectives will be satisfied.

The factors contributing to end user satisfaction will also be discussed in this chapter. A model hypothesising the relationship between end user satisfaction and the various elements will be constructed.

Chapter 3 will outline the methodology used to test the research model presented in the preceding chapter. This chapter will also review the methodologies utilised by various other researchers whose study bears a association to the evaluation of process mapping software will be discussed. The data requirements and the associated limitation to the research will also be discussed in this chapter.

Chapter 4 will report the findings from the analysis of the data collected. This will be presented firstly for the expert feedback then the pilot study and finally the actual data collection by utilising the survey. The validity of the hypothesis developed in Chapter 2 will be discussed based on the findings of the survey.

Chapter 5 will revisit other research conducted with the aim of assessing software vendor benefits or similar subjects will be discussed with relation to the findings of this research. This chapter will also discuss the validity and reliability of the results presented by the research.

The final chapter of this dissertation will consist of the conclusion (Chapter 6). The list of references and the appendices will follow this chapter.

Chapter Two

LITERATURE REVIEW

2.1 INTRODUCTION

The origins of the word quality originates from the Latin word 'qualis' which means 'such as the thing really is' and the international definition of quality, 'degree to which a set of inherent characteristics fulfils requirements' (BS EN ISO9000 2000; as cited in Dale 2003, p.4). How then do we achieve quality? In manufacturing organisations quality is mostly associated with the term six-sigma where the quality is measured by the number of defects which occur in manufacturing (Pande 2000, p.7). "Put everybody in the company to accomplish the transformation. The transformation is everybody's Job." (Deming 1986, p.32). Dr Deming in this book discusses the role of managers in the development of the organisation and how the managers must guide the organisation toward an achieving quality.

A quality director for IBM in the 1980's adopted a process based approach for improving quality in business. The director was quoted as saying; "everything we do in business is related to a business process, there is no product without a process and there is no process without a product. That these processes should be controlled in the same way as the manufacturing processes are controlled" (Harrington 1991, pp.9-10). The intention was that, when the process controls are introduced the managers will step in and understand the responsibilities and lead the business in to a process revolution. This is also similar to Deming's (1986, p.59) ideas on how the managers of modern business should take more responsibility in improving the quality of the business. Deming describes it in his book 'Out of a crisis' where he explains that mangers who manage modern businesses are not mature enough to take on the responsibility. This in turn leads to the lack of understanding in to the business processes and the disintegration of the business processes.

The use of information systems was a significant highlight in the early 1990's.

Over the years researchers have attempted to identify the benefits the businesses have gained from information systems (DeLone and McLean 2003; Grover et al. 1995; Karahanna et al. 1999; Staples and Seddon, 2004; Bailey and Pearson, 1983). There were several commonalities in the research which they conducted. The measures adopted for study by the referenced researchers were similar to others in the IS field. The implementation of projects shared some commonalties when looking at the measures identified in figure 2.1. A study conducted by Young and Jordan (2004, p.20) reported that project management methodology is a contributing factor towards successful implementation. Along with the project management methodology they measured top management support, user involvement, high level project planning and the staff involved in the project. Young (2004, p.61) describes the success rates of the projects at 30%. This is predominantly due to the lack of governance around the management of the project. Despite the increasing use of frameworks such as PMBOK and PRINCE2 their is no evidence to explain the number of projects which fail to meet the expectations.

When studying quality initiatives it is also important to understand the driver behind the quality initiative, the core need of the business which the initiative is set out to achieve. The driver behind the imitative will also need to be investigated in conjunction to the framework in which it is implemented in. This is the factor which has been repeatedly overlooked in most research. However references are made to the measure of quality framework by Grover et al. (1995, p.185) and Bailey and Pearson, (1983, p.532). It is important to note that the existence of a quality framework effect the successful implementation of the project. The determinant of implementation success is examined though the review of literature relating to the studies conducted by DeLone and McLean (1992) and subsequently a review conducted by DeLone and McLean (2003). This section examines the implementation framework of the software implementation project. The governance framework of the organisation is investigated in this section. The governance framework not only looks at the governance of the process mapping software and its associated project but also the governance framework of the organisation.

The proposed study will look at evaluating the user satisfaction of process mapping software. It will attempt to do so by looking at the contributing factors

towards user satisfaction. It will examine the notion that user satisfaction may be obtained by implementing the software successfully. As such the measures towards determining the successful implementation of the software will be determined in the following sections. Section 2.1 will examine the characteristics of quality management. Section 2.2 will defines business process improvement and the various Business Process Improvements (BPI) approaches utilised by businesses. The software tools utilised by businesses will be discussed in section 2.3 while the vendor claims are ascertained in the section which immediately follows it section 2.4.

2.2 QUALITY MANAGEMENT

When investigating quality management the origins and the various forms in which it exists need to be discussed. This will form a foundation on which process improvements and the tools utilised in process improvements can be discussed and studied. The section following will look at the definition of quality as described by the researchers discussed in this section. It will include the relevance of the definitions provided by the researchers with regards to the relevance of this study. It will investigate the effect of quality initiatives on the organisation in which it is implemented in. The investigation and the discussion of various quality management methods and tools will be discussed along with its advantages and relevance to the quality initiative.

2.2.1 Background

Many publications claim that the definition of quality has been distorted and misused by some and that the word has lost its meaning to a certain extent. The word quality is used to justify additional resources and to fight back budget cuts (Dale, 2003, p.4).

The definition of Quality Management does vary from country to county and from industry to industry. Despite this, almost everyone agrees with Juran and Godfrey (1999, p.2) where he states that the quality is measured by the features of the products which we produce and how these products meets our customers needs. This in turn provides customer satisfaction. Inherently it is tied back to increased income. In the pursuit of providing our customers with more features there comes increasing costs. Hence Juran claims that the higher the quality the

higher the cost (Deming, 1974, p.38). This leads to the most common question of what does quality mean to an organization. It maybe because the quality profession continues to evolve and that it continues to grow and mature (Evans and Lindsy, 2005, p.12).

Deming (1986, pp.169-170) also says that quality can mean many things to many people and that it greatly depends on the industry in which it is engaged. Quality does not mean the same to a production worker, a supervisor or to a shop assistant. Whatever the definition may be the fact remains that it is an effort to better what is done. This effort of improving the process and the practices when particularly applied by management can be interpreted as quality management initiatives or improvement initiatives.

The figure below (Figure 2.1) describes how quality management may be used to increase the profitability/market share of a business. This would entail that the management efforts of the organisation is the key to establishing a quality management culture. That quality starts with the managers and the management philosophies rather than the workers in the production facilities or staff sitting in office buildings. Deming describes this as a chain reaction where quality improvement cascades through to more jobs (see Figure 2.1) described by Deming (1986, p.3).

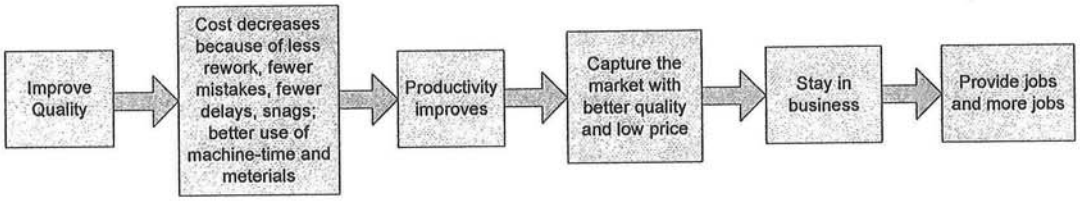

Figure 2.1: Deming's chain reaction model (Deming 1986, p.4).

2.2.2 Quality Management Methods

When attempting to define quality management and the methods associated with achieving quality a large number of experts or quality "gurus" have come up with varying definitions. However a paper written by Doyle (2001, pp.52-62) summarises the thoughts of a great many practitioners such as Edward Deming,

Philip B. Crosby, Joseph M. Juran and Kaoru Ishikawa to name a few. Quality itself may not be achieved without a quality management method. The following section will look at the various methods used by several industries to achieve quality. It can not be said that one method is better than another but that each method is developed and adopted by various organisation to suit its needs and in the quest to achieve quality.

Section 2.1.2.1 will look at the capability maturity model (CMM) and the capability maturity model integrated (CMMI). These models are the quality efforts of the software industry. In manufacturing six-sigma represents the quality initiative to increase production. The quality initiative is discussed in section 2.1.2.2. and the definition of quality by the international standardisation organisation (ISO) is discussed in section 2.1.2.3.

2.2.2.1 CMM And CMMi

The quality efforts of the software industry are represented by the capability maturity model (CMM) and the capability maturity model integrated (CMMi). The software development industry had identified a need to increase the quality of the software developed. Over the years the development of software and particularly the quality of the software has been identified as the weak link in the quest towards satisfying customer needs (Paulk et.al., 2005, p.3). Efforts had been made from November 1986 to counter the quality issues in software development by developing a software maturity framework and by developing the software process maturity framework. After four years of experimentation with these models the Capability Maturity Model (CMM) for Software was developed. The model was based on actual practices in software development. The model reflect the best state of these practices. In addition it reflects the needs of individuals performing software process improvement and appraisals on the software processes (Paulk et.al., 2005, p.5).

2.2.1.2 Six Sigma

Six-sigma is an approach predominantly linked to production. When discussing six-sigma the first things which comes to mind is a production line and the quality associated with the products manufactured.

In the 1980's most organisations looked at increasing productivity. This is when six-sigma was developed and introduced in to manufacturing plants. When

looking at what six-sigma was meant to achieve and what it stands for the best place to start would be Motorola. Motorola explains Six-Sigma in three different levels. Firstly it is described as a matrix for the quality effort. Secondly, as a methodology for the improvement of production, and finally as a management system for the entire production facility.

But in the literal sense Six-Sigma is defined as a term used for "goodness" or "quality". Six Sigma a method which aims at reducing defects in terms of 3.4 defects per one million opportunities (DPMO) particularly in production facilities was later adopted in to business processes improvement as well (Pande, 2000, p.6).

The concepts behind six sigma is said to be similar to "Total Quality" and that the concepts and techniques of Deming and Juran are greatly incorporated in to it says Pande (2000, p.xii).

George (2002, p.16) claims that once of the most important aspects of six sigma is the culture. That an organisation must be ready embrace it. The culture is one of the most influential factors in a successful implementation of six-sigma. The importance of the entire organization from the CEO to the line managers must be involved in implementing six-sigma.

2.2.2.3 International Standardisation Organisation (ISO)

Many argue that ISO accreditation is merely a means of signifying accreditation and not an actual initiative towards quality management. The international standards organization looks at quality in three dimensions in addition to the traditional quality structure. These dimensions lengthen the bounds even further. The business quality dimension looks at the administrative processes and procedures of the business. The product quality dimension looks at the production quality of the organisation while the organisation quality dimension takes a holistic view of the quality initiative (Hoyle, 2006, pp.21-22).

ISO 9000 the standard associated with quality management systems is a way of ensuring that the quality management system of an organization is doing what it is supposed to be doing. The key benefits of ISO 9000 are gained in the journey to obtain accreditation and from the post accreditation external audits and management reviews, as described by Scott (2005). In an opposite view Dagleish (2005) says that ISO registers organizations show no significant improvement in sales to the organizations that are not registered. The reason provided in this

instance is that the organizations have adopted good quality management practices and that it is difficult for them to break through and gain more significant improvement.

Whatever the view adopted by the organisation adopting/seeking ISO accreditation the path towards achieving it ensures that a formal method of measuring process are employed and the employees understand quality improvement and initiatives. At the end of this exercise the auditing process coupled with the management reviews ensure that the current processes are revised and improved Scott (2005). The revision and the improvement of the processes ensure the sustainability of the quality initiative.

2.3 BUSINESS PROCESS IMPROVEMENT (BPI)

Business Process Improvement is a method which can be used in a cross section of industries and organisations. It is not dependent upon a specific industry or organisation and hence the popularity and the widespread adoption of this methodology.

2.3.1 Background

When looking at Six-Sigma its main objective has been to reduce the defects in the production processes as seen in Pande (2000, p.xii). While it is said that these practices were adopted to increase efficiencies in business processes (Pande, 2000, pp.6-8) it was not designed to be used as such initially. Harrington (1997, p.9) defines business processes as all service processes that support the production process. That a business process consists of a set of logically related tasks that uses the resources of the organization these tasks in turn support the objectives of the organisation. Businesses experienced the need for methods and techniques which would successfully satisfy the quality efforts of the business.

The problem as stated by Pande (2000, p.3) is that Motorola in the 1980s and 1990s was having many quality programs instead of one central program. This was later rectified when Six Sigma was developed and introduced in the organization.

2.3.2 Business Process Improvement (BPI) Approaches

Over the years several BPI approaches have been tested and implemented. They have all had strengths and weaknesses with an equal amount of case studies

stating the success and the failure. The approaches were highlighted when the revision of ISO 9001 moved to a process orientation from focusing on functions and departments (Klaus, 2002). This in turn has brought the emphasis on to process documentation. The Deming Cycle (Brassard, 1996, pp.1-2) described in Figure 2.2 was aimed at breaking up the departmentalisation of the organisation. The plan-do-check-act cycle attempts to improve the quality initiatives by adopting a continuous improvement philosophy.

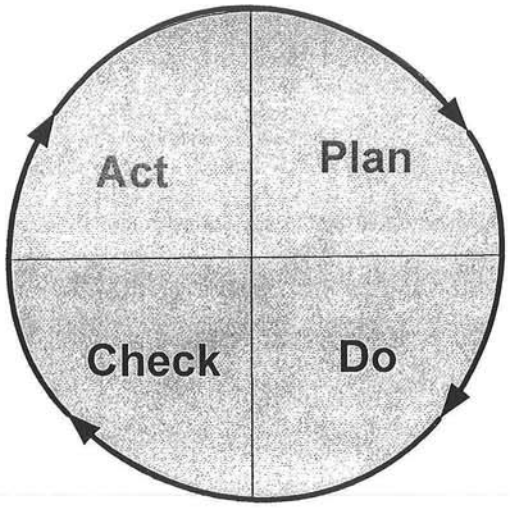

Figure 2.2: Deming Cycle (Brassard, 1996, pp.1-2)

The Deming cycle relates not only towards the operations of a business but also the practicality of the day to day lives of individuals. It suggests initially, to **plan** out what is to be accomplished and the actions required to achieving the goal. Action is taken (**do**) to achieve the goal and our plan. The results are **checked** against the actions to ensure that it will meet the needs and finally, **act** by making changes to the approach, which help to achieve the goal. A few fundamental issues in utilising the Deming cycle in business have been discussed. The departmentalisation or the separation of business units in organisations has become a vital factor in the ineffectiveness of the cycle (Brassard, 1996, pp. 2-3). When the business units are separated the communication and the interactions

between the business units breaks down. This causes inefficiencies in the operation (Harrington, 1991, p.12; Brassard, 1996, pp. 2-3; Dias and Saraiva, 2004, p.47).

The effective use of the 7 management planning (MP) tools can help managers to breakdown the departmentalised behaviour. Effectively used, the tools will ensure the managers will be able to plan an effective and satisfying process (Brassard, 1996, p.3). Future investigations in to the MP tools by Dias and Saraiva (2004, p.47) reveal that even the implementation of 4 of the 7 tools provide significant advantages to businesses.

The 7 MP tools are; Affinity diagram, interrelationship diagram, tree diagram, prioritisation matrices, Matrix diagram, Process decision programme chart (PDPC) and activity network diagram. The 7 MP tools are described in the paragraphs to follow as described by Brassard (1996, pp.5-6).

An affinity diagram is used to collect large amounts of ideas, options, issues and so on,. and to organise the data in to groupings based on the normal relationships which exist between the data. It is known mostly as a creative tool as opposed to a logical process.

Interrelationship diagrams (I.D.) analyses the complex problems with multiple variables or desired outcomes. The method explores and displays all the factors involved. The diagram presents a graphical representation of the logical relationship between the factors. It often displays the cause of the problems as well.

The tree diagram systematically maps out in great detail a full range of paths and tasks which need to be accomplish in order to reach the required goals and the sub goals. This tool is yet another graphically represented method which resembles a family tree or an organisation chart.

The prioritisation matrices utilises the tasks, issues, actions and prioritises them based on criteria which are known and weighted. When correctly utilised with a combination of tree and matrices diagramming techniques, the problems can be narrowed down to the ones that are the most desirable or effective to accomplish.

Matrix diagrams show the correlation of the ideas or the issues in one single diagram. It is often used to show who has responsibility of the different parts of the implementation plan.

Process decision programme chart (PDPC) maps out every conceivable event and contingency which could occur in the path towards the solution or moving away from the problem. When the problem or the end outcome is unfamiliar, this method is used to plan each possible chain of events that need to happen.

Activity network diagram, are used to plan the most appropriate schedule for any task or its related subtasks. It monitors the schedule and predicts the likely completion time of the task. In order to successfully utilise this tool the task must be familiar and the subtasks must be of known duration.

Brassard (1996, p.7) also describes the integration of these techniques in to a cycle. This was done by the Japanese, who used the output of one technique as an input in to the other technique. The combination of the techniques provides a implementable action plan which optimises the effect of each individual tool. Figure 2.3 describes the relationship, the inputs and outputs of the tools in the way in which the Japanese adopted it.

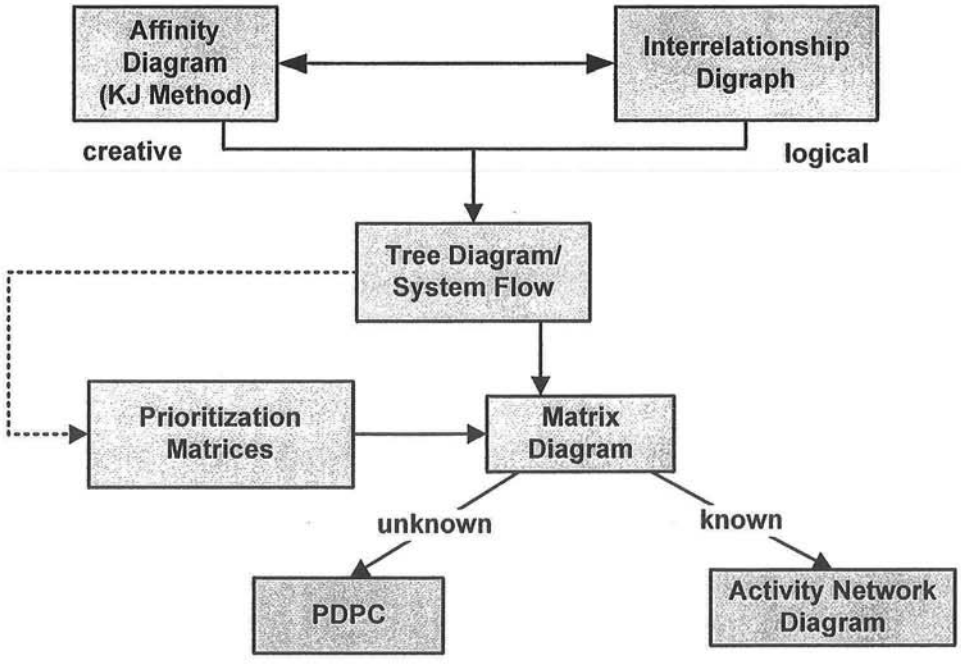

Figure 2.3 Management & Planning tools typical flow (Brassard 1996, p.7)

2.3.3 Expected Outcomes

Various organisations have varying levels of expectations. This is as well the case with the use of software. A research conducted by Staples and Sheddon (2004) set

out to investigate the technology-to-performance also known as the technology performance chain (TPC). The TPC was initially proposed by Goodhue and Thompson in 1995 (Staples and Sheddon, 2004, p,17) this model seeks to link the technology to user performance. The reason for the research was that, since organisations make significant investments in technology it is important for the business to understand the success of the system.

In another study relating to the evaluation of library software Joint (2006) investigates several dimensions of functionality in the software as objective and subjective functionality. Hence software purchased by an organisation may undergo several levels of evaluation of its functionality by its users.

User satisfaction is "in a given situation is the sum of one's feelings or attitudes towards a variety of factors affecting the situation " (Bailey and Pearson, 1983, p.531) this notion is also discussed by Karahanna et al. (1999, p.187). When identifying the measures relating to user satisfaction, the following measures have been a common element in several studies (Bailey and Pearson, 1983 p.532; Grover et al. 1995, p126-127): the attitude of staff, perceived utility, documentation, feeling of participation, understanding of the system, involvement of top management, expectation.

Most of the empirical studies identify the 5 areas in various forms. These being: the governance framework, the expectations of the users, the implementation of the system, the culture of the organisation (includes top management support) and finally acceptance of the system. Hence in order to change the feelings of end users it is not one but many measures need to be established.

2.4 SOFTWARE TOOLS USED IN BUSINESS PROCESS IMPROVEMENT

Over the years several BPI approaches have been tested and implemented. They have all had strengths and weaknesses with an equal acclaim stating the successes and the failures. The approaches were the focus of attention when the revision of ISO 9001 moved to a process orientation from focusing on functions and departments (Klaus, 2002). This in turn has brought an emphasis on to process documentation. When examining process documentation methods and techniques one of the most comprehensive readings is the technique described by Dias and

Saraiva (2004, p.47). The authors discuss three different types of tools which can be used in collaboration to manage the quality initiatives of organizations.

The definition of a process map may be interpreted as an organised way to record all activities performed by a person or a machine (Gourishanker, 2003, p.104). Processes maps contain step-by-step description of actions taken by workers as they use a specific set of inputs to produce defined set of outputs (Merrelli, 2005).

The main reason for businesses utilising process maps is to maintain consistency and quality. There is one overlying reason why businesses utilize process maps, to maintain consistency and quality. Process maps assist all the departments within the business to see a common goal and to predefine the interactions with each other. Without process maps the various departments within the organisations work as individual units without consideration to the other parts of the business. These departments tend to work as individual entities instead of one organization. This is typically known as working in a silo or as adopted a silo mentality. Process maps help the various departments iron out these inconsistencies by predefining requirements (Gourishanker, 2003, p.104).

Once a business has documented the activities as a pictorial process it can be used to these processes maps to improve the processes. What leads to common failure of a process improvement initiative is when a project team fails to document the current state or as-is process in an attempt to leap ahead to obtain the benefits of improving the process. The approach commonly adopted by the project teams is deem to be counterproductive (Selander &Cross, 1999; Mason, 1997; Pyke, 2006).

The three tools discussed by Dias and Saraiva (2004, p.47) are affinity diagrams, relationship diagrams and matrix diagrams. The three tool discussed by Dias represents 3 out of 7 management planning (MP) tools stated by Brassard (1996, p.3). Brassard describes the 7 tools as the outcome of post world war II operational research work originating from Japan. The 7 MP tools are Affinity diagrams.

The affinity diagrams are meant to identify various levels of existing processes and to inhibit the development of new processes without any of the constraints. The relationship diagrams are meant to show the interaction of processes by representing them in a pictorial format and by exploring the

interactions among each other. Finally, the matrix is meant to identify the process owners and the business owners within the existing organizational structure.

2.5 VENDOR CLAIMS

For the purpose of this research vendor claims have been compiled from numerous sources. The objective of which is two fold. Primarily to determine that the claims made by vendors are generic and applied to all vendors of process mapping/documentation software. Secondly to ensure that the software vendor being surveyed is kept confidential as per the agreements made with the vendor for the purpose of this research.

This study had identified and grouped the vendor claims into two sections. Operational efficiency and functionality or the ease of use are the sections. Operational efficiency will take in to account the benefits which the purchaser of the software may stand to gain by utilising the software in their business. The ease of use relates to the feelings or the likes of the users. The level of comfort which the users have in adopting, utilising and accepting the software in their roles in the business is critical.

Section 2.5.1 will investigate the claims or what could be considered for measuring operational efficiency. The ease of use will be discussed in section 2.5.2. Section 2.5.3 will look at the contributing factors towards the ease of use.

2.5.1 Operational Efficiency

The ultimate objective of most businesses may be summed up with one word 'profit'. Most often due to the competitive nature of industries the preferred means of achieving profit is through operational efficiency. Beischel (1993, p.23) in his article discusses ways of improving production through processes. The basis for this articles lies with Activity Based Costing (ABC) where he explains that two products developed with the same raw material and in the same amount of time can end up costing organizations two different costs. The means in which this may be countered sits with a simple principle called Process Value Analysis (PVA). Beischel claims that organisations applying PVA can achieve organizational efficiency. This is also discussed in an article written by Sibben (1992, p71) as an effective method of process improvement.

It is of utmost importance to businesses because, step 1 of the PVA methodology is documenting the process in a flowchart. Even if businesses do not realize the value of PVA it would have taken the first steps towards analyzing its activities and achieving operational efficiency by documenting its processes.

Booth (1996, p.18) defined PVA as a sequence and emphasized the importance of process documentation in the PVA methodology

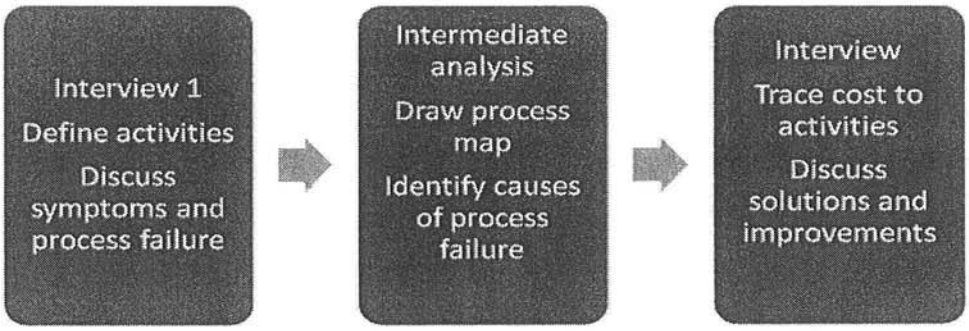

Figure 2.4: PVA Methodology (Booth 1996, p.18)

The impact of information systems can also be measured by the technology to performance model (Staples and Seddon, 2004, p.17). This model looks at predicting the information system on the individual performance. This will also provide a means for measuring operational efficiency derived from an information system.

Deming (1982, p.1) in his book Quality, Productivity, and competitive Position asks the question "why is it that productivity increases as quality improves" in simple terms he provides the answer "less rework". It is further elaborated that people realise the importance of quality in their workplace and generally people are aware that quality is achieved by the improvement of the process. This in turn increases the uniformity of the output and contributes towards reducing mistakes in the operations. This in turn reduces the waste of manpower (the effort). When it is related to production it can also reduce machine time and also the waste of materials. These factors combined contribute towards improved quality, cost reduction and a better competitive position for the organisation. It has a positive effect on job satisfaction for the employees and the

addition of increased employment in the organisation due to the improved position of the organisation. Collectively it will increase the output with less effort for both manufacturing and service oriented industries.

2.5.2 Ease Of Use

A study conducted by Staples and Seddon (2004) investigates the technology to performance fit in organisations. The information system is measured against the preference of the individual using it. This investigation takes in to account several factor including the characteristics of the staff and the characteristics of the technology. The technology to performance chains investigated by the authors has similarities to Deming's (1986, p.3) chain reaction model. Where a positive effect may trigger a positive chain reaction in the entire organisation.

One of the highest ranking measures towards measuring the adoption of information systems in organisations is the ease of use (Grover et al. 1995, p.187; Bailey and Pearson, 1983, p.532). When looking at the behaviours and the attitudes of the end users the less complicated the system seems to the users the higher the likelihood of adoption.

2.6 IMPLEMENTATION SUCCESS

The Project Management Institute and the OGC both define a successful implementation in terms of a project. The success of the project is measured by the time in which the project is delivered (specified by the client), the cost or the allocated budget and the scope or the requirements of the client. Each of these factors competes against each other. The quality of the project is affected by balancing these three factors, a product or service of high quality is considered to have delivered the required product or service on within the specified scope on time and within budget. In project management this is known as the triple constraints (PMBOK, 2004, p.8).

When looking at an implementation of a Business Process Reengineering projects the researchers Grover et.al (1995. p.116) took in to consideration four main elements. These are management support, the support given by the senior managers towards the project. The technology compliance relates to the development platform and the system specifications. Change management is the

ability to manage change within the organisation. Project preparation includes the planning and the readiness of the organisation to implement the software.

The factors identified by Grover et.al (1995. p.116) was different to those chosen by Young and Jordan (2005, pp.55-61) and those of Standish (1999, p.4). When evaluating the implantation of ITC governance standards in Australia unlike the Standish study the project success factors were weighted in order of importance. These success factors were tested in the study.

The project methodology (weighting of 35) ranked highest. The project methodology implied that the project included a clear statement of requirements, proper planning and smaller project milestones.

Top management support and ownership (weighting of 25). The study suggested that despite the fact that this was the second in terms of ratings it was actually the most important factor. This is one of the significant findings in this research.

User involvement (weighting of 19). The research showed that this factor was important when gathering requirements and gaining user acceptance however would not be effective if the management intensions were not transparent to the users.

High level project planning (13).The results revealed that this factor did not have a significant impact on the project. However it was important when the motivation and the benefits of the project needed to be communicated to the project sponsor.

Project staff (weighting of 11). In the projects investigated it was revealed that project staff was motivated in making the project a success. The research concluded that project staff do not contribute to the outcomes of the project.

The two studies stated above display a several common elements such as Management support, user involvement (where change management is used) and the high level project planning , which is dependent upon the methodology adopted (PIMBOK, PRINCE 2).

In another study conducted by Young (2006, pp.60-61) a benchmark is being established for IT projects. The reason for the need arises is organisations inability to implement successful projects. The author suggests that despite the widespread use of project governance frameworks such as PMBOK guide or PRINCE2 there is no compelling evidence that this will lead to superior business performance. It

cannot be determined with certainty that the desired benefits are delivered from these projects.

The author claims a 30% return on investment on the projects studies. It is also a noticeable fact that 2/3 of projects do not deliver on benefits.

2.6.1 IS Success Models (Delone Mclean)

In 1992 William DeLone and Ephraim Mc Lean developed the IS success model. The objective of this model was to measure the complex dependant variables of research relating to Information Systems. This model was initially published in 1992 as "The quest for dependant variables in information systems research" (p.12). The original model adopted from the 1992/93 research conducted by William DeLone and Ephraim Mc Lean is shown below in figure 2.5.

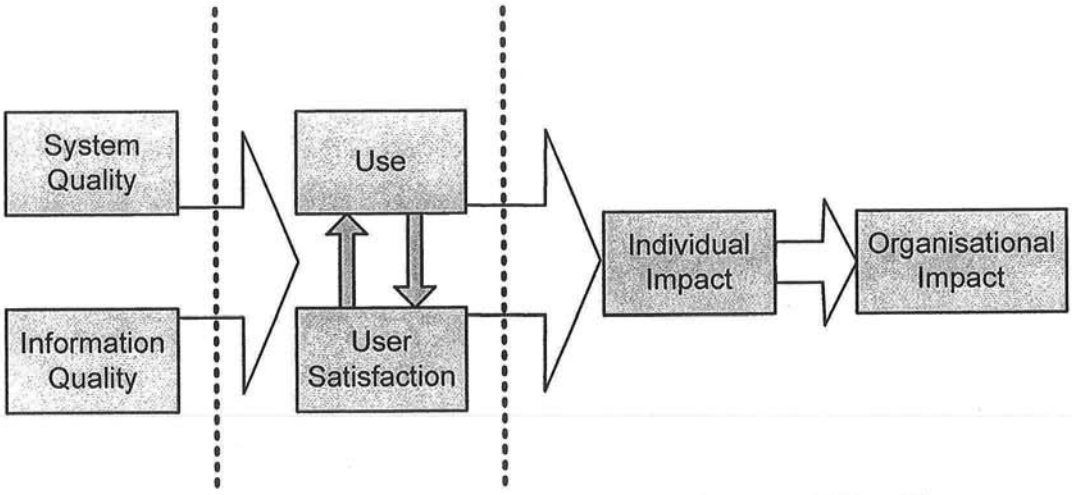

Figure 2.5: DeLone and McLean IS Success Model (DeLone and McLean. 2003, p.12).

10 years later the model was revised by the original authors. In the revision they looked in to the developments IS research has made since the original model was published. They focused their attention on the other research which utilised the IS success model, research which validates the model, challenge and propose improvements to it. Based on the study of the various other IS studies a new and improved IS success model was developed in 2002 (DeLone and McLean, 2003, p.9).

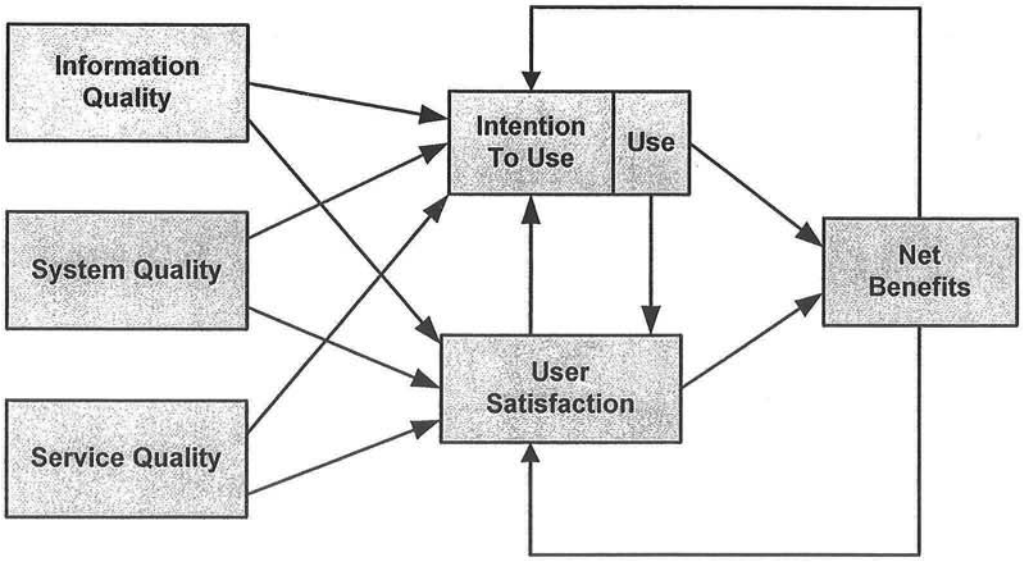

Figure 2.6: Updated DeLone and McLean IS Success Model (DeLone, McLean. 2003, p.24).

As depicted in the model above, the DeLone and McLean Model works around three dimensions.

In the first dimension is information quality. The four studies investigated in the review suggested that relationship between information quality and individual impact to be significant.

The second dimension is system quality. The five studies investigated which tested the association between system quality and individual impact found it to be statistically significant.

Finally in the third dimension, service quality. This measure was not included in the original model by the researchers. However other researchers have argued that it is a contributing factor towards testing the intangible benefits of the software.

The authors claim that all three of these dimensions needs to be measured and controlled as they will have an effect on the use of the software and subsequently user satisfaction (DeLone and McLean, 2003, p.23).

When looking at what organizations may look at gaining from an implementation of software this model looks at several methods of measuring the outcome. It suggests ways in which the software may affect the stakeholders such as inter organisational impact assessment, industry impact assessment, and consumer impact assessment and so on. However the preferred method of dealing

with this impact measures is that it is grouped in to one category as "net benefits". (DeLone and McLean, 2003, p.23).

2.6.2 The Implementation Framework

In a study conducted by Young and Jordan (2005, p.61) the project implementation frame work has been put under scrutiny. The study looks at how information technology has been used to gain strategic advantage by businesses and how the productivity gains have been achieved by implementing information technology.

2.6.3 The Governance Framework

Governance, in a discussion paper released by the World Bank in 1991 (World Bank 1991, p.i) is described as the "exercise of authority, control, management, power of government" which is subsequently adopted for the banks purpose as the managing the economic and resources of a country. When governance is applied to organisations and particularly related to IT systems and processes, the IT Governance Institute assigns the responsibility to the board of directors and the executive managers. The board of directors must ensure that it consists of leadership, organisational structure and processes which are put in place. Which will ensure that the organisations information technology uphold and develop the organisation's strategies and objectives (ITG board briefing, 2003, p.3).

Brand & Boonen (2004, p.16) when describing IT Governance as "a system by which IT within enterprises directed and controlled" the authors further explains that the governance structure distributes the rights and responsibilities among different participants such as board members, managers of IT and the business. These principles in turn spell out the rules and the procedures for making decisions in the organization specifically related to IT. Even though the emphasis her is on the IT governance framework and it specifically relates to IT, it is and needs to be addressed in the entire organisation.

Brand and Boonen (2004, p.14) also refers to the definition given by the Chartered Institute of Management Accountants (CIMA) where the term enterprise governance is used to describe a framework which covers both corporate governance as well as the business governance aspects of the organization. The enterprise governance frameworks discussed have been

graphically represented with its various dimensions and its relationships in the diagram below. This framework describes the relationships between the various forms of governance frameworks under corporate governance.

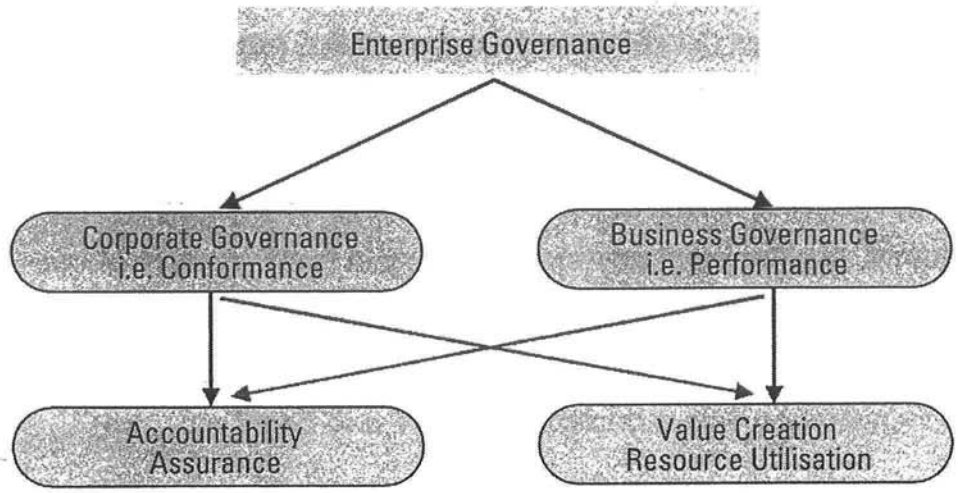

Figure 2.7: Enterprise governance framework (CIMA) (Brand and Boonen 2004, p.14)

Despite the introduction of such systems a study conducted by Letsoala et al. (2006, p.27) discusses the implementation challenges of governance frameworks. The study identified the importance of the governance framework to enable the business to achieve its strategic goals. This is particularly important as a governance framework

In the context of this research the governance required for ensuring that the processes of the organisation or the lack of these measures will be investigated.

2.7 THE RELATIONSHIP BETWEEN IMPLMENTATION AND USER SATISFACTION

In the study conducted by Staples and Seddon, (2004, p.19) the mandatory verses optional use of software is discussed. This is discussed with relation to software which the organisation chooses to adopt. In the case of the process mapping software being evaluated the managers of the business make a conscious decision to adopt this software. In modern business process documentation and the use of software has predominantly become a prerequisite (Pferd, 1996, p.46).

When evaluating software the British and the International Standards BS ISO/IEC 9126 are clear on what the users should expect. These are functionality,

reliability, usability, efficiency, maintainability and portability (Joint, 2006, p.393). These standards form commonalities with the literature reviewed in the preceding sections.

The table below describes the use of measures in the literature revived in order to determine successful implementation.

Measure	Contributing Factor	Study
Quality framework	• Chain reaction from improved quality	Deming (1986 pp.169,170)
User expectations	• System quality • Information quality • Net benefits	DeLone and McLean (2003p.32)
	• Expectations	Bailey and Pearson (1983 p.532)
Project governance	• Project governance framework	Young (2004, p.61)
	• Project definition and planning	Grover et al. (1995 p.114)
Organisation culture	• Top management support	Deming (1986 pp.169,170)
		Karahanna et al. (1999 p.187)
		Bailey and Pearson (1983 p.530)
		Grover et al. (1995 p.114)
Organisational acceptance	• Adoption	Bailey and Pearson (1983 p.532)

Table 2.1 Issues identified from the literature review

The table above lays the foundation for a model which could be tested. It collates the research conducted by researchers who has investigated the successful implementation of projects, the implementation of software and the implementation of business process reengineering tools and techniques. At present it represents a set of measures identified by these researches, which has

been published in the past. The authors stated in table 2.1 have identified the measures as a contributing factor towards the successful implementation. This in turn would provide the basis for end user satisfaction. The studies conducted in the past would provide a foundation by displaying common measures towards the measurement of a process mapping software. Once the measures are described in a diagram it is clear how these factors influence the successful implementation of the process mapping software. The diagram below (Figure 2.8) shows the relationship of the variable towards successful implementation.

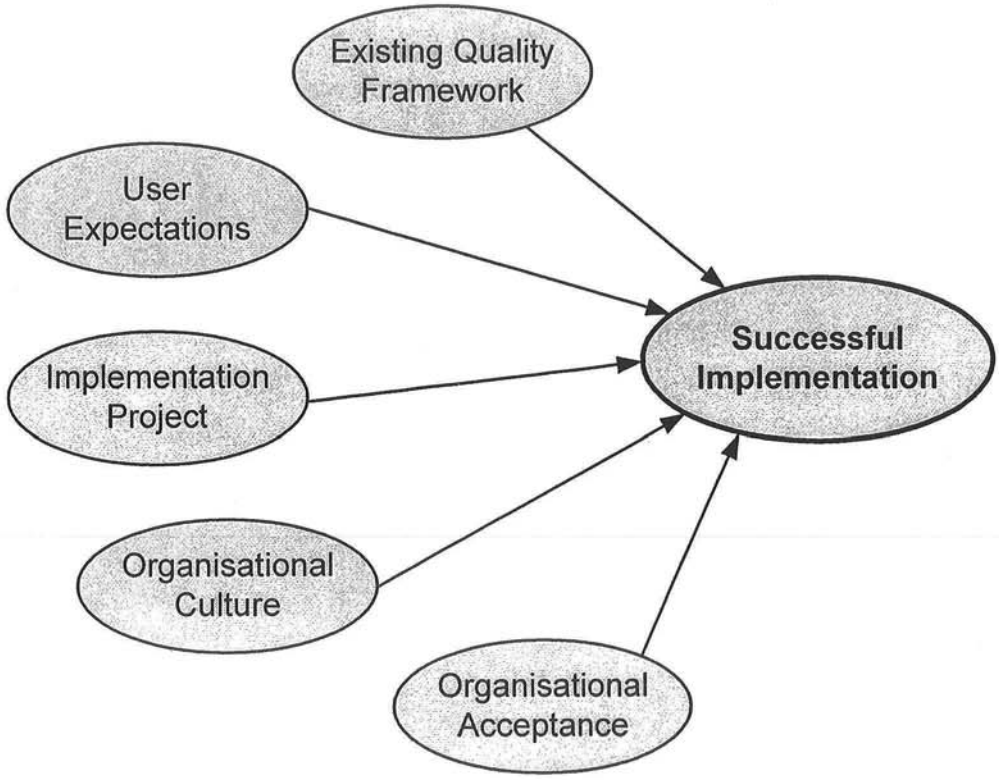

Figure 2.8: Decomposition of implementation success

The figure above describes the relationship which contributes towards successful implementation of process mapping software. The model identifies that a in order to achieve a successful implementation five factors need to be taken in to consideration. This study will investigate and determine if an existing quality framework, user expectations, the implementation project, the organisation culture and organisation acceptance determine the successful implementation of the software.

2.8 CONCLUSION

Successful implementation of projects has been studied across various types of projects. The arguments made by researchers for successful implementation can only be supported if the project was conducted under a controlled environment or a project governance framework has made significant impact. The contributing factors towards a successful implementation of a project were discussed in this and the measure of user satisfaction was also another factor investigated.

It was revealed that successful implementation was dependant upon several measures. These were the existence of a quality framework in an organisation, the expectation of the users with regards to what the project is offering, the governance of the implementation project, the culture of the organisation and finally organisational acceptance.

Based on the above factors a relationship model can be built between successful implementation of the software and end user satisfaction. The expectations of the users and organisational acceptance have been reported to be critical for the implementation of the software. The existence of these measures may be construed as a successful project where by the users achieves satisfaction.

To accurately verify this framework the nature of the relationships would need to be confirmed though empirical data. The data would be gathered to ascertain the measures and the level of impact these measures would have on the successful implementation of the process mapping software. The collected data would verify these relationships and determine the validity of the relationships. Chapter 3 will discuss the research methodology, and the data collection methods will be discussed in detail. It will also discuss the analysis of data for the purpose of this study. The analysis is instructed by examining empirical studies where the implementation of projects was investigated.

Chapter 3

RESEARCH METHODOLOGY

3.1 INTRODUCTION

A review of literature relating to process mapping and process mapping software was presented in chapter 2. The review identified variables which could effect a successful implementation of a process mapping software. This chapter will identify the main research question and a plausible working model which supports a hypothesised relationship between these variables and the successful implementation of a process mapping software. The variables relating to a successful implementation are the existing quality framework, user expectations, the implementation project, organisation culture and organisational acceptance of the software.

In the development of the research model the steps required to empirically test the model will be derived in several steps. Firstly, the development of the measures is derived from empirical studies in similar research. The research examined provided vital information as to what has been done in the past in similar studies. This in turn provides a foundation towards establishing the measures. Once the measures are decided an expert panel will provide feedback on the relevance of the measures against the model. This will assist in enhancing the relevancy of measures in the proposed study. A pilot study will ensure that the questionnaire reliability. This will also provide a test bed on which the questionnaire and appropriateness of the questions towards the research question can be checked. Once any required enhancements to the questionnaire have been completed the data will be collected and finally the data will be analysed and the outcomes presented.

Chapter 3 operationalises the models developed in chapter 2. The models will be prepared for testing in this chapter. The methodology for testing the model is developed based on a review of methodologies used in similar studies. This is to ensure that the most appropriate methodology is selected. The review of methodologies is presented in section 3.2. Following the analysis of the studies the research design will be developed in section 3.3. Following which the design of the

questions and the hypothesis will be presented in section 3.4. The specification of the data requirements for this study will be stated in section 3.5. Finally, section 3.6 will discuss the limitations of the methodology. Along with the limitations of the methodology it will also look at the limitations of the proposed study.

3.2 REVIEW OF SIMILAR STUDIES

In the development of the methodology for this research five studies have been identified and analysed. The research methodology has been based on the analysis of these studies. The pre published studies have provided evidence and contributed towards the construction of the methodology adopted for this research.

The first research conducted by Grover et al. (1995) displays a set of variables which are consistent with those identified in the literature review. The research topic showed similarities since the research was conducted in to the successful implementation of business process reengineering projects. This is discussed in section 3.2.1. Karahanna et al. (1999) discussed information technology adoption against the benefits gained by the technology is analysed in section 3.2.2. The testing of technology, a new platform a new behaviour is investigated against the performance it delivers is researched by Staples and Seddon (2004) which is discussed in section 3.2.3. Section 3.2.4 explores a research which looks in to the measurement and analysis of computer user satisfaction. This study was conducted by Bailey and Pearson (1983). Finally in section 3.2.5 a study investigating the role of product and process improvements is discussed.

3.2.1 The Implementation Of Process Reengineering

The study conducted by Grover et al. (1995) investigates the success of projects implementing business process reengineering (BPR). It links between the implementation of projects and the success of the project by investigating research conducted in the past. The researchers investigated past research relating to implementations of projects associated with business change. The outcome of which was the identification of sixty-four BPR implementation problems. The researchers gathered a panel of 105 industry experts who have worked in similar projects. These

experts were asked to rated the sixty-four problems based on their severity. The identified problems contributed to the foundation of the research.

The variables displayed in this study have similarities with the ones derived through the literature review in chapter 2. All the projects investigated by the researchers had common elements relating to project success. In the research the authors derived the following problems which they investigated in relation to successful implementation. Management support was recognised as one of the highest ranked problems in the successful implementation of a project. The technological competence was also a common contributing factor. The definition of process is also a contributing factor. Project planning, change management and project management were also identified as contributors towards the successful implementation of reengineering projects.

The researchers established from past research that the means in which validity can be ensured is by using key informants who have participated in at least one reengineering project. Hence the respondents were knowledgeable about the issues at hand. 853 questionnaires were sent out to the members of a professional forum. A total of 239 usable responses were received from to the researchers. The response rate of the survey was 29.2%. The researches deemed that this rate was positive rate in comparison to the literature reviewed for the research.

To ensure that the respondents represented the sample frame the researchers carried out chi-squares and *t*-test across a number of key characteristics. These were mostly done by comparing the early responses to the late responses and relating them to the key responses. Through the analysis the study concluded that when looking at reengineering project factors such as process delineation, project management and tactical planning were less difficult to control but had a high relationship to the success of the project.

The research steps followed by the researchers are as follows.

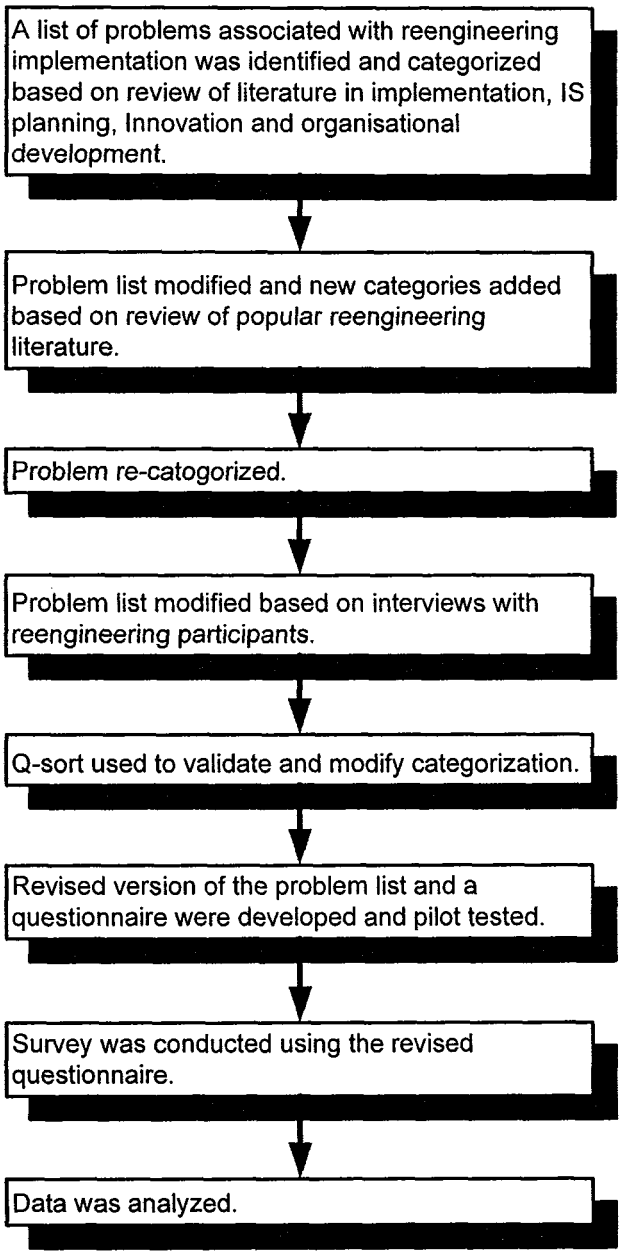

Figure 3.1 steps in the research methodology (Grover et al. 1995, p. 117)

3.2.2 Information Technology Adoption

Research conducted by Karahanna et al. (1999) investigates the information technology adoption against the benefits achieved by the technology. The researchers identified a need to investigate the behaviours or the benefits which individuals display in pre adoption and post adoption of information systems.

The researchers utilised a cross sectional field study in 1993 to obtain the data for this study. The researchers developed 2 questionnaires one for the pre adoption of the information system and another for the post adoption, users already using the new system. A pilot study was conducted utilising both questionnaires. The significant fact about this pilot study is that it was administered face to face in an interview scenarios. 11 potential adopters and 10 users of the new software were randomly selected from the population. As a result of the pilot study changes were made to the questionnaire. The updated questionnaire was finally sent out for data collection.

Since they were unable to determine the participants who had already adopted the new software and the participants who were still using the old software both questionnaires were mailed to all 977 potential respondents. 26 questionnaires were returned as the respondents were no longer employed by the company. The respondents received 268 usable responses. The response rate was 28.2%.

The researchers determined that there was no significant difference between demographics and key constructs between the respondents and the non respondents by conducting a *t*-test.

The data was analysed to determine the reliability and the discriminant validity of the final scales. Reliability and factor analysis revealed a good alpha value greater than .8. where the alpha value was less than .8 the researchers concluded that the results of the scale did not have enough variability. The results supported the factor structure proposed hence the compatibility was omitted from the testing of the research model.

An important factor relating to the interpretation of the results in this survey was that the plausible explanation offered by the researchers for why the perceived usefulness and the compatibility load on the same factor was; "compatibility is multidimensional construct defined as the degree to which using an innovation is

consistent with the existing socio cultural values and benefits, past and present experiences, and needs of potential adopters (Rogers. 1983) as cited by Karahanna et.al (1999, p.193)

The theoretical model tested by Karahanna et.al (1999) is as follows:

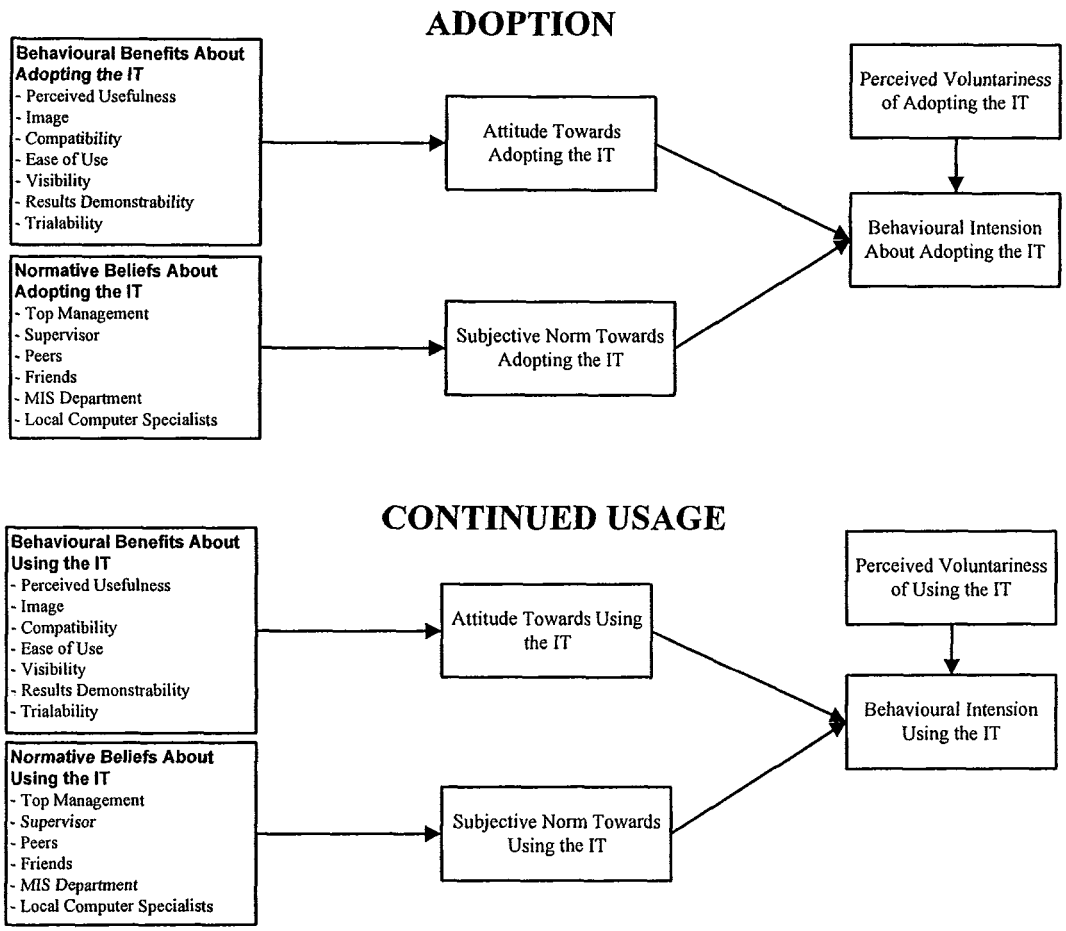

Figure 3.2 Karahanna et.al Model (1999, p.187)

3.2.3 Testing The Technology-To-Performance Chain Model

In a research conducted by Staples and Seddon (2004, p.17) the researchers discuss the testing of technology to the performance it delivers. The researchers in this instance were testing a chain model where the model seeks to predict the information system on the individual user's performance. The researchers aim was to understand the success of the investment in the information system. They realised that both the

researcher and the practitioner will have significant benefits in such a research. The concepts tested by the researchers were similar to DeLone and McLean (2003) information systems success model. The researchers built upon the model published by Goodhue and Thompson (1995).

The researchers choose to obtain data from two different types of system users, mandatory users and voluntary users. The data was analysed independently for each user set. For the mandatory users 250 librarians were selected. After one follow-up letter a 140 usable responses were received. This resulted in a 56% response rate for the researchers. The researchers decided to use a Likert scale in their questionnaire. The scale had 7 possible answers with 1 being strongly disagree to 7 which was strongly agree.

The second set of users were voluntary. For this the researchers chose senior year undergraduate commerce students. These students were selected 12months in advance. Questionnaires were mailed out to 600 students. After a follow-up letter 308 responses were received by the researchers, which resulted in a response rate of 50%. The missing responses to some of the questions reduced the usable dataset to 114.

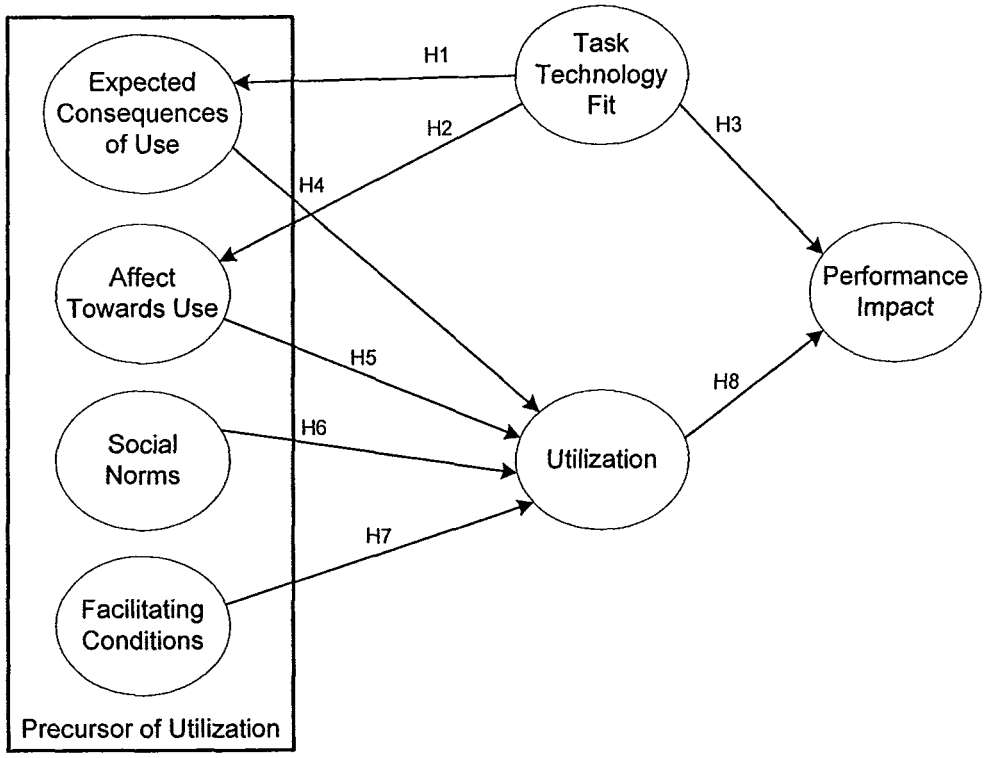

Figure 3.3 Staples and Seddon model (2004, p.20)

For the analysis of data the researchers selected Partial Least Squares (PLS) which was a structural equation model (SEM) technique. They chose this technique over the covariance SEM approach. The researchers determined that this method was more robust and that it did not make any assumptions on the distribution of variables. Another advantage which the researchers realised was that PLS can be used when the sample size is significantly smaller. The research model used by the researchers is in figure 3.3.

3.2.4 Measuring And Analysing Computer User Satisfaction

In the 1980's as it is still the case now it was important for practitioners and researchers alike to find out the satisfaction gained by the users of computers. The research conducted by Bailey and Pearson (1983) investigates this. The researchers claim that the measurement and the analysis of computer user satisfaction were linked to the motivation or the desirers of management to improve the productivity of information systems. A similar fact is discussed by Deming (1986) when he discussed the role of managers in quality organisations.

The literature review of the researchers Bailey and Pearson (1983, p.531) led them to the definition of user satisfaction as the "sum of one's feelings or attitudes towards a variety of factors affecting the situation". Another factor which the researches investigated was that user satisfaction is "the sum of the user's weighted reaction to a set of factors". This is also consistent with the method adopted by Grover et.al (1995) where the variables were compiled by the user's weighted reactions.

The researchers derived 38 factors based on the literature and proceeded to rank these factors. They discovered that all but 9 out of the 38 factors failed to make it to the top 5. Hence the researchers decided that all 38 factors were significant in describing or measuring user satisfaction as user satisfaction changes from user to user.

The measurement method selected by the researchers was a rating of four bipolar adjective pairs ranging from a negative to a positive feeling. The researches

decided that this was the preferred method as the feelings could be measures in pairs for example, good versus bad or simple versus complex.

The questionnaires took between 15-25 minutes to respond to. The 29 returned questionnaires were tested for reliability and validity. The researchers found that the average coefficient for reliability was .93 and the minimum was .75 which led them to conclude that only a small proportion of responses were due to measurement error. They also concluded that the questionnaire was a reliable instrument.

The researchers concluded that the tools developed may not measure user satisfaction accurately under every condition. But the tool may contribute towards further studies were researchers may investigate computer user satisfaction.

3.2.5 Small Firm Performance: Modelling The Role Of Product And Process Improvements.

The study conducted by Wolff and Pett (2006) examines the performance of small firms in terms of growth and profitability. The important factor and the relevance of this research lies with the fact that the organisations strived to implement a product or a process improvement framework. The researchers attempted to prove that process improvement and product improvement has a positive association with the firms growth and profitability.

The researchers utilised a survey method as the preferred data collection method. A random sample of 855 small and medium size businesses were selected from a population of 4,614 which was a directory of medium size businesses published by a popular newspaper. The sample represented a cross section of organisations both public and private. The survey was posted with a cover letter to the president or the owner of the organisation. A reminder postcard was sent three weeks following the survey. 182 usable responses were received, this equated to a 21% response rate. The validity of the performance measures were above the recommended threshold was high at Cronbach's alpha was .07 and .86. the researchers utilised a five item Likert-type measure with 1 being not at all important and 5 being very important.

For the analysis of the data the researchers' utilised a two-step process of analysis. The first step was a multistage process; this validated the construct validity of the measures used in the study. The second step utilised structural equation modelling to test the hypothesis simultaneously. They also utilised AMOS 4.0 to conduct a confirmatory factor analysis to test the multidimensionality and the convergent validity of the model.

3.3 THE RESEARCH QUESTIONS AND HYPOTHESES

The five studies reviewed in the section 3.2 have investigated many ways in which the realisation of user expectation of process mapping software can be measured. The main element which needs to be established is how user satisfaction is measured and how the vendor claims of user satisfaction can be linked to successful implementation of the software. Hence the relationship between user satisfaction and implementation success needs to be established. The main objective of this research is to empirically verify the relationship between successful implementation of the software and user claim of user satisfaction. When the related studies were investigated in section 3.2 details of each of the studies were taken in to consideration. It was noted that the studies adopted quantitative approaches in their research mainly using quantitative data types while when relevant using qualitative types as well.

Most of the studies reviewed utilised a survey as a data gathering instrument (Grover et al. 1995; Karahanna et al. 1999; Staples and Seddon, 2004; Bailey and Pearson, 1983). The approach taken by the researchers provide the clear distinction with other methods used in studies. Hence it can be determined that a survey is the best possible method towards testing the relationship between successful implementation of a software and user satisfaction.

The research contained 5 phases (see figure 3.1) firstly the measures were identified in phase 1. To identify the measures an analysis of the literature was carried out. This paved the way towards identifying the measures required to determine successful implementation and user satisfaction. This method had been followed by several researchers in the past. These researchers include Grover et al. (1995) and Karahanna et.al (1999) as discussed in section 3.2. Phase 2 entails the

development of the questionnaire and the expert review of the questionnaire. Once the expert feedback is received the questionnaire is revised and released for the pilot study. The survey would focus on the factors relating to the successful implementation of the process mapping software.

The pilot study conducted in phase 3 will provide an initial data set which could be analysed to understand the reliability of the data. In phase 4 the questionnaire will be administered. Even though the studies examined did not utilise online delivery and collection of data it was decided that the geographically widespread software users would provide a better response rate to this method.

Finally in phase 5 the data is analysed. At the conclusion of the analysis the relationship between the variables relating to a successful implantation of process mapping software, the successful implementation of the software and finally the user satisfaction can be studied. It is also envisaged that the analysis of the data would also aid in the refinement of the research methods, the measures and finally the research model developed. This would make the entire process iterative.

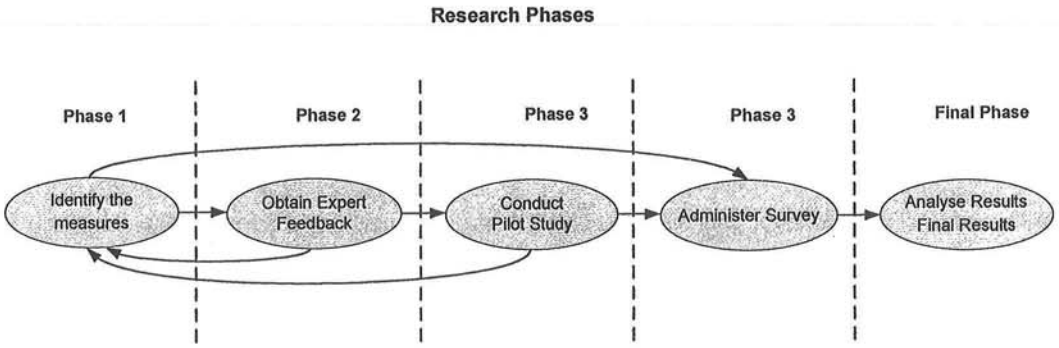

Figure 3.4 Research Phases

3.4 THE RESEARCH MODEL

The review of the literature in Chapter 2 provides a firm basis on which a set of hypotheses can be built on to to support the research question and the sub questions. The main research question in this study is as follows:

Do businesses achieve the benefits claimed by the vendors?

When looking at Chapter 2 an observation can be made that the vendor claims are related to end user satisfaction and the successful implementation of the software hence, based on the hypothesis of the relationship between successful implementation and end user satisfaction the main question could be broken down in to sub questions as follows;

What is the impact of successfully implementing the software on end user satisfaction?

The literature review in Chapter 2 also brought to light that the existing quality framework , user expectations, the implementation project, the organisational culture and organisational acceptance all play a vital role in the successful implementation. Hence the successful implementation can be classified as a dependent variable and all others as independent variables.

The final model encapsulates all these variables and their relationships. This is presented in Figure 3.2. Based on this model, it can be viewed that end user satisfaction is dependent upon successful implementation, which in turn is dependent upon the existing quality framework, user expectations, the implementation project, the organisational culture and organisational acceptance.

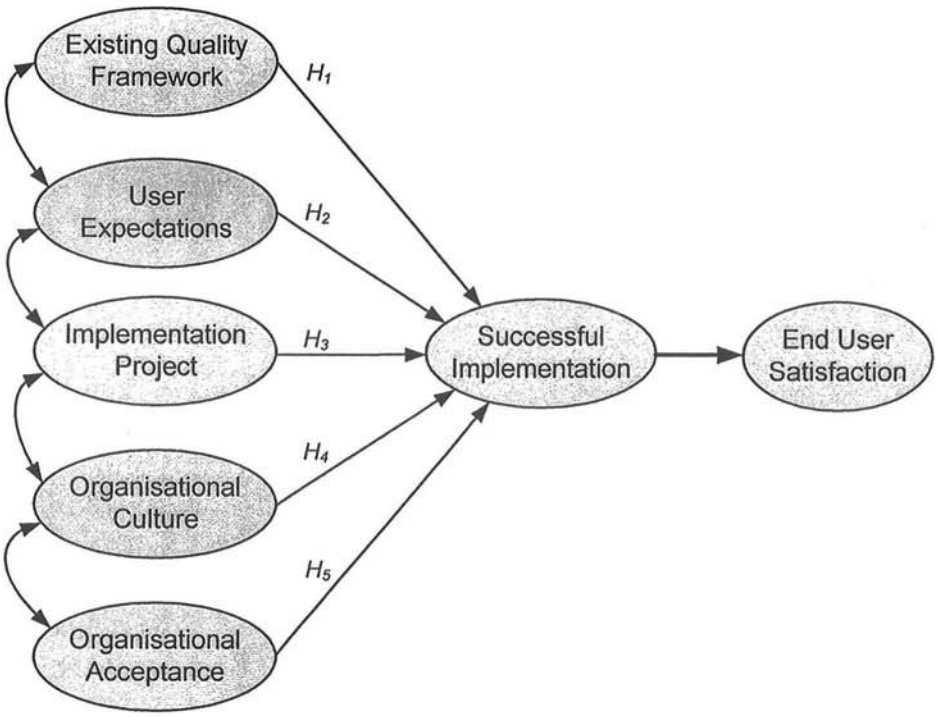

Figure 3.5 Theoretical Model

The hypotheses for these relationships are as follows:

> *H_1: The existence of a quality framework positively affects user satisfaction by achieving the desired results?*
>
> *H_2: The organisation culture positively affects user satisfaction by achieving the desired results?*
>
> *H_3: An effective implantation of the software (the implementation project) positively affects user satisfaction by achieving the desired results?*
>
> *H_4: The organisation culture positively affects user satisfaction by achieving the desired results?*
>
> *H_5: Acceptance of the software by the users positively affects user satisfaction by achieving the desired results?*

The alternative hypotheses would be:

> *H_0: The successful implementation of the software does not effect end user satisfaction?*

3.5 DATA REQUIREMENTS

In order to test the research model developed in the preceding section (Section 3.4) data is collected and assed in each stage of the research process. The first stage collects information from past literature relating to successful implementation of software. A questionnaire was developed using the measures collected from this literature. An expert panel was engaged to comment on the measures and its relevance to commercial enterprises implementing the software. Once questionnaire was enhanced with the feedback, a pilot study was conducted. The feedback from the pilot study is utilised to test the goodness of the data received. In the final step the data is collected from the survey and is analysed.

The expert feedback and the way in which it was obtained will be discussed in section 3.5.1. The pilot study and its sample size will be described in the section to follow (Section 3.5.2). The data collection method which includes the sampling (Section 3.5.3) design of the questionnaire and the data collection method (Section 3.5.4) and the data processing method (Section 3.5.5) will be described. Finally the data analysis techniques will be discussed and defined in Section 3.5.5.

3.5.1 Expert Feedback

Once the measures have been identified many researchers have used expert feedback in order to develop the questionnaire. This was the case with both Grover, et.al (1995) and Bailey and Pearson (1983). Grover utilised experts who had experience with more than one reengineering project to ensure that the measures were correct. Several professionals from a cross section of academic as well as professional backgrounds were sought to obtain the expert feedback from. While some commented on the structure of the measures other commented on the relevance with their past experiences. Based on the feedback from the 6 experts the questionnaire was revised.

3.5.2 Pilot Study

Pilot studies are used by researchers as a means of reviewing and revising the questionnaire. In the studies examined in the previous sections (Section 3.2) the

researchers such as Grover et.al (1995) and Bailey and Pearson (1983) utilised a qualitative method of conducting a pilot study. The questionnaire was delivered to a pilot audience in face to face interview. The aim of the pilot study was to obtain validity of the questions. It was envisaged that the pilot group would consist of 20-25 participants from the user base of the process mapping software.

3.5.3 Sample

The New Zealand customer base of the process mapping software vendor consists of approximately 300 users. The aim was to obtain at least 150 responses from this use base. In the studies examined several researchers had sent out questionnaires to the entire population attempting to obtain a high response rate. This was noted in Grover et al. (1995) and Karahanna et.al (1999) while the other researchers decided to select a random sample. The studies related to Karahanna et.al (1999) and Grover et al. (1995) were faced with a single target audience which they had to investigate and hence the entire population needed to be approached.

Staples and Seddon (2004, p.17) received 114 responses which the researchers deemed as sufficient for the statistical analysis and to produce acceptable results.

The participants did not receive any incentive for completing the questionnaire as no personal data as to the identity of the respondents were collected. If an incentive was to be offered, personal information relating to the respondent needed to be included in a questionnaire in order to effectively distribute such an incentive.

Anderson and Black (1998, p.10) suggests that the sample size of a study is related to the effect size (ES) and the type I error (alpha - α), where the probability of a difference of means between two groups of correlation between variables. This difference is regarded as the effect size. The alpha or the type I error the probability of rejecting the null hypothesis when it is actually true or the chance of the test showing a statistical significance when in reality a statistical significance does not exist. Anderson and Black recommend an alpha level of .05 with a power level of 80 percent. Due to the complicated nature of the relationships in the power level, effect size and sample size it is difficult to achieve these levels. It is recommended by

Anderson and Black (1998, pp.12-13) that to achieve an alpha level of .05 with a power level of 80 percent the sample size needs to be approximately 130. Hence for the purposes of this research an alpha level of .05 with a power level of 80 percent and a sample size of 130 have been selected.

3.5.4 Data Collection Method

All the research investigated in Section 3.2 suggests that a questionnaire is an appropriate means of gathering quantitative data (Grover et al. 1995; Karahanna et al. 1999; Staples and Seddon, 2004; Bailey and Pearson, 1983). In the studies listed the researchers had categorised the questions in to various sections relating to the research. This is not only seen as a means of organising the data but also as a means of ensuring the data is maintained in sets for analysis. The questionnaire gathers information relating to the studies conducted by several studies reviewed (Grover et al. 1995; Karahanna et al. 1999; Staples and Seddon, 2004; Bailey and Pearson, 1983).

Several studies (Grover et al. 1995; Karahanna et al. 1999; Staples and Seddon, 2004; Bailey and Pearson, 1983; Wolff and Pett 2006) had identified missing data as a problem when it came to analysing the results. Hence it was decided that the online questionnaire would not have the data in sections but it would be mixed. This would ensure that the rejection of responses due to missing information is minimised.

The questionnaire utilised in this study will contain 27 close ended questions in 5 areas, existing quality framework, user expectations, the implementation project, organisational culture and organisational acceptance. The questions on the questionnaire do not represent these sections due to the fact that the research endeavoured to increase the amount of usable responses by systematically re sequencing the presentation of the questions. The questions in its sections and the online questionnaire are attached in Appendix A and B respectively. No personal information relating to the respondent will be collected in the questionnaire. A 5 item Likert-type measure would be used in the collection of data. 1 = strongly disagree and 5 = strongly agree. It is believed that a Likert-type scale permits the respondent to answer questions relating to feelings and attitudes more effectively (Bailey and Pearson, 1983).

3.5.5 Data Processing Method

A link to an online questionnaire would be distributed to the user base of a process mapping software vendor. The end users would require 5-10 minutes to complete the online questionnaire. No personal information will be gathered when the survey is completed. The time and date stamp of the completed questionnaire and the questionnaire number will act as unique identifiers of the respondents.

The responses collected from the online repository will be coded as per the setup configuration. The data will be downloaded as a text file with comma separated values (CSV file) ready to be uploaded on to a SPSS package for statistical data analysis. When a large percentage of data is missing the responses will be ignored from the analysis and when an acceptable amount of data is missing the statistical package would included in the analysis and will be represented in the results. It is essential that the responses with large amounts of missing data are ignored as the analysis of results based on missing data would be biased and incomplete.

3.5.6 Data Analysis Method

Phase one of the analyses incorporated a review of relevant literature in order to derive items which could measure end user satisfaction from an implementation of process mapping software. These items were adapted to suite the purposes of this research and reflected in the questionnaire. The measurement of user satisfaction are discussed by Grover et al. (1995); Karahanna et al. (1999); Staples and Seddon (2004); Bailey and Pearson, (1983). IS discussed by these researchers the feedback received from the pilot study and expert feedback was used to refine the questionnaire further.

A statistical analysis model will be used to analyse the data collected from the survey. These statistical analysis techniques were used by all the researchers reviewed in section 3.2 with relation to the measurement of user satisfaction (Karahanna et al. 1999; Staples and Seddon, 2004; Bailey and Pearson, 1983; Grover et al. 1995). The researchers utilised Cronback's alpha to analyse the reliability of the measures. Researchers such as Bailey and Pearson (1983) evaluated reliability and validity in their research. Where the questionnaire was tested for reliability as a

instrument. The validity as the extent to which the measurement instrument measured what it was meant to measure. They also discussed three types of validity content validity, predictive validity and construct validity.

Researchers such as Grover et al. (1995) and Karahanna et al. (1999) used analysis techniques such as chi-squares or *t*-test on across a number of key characteristics. While others such as Staples and Seddon (2004) used variations of structural equation model (SEM) techniques. They further elaborated that structural equation model (SEM) enables generalised conclusions to be drawn more accurately from a sample which represents the population. This is because they found that structural equation model (SEM) is a more robust method. Therefore the structural equation model (SEM) is the preferred method for the analysis of data in this study.

A statistical software package was used by Wolff and Pett (2006) for the analysis of data. Using this software package the data was checked for normal distribution and missing values. Another statistical package AMOS was used to create a path diagram. The researchers also utilised Cronbach's alpha to test the reliability of the of the measurement items.

Given the research methods and the models discussed in preceding sections, the following is deemed to be the most suitable data analysis model for the purposes of this study. The statistical package used in the analysis of this research is SPSS and AMOS to conduct a confirmatory analysis. The data will be checked for normal distribution and missing values. The creation of the path diagram of the research model will be done utilising AMOS. This path model will be tested using the data presented though SPSS. The correlation matrix would be used as opposed to a variance-covariance matrix. An appropriate fit matrix will be selected. The reliability of the measurement items will be tested using Cronbach's alpha. The structural model will be evaluated against the data and the fit of the data against the model.

The mapping of the research question to the research phases where it will be analysed is shown in Figure 3.4. The data collected in each section and the model and the answers will be linked in the model. The hypothesis where this research is based on are mapped to the questions and the sections in the questionnaire. These sections and the corresponding questions will be used to test the hypothesis.

Data mapping

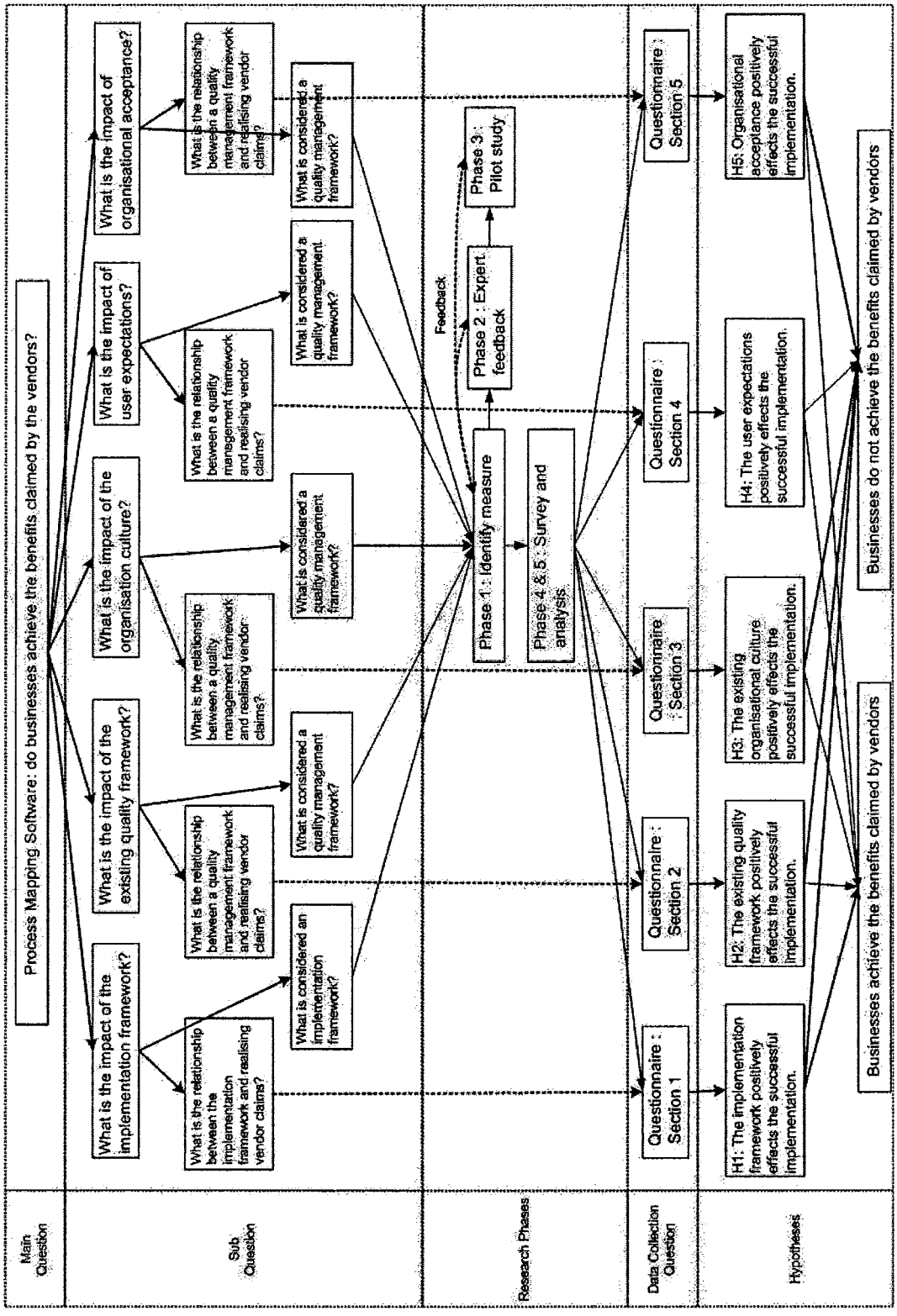

Figure 3.6

3.6 LIMITATIONS OF THE RESEARCH

This research endeavours to identify the relationship between successful implementation of the software and the end user satisfaction. This will in turn sustain the claims made by vendors of process mapping software. Two major limitations of the research process proved to be firstly time and then budget.

The research depended primarily on quantitative data in order to validate the hypothesis. Due to the limitations in time qualitative data collection could not be carried out this would have significantly contributed towards the reliability of the study (Bailey and Pearson, 1983). In the studies reviewed the researchers utilised two questionnaires, a pre adoption as well as a post adoption questionnaire (Karahanna et.al 1999; Bailey and Pearson, 1983). The use of two questionnaires gave the research a two different points in time which in turn would enable the gathering of data relating to success in a more accurate manner. Administering two questionnaires would have required more time and significantly larger budgets in order to collect the results over time.

A two staged study would have also enabled the research to accurately measure the state of the organisation prior to the adoption of the software and the state of the organisation after the implementation of the software. Time constrains inhibited the collection of this information. To conduct a pre and post adoption research organisation would need to be approached months in advance in order to align the study with the implementation of the software. Time would also have needed to have elapsed from pre adoption to post adoption. A period of at least two financial years would need to have been measures to accurately measure benefits and the change in behaviours in the organisation. This would have also called for qualitative data to have been collected in order to encompass all the various aspects of change which occurred in the organisation.

At present the study has not included in the research measures relating to the functionality provided by the software, ease of use, the skill levels required by staff to use the software and the motivation of the staff to utilise the software. Given an increase in budget and time these questions could have been addressed in this study.

There were several risks associated to the successful completion of this study. These risks were mitigated to reduce the effect of it on the outcomes of the study. It was a concern that the questionnaires would be partially completed and the data would not be usable. The questions were rearranged in order to create a random list of question which would enable the responses to be used even if certain questions were overlooked. This created another risk which was associated with the comprehension of the questions by the respondents. Since the questions were not in sections the users may not have understood the questions in the appropriate context.

The sample created yet another limitation to this study. As the intension was to use the customer base of a particular software vendor the sample became limited. Further to this the Unsolicited Electronic Messages Act of 2007 which came in to effect on 5th of September 2007 the software vendor was unable to send a mass mail message to all of its end users requesting them to participate in the research. The act deemed this a commercial endeavour as the message is generated from a software vendor from within New Zealand. Hence the users need to be contacted by phone in order to obtain permission to email the survey link to them. This not only limits the responses but also makes the process much slower than it needs to be. This will prohibit a larger proportion of the users being contacted in order to obtain permission to send the survey link. A significant proportion of responses would have created additional validity to the data collected and the outcome of the survey.

What was identified above were some of the limitations encountered when utilising the selected research methodology.

It is expected that the existing quality framework, user expectations, implementation project, organisation culture and organisational acceptance would impact the successful implementation of the software. It is also expected that since the user expectation have contributed positively to the successful implementation of the software the end users needs have been fulfilled by the software. This would increase efficiencies and enable the organisation to function more effectively. It is expected that financial benefits to the organisation cannot be gauged by the measures utilised in this survey, however the study expects to see an increased amount of efficiency which has derived by implementing the software. It is also envisaged that

the software implantation structure also identified as the project management methodology and the quality management tools and the methodology utilised will provide insight in to any future research in this area.

3.7 CONCLUSION

The research model developed in this study encapsulates the character of the relationship between successful implementation of process mapping software and realising user expectations (vendor claims). There are 5 hypotheses which form the basis for a successful implementation of the software. These are the existing quality framework, user expectations, implementation project, organisational culture and organisational acceptance. The hypothesis will test the effect of these measures towards successful implementation of the software. These are consistent with the literature review and the variables identified in Chapter 2.

The review of similar studies revealed the survey method to be most effective for this study. The measures were identified through the review of literature. Once the questionnaire was compiled an expert panel verified the measures. Required alterations were made to the questionnaire. A pilot study gathered sufficient sample data to conduct a preliminary analysis of the data. The data collection was carried out via an online questionnaire. The questionnaire consists of a 5 item Likert-scale. Electronic distribution and collection of the data was considered due to the geographic extensiveness of the vendor's customer base. The New Zealand privacy act prevented the wide distribution of the survey as the vendor was not able to send out mass e-mails to its customer base. SPSS and AMOS would be utilised in the statistical analysis of the data gathered in the research and to validate the research model and the hypothesis developed. The validity of the measurement will be tested and validated using Cronback's alpha. Regression testing will be employed using structural equation modelling (SEM). The survey findings are to be reported in the next chapter.

Chapter 4

REPORT ON FIELD FINDINGS

4.1 INTRODUCTION

Chapter 3 outlined the research methodology in which the various phases of the research were discussed. These steps, once followed would validate the research model which was developed. This chapter will present the results obtained during the field survey research. In phase one the review of literature paved the way towards the identification of the measures for evaluating successful implementation of the project and end user satisfaction. These measures were reviewed by a panel of experts. The measures were revised as a result of this phase. The next phase entailed a pilot study, where the pilot study revealed the reliability of the questions and potential enhancement of the measures.

The data collected was analysed utilising structural equation modelling techniques. A set of predefined steps decode the research data in to measurement and a structural model. The model and the measurement will be used to ascertain how well the data will fit the hypothesised research model. The data will provide weightings on the effectiveness of each construct and will be used to test the hypothesis.

This research utilised a variety of statistical measures to ensure that the data was reliable and valid. Cronbach's alpha, composite reliability, convergence validity are a few of these measures. The model fit will be tested by utilising guides such as Chi-square statistics, GFI and AGFI. Once the measures have been utilised to establish a model fit the hypothesis developed in chapter 3 are tested based on the path estimates obtained.

The results of the expert feedback will be presented in Section 4.2. Section 4.3 will discuss the responses from the pilot study. The responses received from the survey will be discussed in Section 4.4. The field findings together with the reliability test for the data, the validity tests test for the data and the analysis of the research

model will follow in Section 4.5. The conclusion to chapter 4, the report on the findings will be presented in section 4.6.

4.2 EXPERT FEEDBACK

Once the measures were determined through an investigation of related literature an expert panel was engaged to provide feedback on the measures. The panel of experts consisted of an academic, a senior project manager, process improvement consultants, business improvement consultants and quality managers. 8 experts were asked to participate in this study. 5 experts provided feedback while 3 were unable to commit time towards providing feedback as it was inconvenient due to overwhelming work commitments. The initial expectation was to receive feedback from 5-8 experts, hence the responses received were deemed to be sufficient for the purposes of the study. From the feedback received, section 2 of the questionnaire which referred to the organisational culture was re phrased and additional elements included (Appendix B, Question 10).

4.3 PILOT STUDY

The pilot study collected a sample of 25 participant response, the 25 were randomly selected from vendors customer database. The objective of the pilot study was to obtain an initial understanding of the construct of the questionnaire and to amend and reconstruct it if required. The data was analysed for reliability and validity to ensure that the measurement items would successfully measure the identified construct. Once the 25 responses were obtained a Cronbach's Alpha test was conducted. The desired outcome in this test was an alpha value greater than .7. The Cronbach's Alpha values for each construct are given in the table 4.1 below.

Table 4.1: Reliability of the measurement items (Pilot Study)

Construct	Cronbach's Alpha(>0.7)
Governance Framework	0.78
Organisational Culture	0.75
Implementation Project	0.76
Organisational Acceptance	0.83
User Expectations	0.87

As the alpha values for all 5 constructs were above the recommended alpha value of .7 it was determined that no additional enhancements were required. The questionnaire was utilised for the collection of data for the study.

4.4 SURVEY RESPONSE

77 users of a process mapping software vendor responded to the survey. All respondents were from New Zealand. Users from both the north and the south islands responded to the survey. Demographic information relating to the respondents is unknown as the survey was conducted online and information relating to age, gender and position in the organisation was not collected.

The sample included only New Zealand based despite the widespread use of the software in Australia the United Kingdom and North America. The users of software from 85 organisations were invited to participate in the survey. The 85 organisations collectively had over 350 users. Since the survey was only sent to a designated contact in the organisation it is unable to determine if all the end users received an opportunity to respond to the survey. Out of the 77 responses received 10 questionnaires had missing data. Out of which 6 respondents had only completed 6 questions, the other 4 respondents had an average of 1.75 question missing. There was no more than one response missing from each of the 5 sections. Hence it was determined that these respondents were within the tolerance level and the responses could be utilised in the analysis. The software utilised for analysis, SPSS was configured with the tolerance levels for missing data. In total the 71 usable responses fell well below the initial expectations of 130 which were aimed at a power function of 80% at a significance level of .05. Therefore to ensure that the number of responses can be analysed effectively the power function will be changed to 60% at a significance level of .05. An average of the respondents to the questions were utilised to fill the missing values. Since there were no more than two missing values in any one respondent the integrity of the data was maintained while estimating the missing values.

4.5 FIELD FINDINGS

The model developed in Chapter 3 denotes the relationship between the various constructs. The model was validated by means of SEM utilising SPSS 15.0 and AMOS 7.0. The measurement item of the questionnaire was studies for reliability and validity. This was done prior to the validation of the model. This section discusses the information related to the data collection and the results of the analysis.

The descriptive statistics of the data obtained from the respondents will be presented in Section 4.5.1. The preliminary steps of the SEM technique which include building a theoretical path, measurement and structural model are explained in Section 4.5.2. The specification of the analytical techniques will be stated in section 4.5.3 followed by the analysis of the measurement item in Section 4.5.4. The fit indices for the overall fit are analysed and explained in Section 4.5.4. While section 4.5.6 explains the fit indices for the overall fit Section 4.5.7 explains the fit indices for the structural fit.

4.5.1 Descriptive Statistics

The objective of the reliability test was to ensure that each class of the section meets the Cronbach's Alpha acceptance level of .7 or above. This will ensure that the question is measuring the entity accurately. Respondents or questions below the Cronbach Alpha level of .7 is investigated and removed from the study. Data excluded from the study due to a below acceptable Cronbach's Alpha level will be explained within the research framework. Since the power function of 0.6 at $\alpha.05$ only require 60 responses and the survey concluded at 72 usable responses a minor outlier groups could be excluded from the study without significantly reducing the number of usable responses. Significant outlier groups could not be found in the data, hence there was no need exclude any responses from this study.

Table 4.2 Reliability of measurement items (Main study)

Construct	Cronbach's Alpha(>0.7)
Governance Framework	0.79
Organisational Culture	0.81
Implementation Project	0.80
Organisational Acceptance	0.74
User Expectations	0.85

When the construct validity test was applied to the measurement items it confirmed the validity of the items. The test revealed that the items measured what the items were meant to measure in relation to the research model. It also included the analysis of convergent and discriminant validity. The objective of the convergent validity was to examine the measurement items, it ensures that the measurement items correspond with the construct. The convergent and the discriminant validity was tested by examining the factor loadings of the of each item and the fit indices of the model.

4.5.2 Normality Tests of Sample Data

Demographic, personal as well as professional data of the respondents were not collected through the questionnaires, hence it is not possible to report on the age group, length of service qualifications or any descriptions on the organisations of the respondents. However since the organisations were picked from the customer data base of the software vendor, information relating to the organisations and the industries was compiled from information commonly available about the organisations. A table of types of industries and the number of organisations invited to participate are given below.

Industry	Number of organisations invited to participate
Government	4
Local Government	4
Utility	3
Education	2
Manufacturing and distribution	2
Retail	2
Engineering	4
Information Technology	4
Finance	2
Sales and distribution	2
Logistics	2
Consultancy	6

Table 4.3 – Organisations Surveyed by Industry

The descriptive analysis of the data are given in the appropriate constructs are displayed below in figure 4.1.

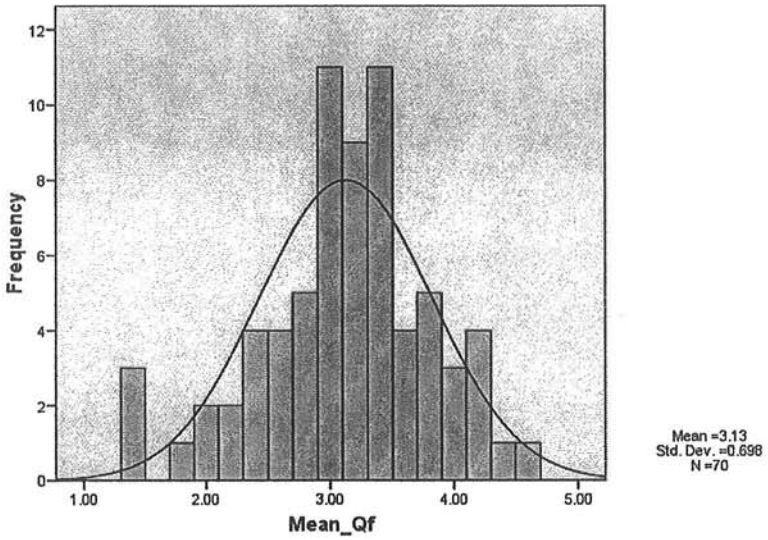

Figure 4.1 - Histogram for Quality Framework (QF)

The sections relating to the quality framework of the organisation reveals a normal distribution with the exception of 3.5 outliers. These outliers were not taken out of the sample due to the number of responses being analysed. The removal of the outliers would reduce the number of the sample; this in turn would have reduced the power function and the reliability of the data. The data shows that a large proportion of the organisations surveyed did not have a quality framework or implemented the software outside of the quality framework. It also showed that an equally large proportion of organisations agreed to the fact that the organisations had an operational quality management system. This shows a relationship between the fact that organisations implement the software with an intension of improving or supporting the quality initiative.

The test for the importance of the organisational culture plays an important role in the success of the process mapping software. Three outliers were observed in this section. Due to the limited number of responses these outliers have not been removed from the sample. The outliers reflect a negative score towards the organisational culture. This may be due to the individual opinions of the respondents who may not necessarily share the same vision as the managers.

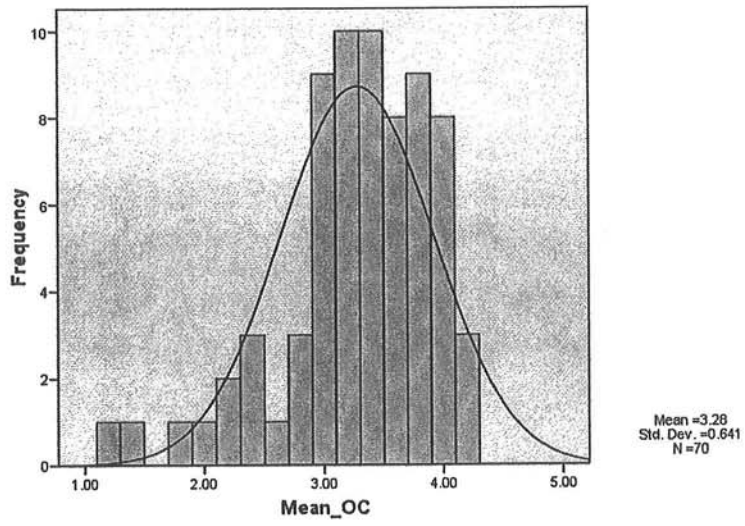

Figure 4.2 - Histogram for Organisational Culture (OC)

The analysis of the results in Figure 4.2 shows that a large proportion of the organisations surveyed possess an organisational culture which encourages quality initiatives and the implementation of the software while a similar number of organisations are uncertain if they do. In these organisations managers supported the quality initiatives. The processes documented utilising the software was used in the induction of new employees which reinforced the use of proper processes in the organisation. Deming stated that it is the manager's job to cultivate good practices in businesses and that most managers in modern businesses do not know what they need to achieve (Deming 1986 p.32). this section dwells towards that statement as to how it applied to the businesses surveyed. The results revealed that in most cases the existence of quality systems and the constant efforts to maintain the quality has changed the nature of the organizations where managers play an active role in the quality initiatives of the organisation.

The implementation project was deemed to have been the foundation towards the successful use of the software which was set out to deliver the benefits desired by customers.

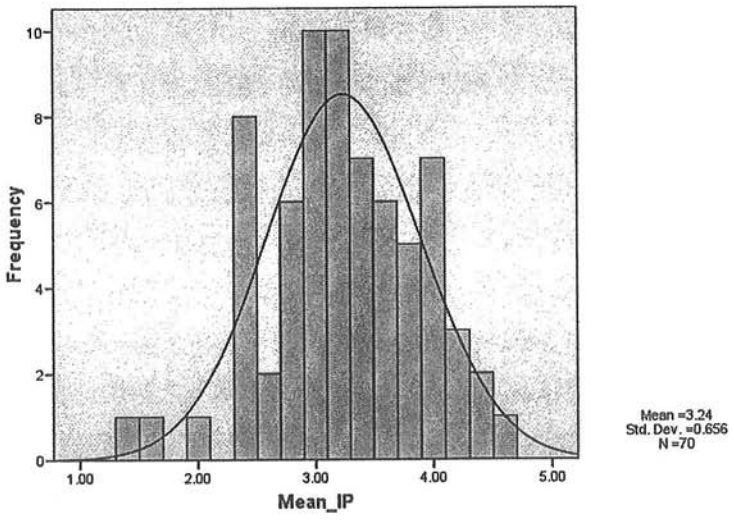

Figure 4.3 - Histogram for Implementation Project (IP)

The results indicated that the software was implemented under a project structure. However two outliers were observed. Due to the limited number of responses, the outliers were not removed from the sample. It was a noticeable fact that similar number of organisations implemented though a project structure while the others did

not. It is also significant that the number of neutral responses were considerably lower than the ones who agreed or disagreed. This indicates that organisations take a conscious decision to implement the software in a project framework or not. As stated by Young (2004, p.61) the results relating to the implementation truly does have a significant effect on the success of the project.

The results relating to organisational acceptance are shown in Figure 4.3. The data reveals the level of engagement of the employees of the organisation with the output of the software. The data indicates that there seems to be a distinct lack of ownership of the processes developed within the organisation. A significant proportion of the responses were observed as neutral. This indicates that there is no clear ownership of the processes by the employees. The results were in line to those of Staples and Seddon (2004, p.17) where the consequences of use were related to the utilization of the software. The acceptance of the software also relates to the culture of the organisation where the employees are motivated to utilise the software and the output which it produces.

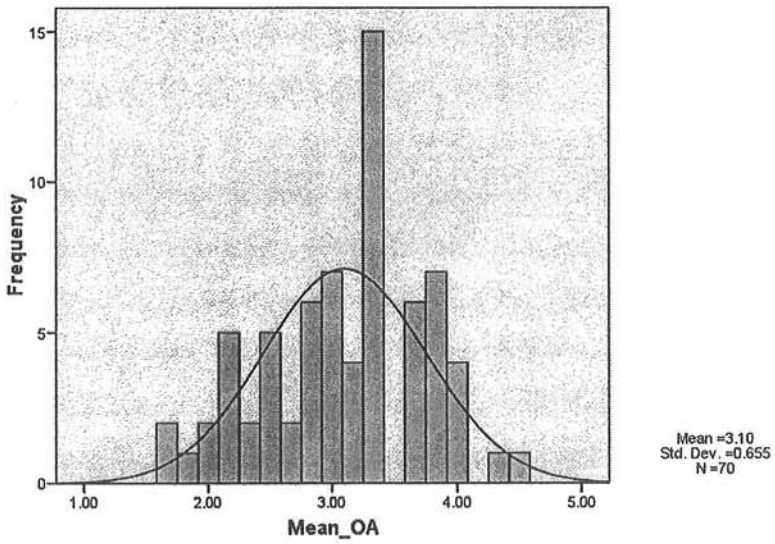

Figure 4.4 - Histogram for Organisational Culture (OC)

Despite the fact that a higher than expected mean was observed, the results relating to the user expectations of process mapping software were fairly distributed. This also displayed three outliers which were retained in the sample due to the size of the

sample. The analysis confirmed that the use of the process mapping software do support the businesses in what it strives to achieve. A large proportion of the respondents agreed that the organisation was able to publish and maintain the business processes effectively. It also supported the claim that the organisations were able to improve the existing processes using the software. The respondents were mixed when asked if the software instilled a quality management structure in the organisation. While a large proportion agreed that it would a there were similar respondents who thought that it wouldn't and were neutral. The neutral responses may well be due to the fact that the software was not implemented within a framework hence it does not contribute towards one. The number of organisations appears to be consistent with the organisations implementing the software in order to obtain or maintain accreditation.

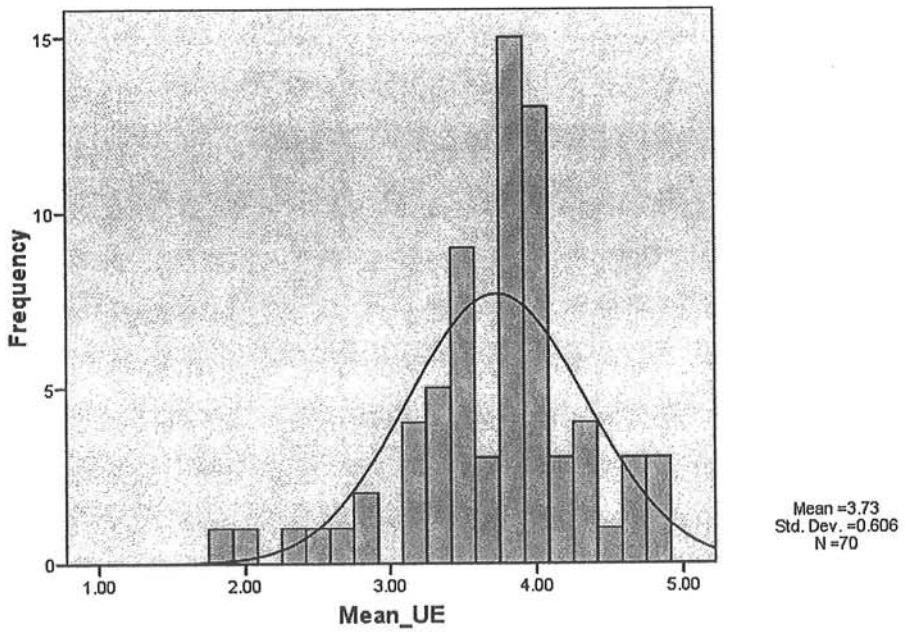

Figure 4.5 - Histogram for User Expectations (UE)

4.5.3 Analysis Of The Research Model

In Chapter 3 a research model was developed, for the analysis of this model the structural equation modelling technique will be utilised. The technique utilises the

Variable	Description
QF1	1. Our organisation has a quality framework
QF2	6. Our quality management system is very effective.
QF3	15. We are required to have a quality framework in order to obtain/maintain accreditation status (i.e. ISO)
QF4	20. The quality initiative is communicated well and is understood by the employees.
QF5	25. Our quality initiative is audited and reviewed regularly.
OC1	2. The managers champion the quality initiatives in our organisation.
OC2	7. The managers of our company know that quality initiative starts with them.
OC3	14. The use of processes and procedures are emphasised during the induction of new employees.
OC4	19. The use of processes, procedures and business rules are encouraged in our organisation.
OC5	24. People who do not follow processes and procedures are reprimanded.
IP1	3. The software was implemented through a project structure.
IP2	13. The project manager/implementer had extensive knowledge of quality management programme principles.
IP3	10. The project/implementation was scoped properly.
IP4	18. The implementation was on time and on budget.
IP5	23. The project delivered what was required.
OA1	4. The employees of our organisation refer to the published documents frequently.
OA2	9. The employees of our organisation update the documentation as a part of set reviews and continuous improvement.
OA3	12. The employees of our organisation encourage the use of the published documents.
OA4	17. The employees of our organisation constantly provide feedback on the processes.
OA5	22. The employees of our organisation take responsibility for the maintenance and the accuracy of the published processes.
OA6	26. The employees of our organisation are trained to use the processes effectively.
UE1	5. By using process mapping software we are able to publish and maintain our processes more effectively.
UE2	8. By using process mapping software we are able to improve our existing processes.
UE3	11. By using process mapping software we are able to improve service levels.
UE4	16. By using process mapping software we are able to improve operational efficiencies
UE5	21. By using process mapping software we are able to instil a "quality management" culture in our organisation.
UE6	27. By using process mapping software we are able to reduce costs and improve profits.

Table 4.4 Research Model Variables and description

measurement and a structural model to analyse the data obtained from the survey and validate the relationships between the constructs of the model (Anderson and Black,

1998). The measurement model aims at establishing links between the latent variable and their various indicators. Hence objective of the structural model is to study the relationship between these constructs. The hypothesised model in Figure 4.5 gives the constructs. The constructs defined in the model are made out of the questions asked in the study. The model is displayed following the questions depicted in the Table 4.4.

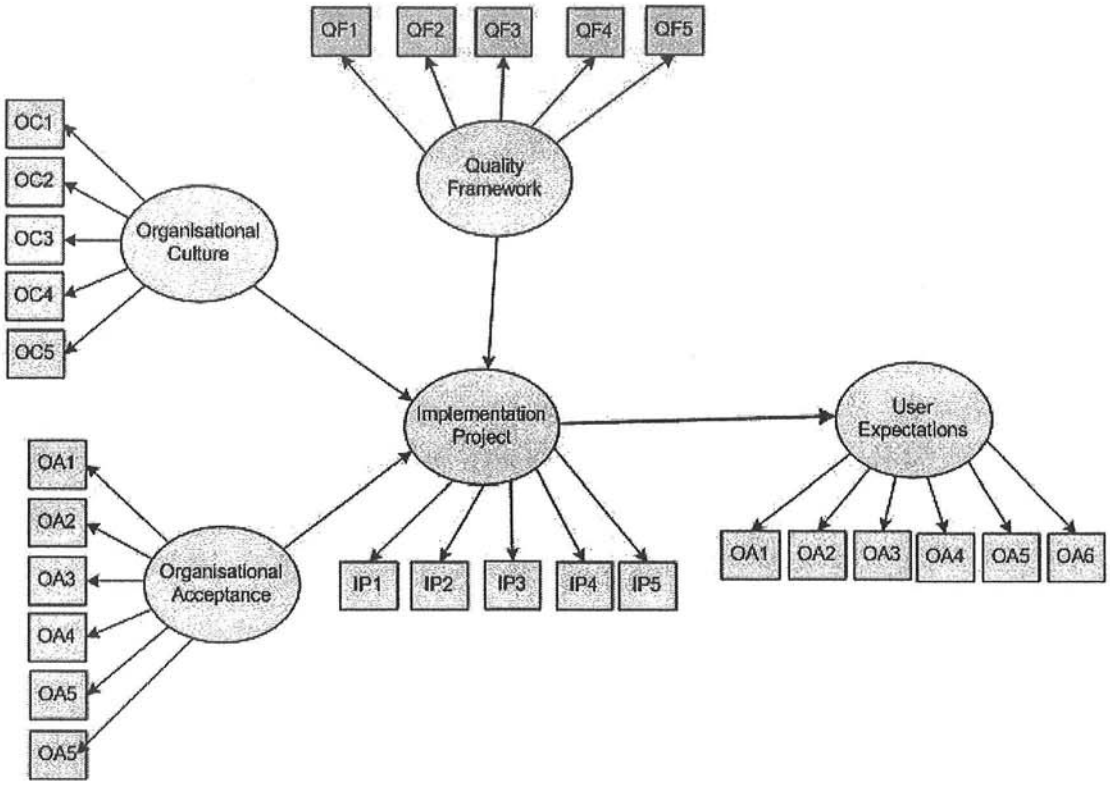

Figure 4.5: Path model

4.5.4 Specification Of The Analysis Technique

The SEM technique utilises multiple indicators for each construct. As depicted in Table 4.1 and Figure 4.5 the model utilised multiple questions for each construct (Anderson and Black, 1998).

The correlation matrix is shown in Table 4.5. This matrix was selected over a variance-covariance matrix as it allows the direct comparison of the coefficients in the model. The correlation matrix is also considered as a standardised variance-covariance matrix (Anderson and Black, 1998).

	QF1	QF2	QF3	QF4	QF5	OC1	OC2	OC3	OC4	OC5	IP1	IP2	IP3	IP4	IP5	OA1	OA2	OA3	OA4	OA5	OA6	UE1	UE2	UE3	UE4	UE5	UE6
QF1	1.000																										
QF2	0.604	1.000																									
QF3	0.298	0.109	1.000																								
QF4	0.632	0.666	0.046	1.000																							
QF5	0.545	0.523	0.338	0.514	1.000																						
OC1	0.611	0.589	0.040	0.650	0.426	1.000																					
OC2	0.441	0.487	0.023	0.572	0.332	0.505	1.000																				
OC3	0.219	0.251	-0.127	0.396	0.169	0.417	0.392	1.000																			
OC4	0.488	0.402	0.051	0.560	0.453	0.449	0.392	0.554	1.000																		
OC5	0.331	0.315	-0.108	0.382	0.288	0.414	0.279	0.146	0.214	1.000																	
IP1	0.308	0.252	0.024	0.228	0.359	0.257	0.147	0.085	0.142	0.087	1.000																
IP2	0.370	0.529	-0.146	0.510	0.486	0.444	0.386	0.315	0.350	0.224	0.504	1.000															
IP3	0.333	0.266	0.055	0.277	0.311	0.246	0.187	0.003	0.255	0.135	0.418	0.370	1.000														
IP4	0.229	0.286	0.102	0.268	0.285	0.308	0.204	0.084	0.158	0.298	0.329	0.490	0.211	1.000													
IP5	0.180	0.382	0.065	0.397	0.368	0.298	0.142	0.245	0.288	0.232	0.343	0.553	0.373	0.409	1.000												
OA1	0.462	0.317	0.059	0.346	0.385	0.331	0.328	0.372	0.424	0.302	0.403	0.506	0.378	0.376	0.365	1.000											
OA2	0.473	0.395	0.143	0.445	0.652	0.251	0.172	0.239	0.353	0.096	0.366	0.469	0.221	0.118	0.405	0.466	1.000										
OA3	0.354	0.365	0.106	0.371	0.454	0.353	0.198	0.190	0.449	0.255	0.316	0.428	0.364	0.224	0.480	0.477	0.441	1.000									
OA4	0.279	0.262	0.006	0.419	0.272	0.408	0.369	0.525	0.449	0.200	0.099	0.353	0.274	0.162	0.321	0.486	0.218	0.387	1.000								
OA5	0.428	0.514	0.223	0.536	0.552	0.292	0.309	0.244	0.269	0.177	0.299	0.397	0.227	0.229	0.565	0.365	0.615	0.299	0.389	1.000							
OA6	0.423	0.522	-0.149	0.462	0.394	0.425	0.437	0.423	0.506	0.342	0.392	0.606	0.357	0.295	0.570	0.569	0.322	0.497	0.357	0.385	1.000						
UE1	0.169	0.242	0.049	-0.012	0.257	0.153	-0.048	0.050	0.087	0.139	0.317	0.289	0.203	0.157	0.235	0.317	0.125	0.403	0.102	0.201	0.238	1.000					
UE2	0.022	0.008	0.059	0.013	0.207	-0.024	0.013	-0.023	0.128	0.134	0.054	0.038	0.174	0.088	0.326	0.183	0.116	0.365	0.294	0.235	0.131	0.405	1.000				
UE3	0.077	0.321	0.102	0.188	0.300	0.117	-0.070	-0.039	0.166	0.133	0.059	0.335	0.284	0.185	0.510	0.279	0.301	0.467	0.277	0.380	0.277	0.394	0.578	1.000			
UE4	0.102	0.131	0.147	0.078	0.207	0.019	0.023	0.037	0.320	0.179	0.022	0.221	0.314	0.168	0.452	0.331	0.168	0.504	0.376	0.274	0.275	0.393	0.710	0.736	1.000		
UE5	0.396	0.371	0.111	0.387	0.422	0.203	0.085	0.164	0.273	0.274	0.121	0.304	0.305	0.136	0.388	0.383	0.343	0.366	0.184	0.396	0.373	0.365	0.490	0.610	0.535	1.000	
UE6	0.160	0.183	-0.020	0.250	0.398	0.214	0.181	0.117	0.308	0.182	0.206	0.355	0.285	0.304	0.409	0.418	0.397	0.441	0.470	0.424	0.351	0.322	0.590	0.662	0.617	0.457	1.000

Table 4.5 Correlations Matrix

4.5.5 Analysis Of Measurement Items

The reliability of the measurement items were tested using Cronbach's Alpha. This method is dependent upon the correlation between the items. A high correlation is represented by a high alpha value. Hence the higher the alpha value the higher the correlation. In the studies reviewed in Chapter 3 it was recommended that an alpha value greater than .7 was acceptable (Grover et al. 1995; Karahanna et al. 1999; Staples and Seddon, 2004; Bailey and Pearson, 1983; Wolff and Pett 2006). The studies reviewed also showed that items falling below the alpha level of .07 should not be considered in the research. All items in this research fell above the Cronbach's Alpha level of.7. The constructs and the Alpha level are given in Table 4.3.

Construct	Cronbach's Alpha(>0.7)
Governance Framework	0.79
Organisational Culture	0.81
Implementation Project	0.80
Organisational Acceptance	0.74
User Expectations	0.85

Table 4.6 Reliability Measurement items

When the construct validity test was applied to the measurement items it confirmed the validity of the items. The test revealed that the items measured what the items were meant to measure in relation to the research model. It also included the analysis of convergent and discriminant validity. The objective of the convergent validity was to examine the measurement items, it ensures that the measurement items correspond with the construct. The convergent and the discriminant validity was tested by examining the factor loadings of the of each item and the fit indices of the model. The recommended factor loading was .05. Table 4.3 depicts the factor loadings for each item.

Matrices (Group number 1 – Default model); Factor Score Weights (Group number 1 – Default model).

	UE1	UE2	UE3	UE4	UE5	UE6	OA1	OA2	OA3	OA4	OA5	OA6
OC	0	-0.001	-0.002	-0.002	-0.001	-0.001	0.008	0.004	0.007	0.004	0.005	0.009
OA	0.003	0.009	0.015	0.018	0.006	0.01	0.14	0.073	0.119	0.069	0.083	0.153
QF	0.001	0.002	0.003	0.003	0.001	0.002	-0.011	-0.006	-0.009	-0.005	-0.006	-0.012
IP	0.005	0.014	0.024	0.028	0.009	0.015	0.078	0.041	0.066	0.039	0.047	0.085
UE	0.046	0.117	0.202	0.239	0.08	0.127	0.006	0.003	0.005	0.003	0.004	0.007

	IP1	IP2	IP3	IP4	IP5	QF5	QF4	QF3	QF2	QF1
OC (continued...)	-0.005	-0.013	-0.006	-0.006	-0.013	0.001	0.002	0	0.002	0.002
OA (continued...)	0.036	0.094	0.041	0.046	0.099	-0.007	-0.014	-0.001	-0.015	-0.011
QF (continued...)	0.007	0.017	0.008	0.008	0.018	0.13	0.267	0.022	0.274	0.211
IP (continued...)	0.056	0.144	0.064	0.071	0.153	0.009	0.019	0.002	0.02	0.015
UE (continued...)	0.004	0.011	0.005	0.006	0.012	0.001	0.001	0	0.002	0.001

	OC1	OC2	OC3	OC4	OC5
OC (continued...)	0.115	0.095	0.101	0.137	0.04
OA (continued...)	0.012	0.01	0.01	0.014	0.004
QF (continued...)	0.002	0.002	0.002	0.003	0.001
IP (continued...)	-0.016	-0.013	-0.014	-0.019	-0.006
UE (continued...)	-0.001	-0.001	-0.001	-0.001	0

Table 4.7 : Factor loading and measurement item

4.5.6 Assessing Overall Model Fit

Discriminate validity guarantees that individual constructs are truly distinct and that there are no similarities between them assessing the overall model fit.

The overall model fit can be determined using several methods. These fit indices are utilised by various researchers in several forms to determine the model fit. Among these indices some of the most popular ones are Chi-square statistics, GFI, AGFI, TFI (or NNFI). These indices separately, can be used to examine individual aspects of the model. However utilised together provide an overall view of how well the data fits the model. The table below (Table 4.4) displays the values of some of the commonly examined indices.

Index	Value	Recommended Value
Chi-Square (X^2)	625.055	
P-value	0.000	
Degrees of freedom (df)	320	
X^2 / df	1.95	<5.0
Goodness of Fit (GFI)	0.653	>0.8
Adjusted Goodness of Fit (AGIF)	0.590	>0.8
Root-mean-square error of approximation (RMSEA)	0.118	>0.05
Tucker-Lewis index (TFI)		>0.9
Comparitive Fit Index (CFI)	0.671	>0.9

Table 4.8 : Model Fit Indices

The statistical package utilised AMOS 7.0, in conjunction with the proposed model provide several forms of data. It provides the indices for a saturated as well as an independent model. In the independent model the variables are assumed to be uncorrelated with the dependants this equates to a model not having any paths while the saturated model has constrains while all paths are included in the model. The goodness of fit (GFI) generally is above .9 while a level of .8 or a .7 is acceptable. Though the model tested managed to meet the minimum criteria the GFI for this model was .653.

4.5.7 Assessing Measurement Model Fit

Anderson and Black (1998) discusses that the measurement model fit evaluates the measurement of each individual construct from within the model. This is considered as a more precise test for assessing the items from within the model. The method of evaluating the measurement model is to firstly test the composite reliability and the variance extracted from each construct based on the item loadings and the variance captures in turn the amount of variance construct will be based on the measurement of errors.

Confirmatory factor analysis was also used to determine the composite reliability of the item. This was observed from Anderson and Black (1998) and the standardised factor loading and the measurement error was used in the formula. The value of the composite reliability should exceed 0.7 and all the constructs should be above the value of the threshold. The average variance extracted from the data should not exceed 0.5. this is demonstrated by all the constructs showing that the indicators represents their related representative variable.

4.5.8 Assessing structural model fit

The fit of the structural model is observed by studying the estimated coefficients of the causal pathways along the critical ratio for the estimates. This is also known as the t-value. The model is found to be fit if the path estimates that are obtained support the underlying hypotheses of the model. This will enable the hypothesis developed in Chapter 3 to be tested while the structural model is being assessed.

Anderson and Black (1998)recommend the following with regards to testing of structural models. A significance level also known as a α – value. This value for the number of respondents was 0.05.The estimates and p-values for the causal path between successful implementation and realising user expectations are given in Figure 4.6.

Regression Weights

			Estimate	S.E.	C.R.	P	Label
IP	<---	QF	0.152	0.079	1.924	0.054	par_23
IP	<---	OC	-0.294	0.188	-1.566	0.117	par_24
IP	<---	OA	0.847	0.155	5.473	***	par_25
UE	<---	IP	0.546	0.137	3.992	***	par_26
QF1	<---	QF	1				
QF2	<---	QF	0.912	0.142	6.438	***	par_1
QF3	<---	QF	0.319	0.188	1.695	0.09	par_2
QF4	<---	QF	0.993	0.153	6.493	***	par_3
QF5	<---	QF	0.892	0.165	5.407	***	par_4
IP5	<---	IP	1				
IP4	<---	IP	0.583	0.148	3.93	***	par_5
IP3	<---	IP	0.761	0.182	4.181	***	par_6
IP2	<---	IP	1.261	0.206	6.13	***	par_7
IP1	<---	IP	0.998	0.227	4.391	***	par_8
OA6	<---	OA	1				
OA5	<---	OA	0.82	0.175	4.684	***	par_9
OA4	<---	OA	0.748	0.176	4.257	***	par_10
OA3	<---	OA	0.835	0.159	5.255	***	par_11
OA2	<---	OA	0.908	0.196	4.635	***	par_12
OA1	<---	OA	1.013	0.176	5.765	***	par_13
OC1	<---	OC	1.806	0.646	2.795	0.005	par_14
OC2	<---	OC	1.577	0.579	2.724	0.006	par_15
OC3	<---	OC	1.669	0.606	2.754	0.006	par_16
OC4	<---	OC	1.465	0.525	2.789	0.005	par_17
OC5	<---	OC	1				
UE6	<---	UE	1				
UE5	<---	UE	0.968	0.174	5.568	***	par_18
UE4	<---	UE	1.07	0.147	7.257	***	par_19
UE3	<---	UE	1.268	0.175	7.26	***	par_20
UE2	<---	UE	1.012	0.162	6.247	***	par_21
UE1	<---	UE	0.633	0.161	3.93	***	par_22

Table 4.9 : Regression Weights

4.6 CONCLUSION

The pilot study and the expert feedback resulted in minor alterations to the measurement instruments. This was done in phase 1 and 2 of the research phases. The changes included rewording of a few items and the inclusion of additional words to describe the question better.

The survey was conducted with a final sample size of 77. 7 responses were removed from the sample due to missing data. In order to obtain a power function of .60 with a significance level of .05 the required size of the sample became 60. This requirement was fulfilled by providing a final sample of 70. The sample included various organisations from around New Zealand ranging from retail, universities to consultancies. All respondents had implemented/utilised the software in the organisation in which they worked in.

The reliability measures were tested using the Chronbach's alpha method. which showed an alpha level of .7 or higher. Validity testing of convergent validity revealed that most items were above 0.6 while all of the items were above the .03 threshold. This enabled all the items to be retained in the analysis. The Chi-square difference test revealed the discriminate validity, this showed that the implementation of the project was distinct from user satisfaction.

AMOS 7.0 indicated that the model meets the minimum requirements. Despite this it was observed that the chi-square was quite significant. However the probability of achieving such a high chi-square was very low. As the results were dependant on sample size the ratio of chi-square to the degree of freedom was considered. In chapter 5 these results will be discussed in relation to the research question and the theoretical issues of chapter 2.

Chapter 5

DISCUSSION AND RECOMMENDATIONS

5.1 INTRODUCTION

The research set out to find the answer to the question regarding businesses achieving the benefits claimed by the vendors. As discussed in chapter two, to answer the primary question the claims made by the vendors were to be identified and understood. The literature review identified claims investigated in studies conducted in the past. This included the successful implementation of the software, the existence of a quality framework, the organisation culture and the expectations of the users. Therefore the answer to the main question inherently lay with the answers to these sub question.

Chapter 4, presented the findings of the survey conducted. The results were analysed using the structural equation modelling technique and showed that the quality framework, organisational culture and the organisational acceptance had a positive impact on the implementation project and the successful implementation of the project had a positive impact on the realisation of customer needs and thereby satisfying the customer. This chapter will compare the findings from this research with those from similar research conducted in the past.

Section 5.2 will subsequently discuss the presented findings. The link of the findings to the main research questions will also be discussed while comparing these links to those made by similar studies. The limitations of this study will be raised and discussed in Section 5.3 after which the discussion on further research opportunities will be presented in section 5.4. The conclusion to this chapter will be given in section 5.5.

5.2 DISCUSSION OF FINDINGS

The results obtained from the analysis discussed in Chapter 4 confirms the existence of a relationship between the existence of a quality framework, the organisational culture, the organisational acceptance, the implementation project and the

expectations of the users. The results also provide an understanding of the relationships between these constructs. The objective of the research was to understand the variables relating to user satisfaction where it was determined that the user would be satisfied if the vendors benefit claims were met. Hence it was important to understand the variables and the effect which these variables have on user satisfaction. These variables will be discusses separately in Sections 5.2.1, 5.2.2, 5.2.3 5.2.4 and 5.2.5.

5.2.1 End User Satisfaction

The literature review in Chapter 2 noted that end user satisfaction is dependent upon the successful implementation of the software. The relative relationship of a successful implementation has been discussed by many researchers in the past as satisfying the expectations of the end user (DeLone and McLean, 2003, Bailey and Pearson, 1983). The customers expectation varied from the improvement of operational efficiency (Beischel, 1993) to the ease of use (Staples and Seddon, 2004). Based on the relationship between the successful implementation of the software and user satisfaction the first hypothesis was developed.

The research investigated that the implementation of the project would have a significant impact on the user satisfaction. The reason for this being that an unsuccessful project would not deliver to the customer what they required. These results are also in line with the results of Young (2004). The studies utilized in chapters 2 and 3 were used as the foundation towards formulating the research questions for this study.

This shows that the project implemented in a structured project management framework will achieve the benefits desired by the customers. Where the software was implemented outside of a project framework it was less likely to succeed as the governance of the project may not be as effective as of one implemented through an accepted framework like PRINCE 2 or PMBOK. This was evident by the results of the projects which utilised project managers with a good understanding of project management. It was also noticeable that organizations who determined that the user expectations have been realised had well defined and well implemented project

management methodologies. These methodologies ensured that the projects delivered what was required on time, to the specifications or the requirements of the business and finally to the specified budget.

5.2.2 Quality Framework

The research question relating to the quality framework attempted to realise if the presence of a quality framework would ensure that the software would be implemented successfully. Section 5.2.1 explained that a quality or the best practices of project managers play a pivotal role in making the implementation a success. However as stated by Grover et al. (1995, p.185) and Bailey and Pearson, (1983, p.532) that the existence of a quality framework greatly improves the success of the project.

The data also indicates that the existence of a quality framework and its effectiveness when it is a statutory need has a higher significance on the success of the implementation. However it is evident that most organizations are not required by law to have a quality framework in order to achieve accreditation. Therefore it has become very much a conscious effort on behalf of the organization to ensure that performance is improved.

The data does confirm what has been said by practitioners of quality management such as Edward Deming, Philip B. Crosby, Joseph M. Juran and Kaoru Ishikawa that Quality itself may not be achieved without a quality management method (Doyle 2001, pp.52-62). This view is confirmed by the organisations that have successful implemented the software to achieve satisfaction in order to complement a quality management system.

H1: Proves that the existence of a quality framework positively affects user satisfaction by contributing towards the successful implementation of the software.

5.2.3 Organisational Culture

The results revealed that the effect which organisational culture has on the successful implantation of the software is insignificant. It might well be that the culture would

affect the ongoing performance of the software and its output on the long term rather than at the point of implementation and immediately after. The study does substantiate the claims made by Deming (1986, pp.169,170) that the managers of the organisation must play an active role in the quality initiatives of the organisation. Deming's claim was that the managers of modern organisations did not have the motivation or the knowledge to support and champion quality initiatives in the organisation. The data showed that this notion has shifted in most organisations where managers Champion the case and appear to be more knowledgeable about the initiatives. This is mostly due to the fact that organisations have realised the importance of the quality initiatives and employed specialised managers to implement quality management systems. This has improved the effectiveness of the quality initiative of the organisation.

For the reasons explained in this section H2: Shows that the organisation culture does not positively effects affects user satisfaction by achieving the desired results.

5.2.4 Organisational Acceptance

The organisational acceptance has displayed the highest significance towards the successful implementation of the software. The results confirm the organisational acceptance plays an important role when it comes to user satisfaction. These results are consistent with the results of a study conducted by Bailey and Pearson (1983). The results revealed that by referring and updating the processes frequently the employees of the organisation endorse the use of the software whereby ensuring that the organizations outcomes are favorable to the organisation. Where most organizations tend to document the process of the organizations due to an initiative but they fail to maintain these processes.

There the results have been significant the organisations encourage the employees to use and update processes by publishing the processes in a common directory or a quality intranet page.

H5: States that the acceptance of the software by the users positively affects user satisfaction by achieving the desired results.

5.2.5 Implementation Project

The implementation project aimed at determining the effect of a quality framework, the organisation culture and organisational acceptance of the software against it. The organisation culture was found to have the least effect on the implementation of the project. This could well be because the organisation culture measure looked at the culture towards the quality initiative. Whereas, the implementation project looked at the effectiveness of the project and not the support towards the project.

Unlike the study discussed by Young and Jordan (2005) where the management support and the management support and ownership rated highly in the scale this study looked at another perspective. It investigated the quality management culture of the organisation and it looked at its relevance to the claims made by Deming (1986) relevance and a where it was discussed that the managers did not take a pivotal role in the quality initiatives.

The results identified and confirmed what the PMBOK and PRINCE 2 stated. Which is, when a project is implemented under a project framework the probability that the project would deliver its objectives are higher. In the case of the implementation of the software when the software was implemented through a project framework the implementation of the software became successful. However it is noticeable that on the long term the quality initiatives of the business may not be successful without a quality management culture or a quality framework (PMI 2006, OCG, 2006).

The results indicate that H3: An effective implantation of the software (the implementation project) positively affects user satisfaction by achieving the desired results.

5.2.6 End User Satisfaction

The primary research question which was, Do businesses achieve the benefits claimed by vendors? The benefits claimed by the vendor and the expectations of the end user were successfully revealed by the research. The users claimed that all claimed benefits were realised. Furthermore the realisation of the benefits showed a

strong relationship to the implementation project. Which substantiates the claims made in studies such as Young and Jordan (2005, p.61); Standish (1999, p.4).

It is worth noticing that the variables measuring user satisfaction showed significant relationships. This indicates that the expectations of the users were accurately derived from the vendor claims and used in the measurement instrument.

Hence, the alternate hypothesis of H0: The successful implementation of the software do not effect end user satisfaction can be rejected.

5.3 LIMITATIONS OF RESEARCH

There were several significant constraints observed within the course of this study. Amongst which the most noticeable was time and the other budget. Due to the restrictions in time the scope of the dissertation was predetermined by it. Several other significant limitations such as access to the customer database were also a key issue during the research. Limitations contributed by the theoretical model were also experienced during this study.

Since the questions were not listed in individual section. The objective of which is to ensure that in the instance of a responded missed a question that the researchers will be able to identify the fact and make the required allowances.

Further to this the Unsolicited Electronic Messages Act of 2007 which came in to effect on 5th of September 2007 the software vendor was unable to send a mass mail message to all of its end users requesting them to participate in the research. The act deemed this a commercial endeavour as the message is generated from a software vendor from within New Zealand. Hence the users need to be contacted by phone in order to obtain permission to email the survey link to them. This not only limits the responses but also makes the process much slower than it needs to be.

Even though the sample represented a wide range of industries and implementation types it must be noted that a greater sample would have provider results which would have increased the accuracy of the results.

Limiting the data collection to quantitative data is another limitation of this research. As other researchers have identified in the past the use of qualitative data with quantitative data present an additional dimension to the analysis. Despite the fact

that the data collected in this research achieved the minimum fit for the analysis it would have added significant advantages and increased meaning to the findings.

Another dimension not explored in this research is the state of the organisation before the implementation of the software. The research was unable to determine the background of the organisation prior to the implementation of the software. In most cases it appeared that organisations which implemented the software did so in an effort to instil a quality management culture rather than to support one. A questionnaire prior to the implementation would have made the motivations of the organisations available and provided a measurement point for the research.

Section 5.2.4 noted that the relationship between the implantation project the quality framework and the organisational culture. This relationship was not as significant as anticipated. The literature review pointed out that this significance would be significantly greater. The measures relating to the quality framework and the organisation culture need to be discussed more in relation to the implementation of the software when assessing the contributions they make.

5.4 FUTURE RESEARCH

While discussing the limitations of this research, various opportunities were presented towards investigation of the vendor benefit claims of process mapping software. Understanding the motivations of the organisations adopting process mapping software and understanding the benefits achieved by businesses which utilises such software was investigated in this study. Budgetary as well as time constraints limited the scope of this dissertation. The utilisation of the findings of this study enabled the understanding of the vendor benefits claims of process mapping software to be extended further.

The concentration of this research was primarily on the effect of a properly implemented process mapping software and its relation towards realising the user's expectations. While it did reveal a relationship between the quality framework and the successful implementation of the software the relationship between the organisational culture and the successful implementation proved to be the opposite.

However organisational acceptance proved to have a strong effect of the implantation of the project. The role of organisational acceptance could be developed to investigate its contributing effects on the successful implementation. Further investigation in to the existence of the quality framework could be carried out to understand not only the effects but also the factors when need to be developed in order to create a significant positive impact on the implementation of the software.

A study by Grover et.al (1995) was discussed in Chapters 2 and 3 in which the experience of the people surveyed were taken in to consideration. This ensured that the knowledge of the implementer was high and they had prior experience to which they could draw on when making comparisons to what had happened in the implementation. Further research could utilise such a question in the main questionnaire or a pre adoption questionnaire to accurately determine the background and the skill set of the implementer of the software.

Further research could also be carried out in to the post adoption benefits of the software. Since this study takes a snapshot at post implementation stages of the project it is not possible to determine if the organisation is in a position to accurately gauge the success of the implementation. As discussed by Booth (1996, p.18) with regards to process value analysis and activity based costing the ability of the oeganisation to measure the value achieved from the organisation as opposed to the perception of achieving such measures must be adequately validated. Also explained by Deming (1986, p.3) as the chain reaction model, it is most often complicated to determine if the organisation truly active the benefits set out to achieve. If so, it is even more arduous to measure the benefits which the organisation gains as a consequence of achieving the primary objectives.

In addition to the research opportunities listed above the research model could be adopted towards measuring the implications of other related software which can be used in a quality framework of organisations. This could particularly extend not only to software implementation but also to reengineering projects where the businesses want to radically change the processes to achieve the changing demands of the industry.

The evolution of process automation is a subject which has most process mapping software vendor's interest. It can also be seen by these vendors that the next step in the evolution of process mapping software. The research model could be extended to include a project in which an implementation of a process automation tool can be measured.

5.5 CONCLUSION

The findings discussed in this chapter showed the significance of the research towards the body of knowledge and the practitioners engaged in the study or the implementation of process mapping software. It was found that the implantation of the software had a significant positive impact on user satisfaction. This implies that the best practices relating to project management need to be employed in order to successfully implement the software.

The relationships between the quality framework and the implementation of the software existed even though it was not significant. This implies that by implanting the software successfully, organisations will be able to achieve a quality framework in the organisation. As it may be that most organisations utilise the software to create a quality framework which they believe would improve quality in the organisation. The significance of the key indicators of which a successful project can be measured by as described by Young and Jordan (2005, pp.55-61) and those of Standish (1999, p.4) were found to be not only adequate but also consistent with the studies of other researchers.

The results indicated that the organisation culture did not have an impact on the implantation of the software. The reason for which would most likely be similar to the quality framework where the organisation is attempting to instill a quality oriented culture in the organisation. By successfully implementing the software the business envisages to gain these characteristics.

The main limitations of this study were related to time and budget constraints. It was also due to the unforeseen restriction laid out by the Unsolicited Electronic Messages Act of 2007. This meant that each participant had to be contacted and permission sought to email the survey link. Another limitation related to time was the

inability to obtain pre implantation data to accurately understand the situation of the organisation prior to the implementation of the software. This limitation is also associated to the fact that qualitative data was not considered in the research. A pre implantation data collection of a qualitative nature would have provided valuable insight towards the post implementation benefits gained by the users.

Further research could incorporate pre and post implantation data collection of both qualitative and quantitative in nature could be explored in the future. The incorporation of qualitative data could significantly extend the capability and the findings of the research. The model could be tested against a project, such as a business process reengineering project which could include an implementation of process mapping software.

Hence the discussion in this chapter highlights the importance of the proper implementation of process mapping software. It brings to light that in order to achieve the benefits claimed by the vendors the implementation of the software must be scoped and implemented in a structured manner. The following chapter will now draw final conclusions from the research.

Chapter 6

CONCLUSION

6.1 CONCLUSIONS FROM THE RESEARCH

The primary objective of this study was to investigate the realisation of vendor benefit claims of process mapping software. Process mapping software has been identified as a 'must have' in most organisational software tools portfolios. While more and more organisation turn towards business process improvements as the preferred method towards improving its efficiencies. The adoption of software tools to assist them in the documentation and the identification of the efficiencies become higher. While most software uses the software tools to complement the quality initiatives other build the quality initiatives around the software. Hence it was important to investigate the success of the software. More importantly to ascertain if the claims made by the vendors of process mapping software, if it can be substantiated and if the end users are satisfied with what they have achieved.

Due to the geographic distribution of the users it was decided to employ the survey method, qualitative data was collected from a sample of randomly selected end users of a software vendor in New Zealand. The wide distribution of the customer base ensured that the sample consisted of various different industries. Due to the restrictions posed by the Unsolicited Electronic Messages Act of 2007 which came in to effect on 5th of September 2007 the vendor was unable to obtain authorisation from all their New Zealand based customers. This resulted in a less than anticipated number of responses. The number of responses collected was sufficient to conduct the analysis under a power function of .6 and α .05.

The data collected passed the tests of validity which included construct and determinant validity tests. The use of reliability measures such as Cronbach's alpha and composite reliability tests ensured that the data was reliable. The data was analysed utilising the structural equation modelling technique. This included confirmatory factor analysis displayed that the data collected met the minimum requirements to fit the research model. This enabled the relationship between the

implementation of the software and user satisfaction be monitored with relation to the use and implementation of process mapping software.

A review of past literature revealed that there were several factors which could contribute towards user satisfaction, out of which successful implementation of the software was deemed to be the most positive impact. This hypothesis was supported by the results and indicated that the successful implementation of software which is accomplished under a controlled project structure would impact positively on end user satisfaction.

Out of the four constructs quality framework, organisational culture, and organisational acceptance, organisational culture displayed the weakest correlation. As discussed in the finding this meant that the culture of the organisation has not affected the implementation of the software. However, it was unable to determine if this would affect the quality management effort which the organisation was trying to establish as a result of implementing the software. Despite the lack of relationship of organisational culture to successful implementation it must be mentioned that the organisation must foster a quality culture where the managers take responsibility towards the development and the maintenance of that culture.

The quality framework of the organisation displayed a significant correlation to the implementation even though the results were not as high as anticipated. The noticeable factor with regards to the quality framework is that the implementation would in most cases instil a quality framework in the organisation. Hence organisations not having an implementation would contribute negatively towards this correlation. In order to accurately test this relationship a follow up survey needs to be conducted after a substantial period in which the framework would be operational. This would provide results towards the ongoing sustainability of the quality management system and the use of the software within the system.

The organisational acceptance showed the most significant correlation to the implementation project. The relationship between organisational acceptance and the implementation of the software describes the most significant measure towards user satisfaction. This proves that the users accepted the implementation software whereby making the implantation of the software a success. In cases where the correlation

between the organisation culture and the quality framework was low this indicates that the implementation of the software has instilled a quality oriented culture while attempting to instil a quality framework.

The relationships discussed in this study looked at the results obtained from a relatively small but sufficient sample. Despite the size of the sample it has proven that a unsuccessful implementation will not achieve any of the objectives set aside by businesses. It has also shown that in order to maintain the expectations set out by the users it is imperative that the organisation maintain by updating the processes documented using the software regularly. It is also important that the organisational culture is developed towards the maintenance of these processes. When the employees are aware of the processes it is more likely that the proper process is employed in the day to day activities of the business. Thus ensuring that the user expectations are maintained and the users are able to reap the rewards of their efforts long after the implementation is completed.

The foremost finding of this research displays the importance of the proper implementation of the software in to the business. The proper implementation will ensure that the vendor benefit claims are met. It is important to remember that the benefit claims can only be met once the software is implemented under an acceptable implementations structure and to complement the quality efforts of the business. It is also imperative that the organisation set out its desired benefits before the software is implemented. The software will only act as means of documenting, presenting and publishing what the organisation already knows that it must active. Even though it may mitigate some of the risk associate with such an exercise it will not completely eliminate it.

The success of the quality initiative is in the hands of the people who drive it and the managers who understand the needs and who are able to support it.

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Appendix A

Ethics Approval

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TE WĀNANGA ARONUI O TAMAKI MAKAU RAU

MEMORANDUM

Auckland University of Technology Ethics Committee (AUTEC)

To: Brian Cusack
From: **Madeline Banda** Executive Secretary, AUTEC
Date: 25 January 2008
Subject: Ethics Application Number 08/09 **Process mapping software: vendor business benefit claims.**

Dear Brian

I am pleased to advise that a subcommittee of the Auckland University of Technology Ethics Committee (AUTEC) has approved your ethics application at their meeting on 22 January 2008, subject to the following conditions:

1. Provision of a printed and signed copy of the EA8 application form;
2. Amendment of the Information Sheet as follows:
   a. Provision of further information about the process and procedures being used in this research in the section titled 'What will happen ...';
   b. Alteration of the verbs 'would' and 'will' in the section titled 'What are the benefits?' to 'may'.

I request that you provide the Ethics Coordinator with a written response to the points raised in these conditions at your earliest convenience, indicating either how you have satisfied these points or proposing an alternative approach. AUTEC also requires written evidence of any altered documents, such as Information Sheets, surveys etc. Once this response and its supporting written evidence has been received and confirmed as satisfying the Committee's points, you will be notified of the full approval of your ethics application.

When approval has been given subject to conditions, full approval is not effective until *all* the concerns expressed in the conditions have been met to the satisfaction of the Committee. Until full approval has been confirmed, data collection may not commence. Should these conditions not be satisfactorily met within six months, your application may be closed and you will need to submit a new application should you wish to continue with this research project.

When communicating with us about this application, we ask that you use the application number and study title to enable us to provide you with prompt service. Should you have any further enquiries regarding this matter, you are welcome to contact Charles Grinter, Ethics Coordinator, by email at charles.grinter@aut.ac.nz or by telephone on 921 9999 at extension 8860.

Yours sincerely

Madeline Banda
Executive Secretary
Auckland University of Technology Ethics Committee

Cc: Buharie Amath buharie.amath@metrowater.co.nz, AUTEC Faculty Representative, Design and Creative Technologies

From the desk of ...
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Appendix B

Questionnaire

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Process mapping software: vendor business benefit claims

Note: Completion of the questionnaire will be taken as indication of consent to participate.

Instructions

1. Tick one box to express your response to each statement.
2. Please indicate in each section whether you *Strongly Disagree (SD), Disagree (D), Undecided (U), Agree (A) or Strongly Agree (SA).*

Section 1: Existing quality framework

Section 2: The organisation culture

Section 3: The software implementation project

Section 4: Acceptance of the software by the wider organisation

Section 5: Realising user expectations

The questions below will be used to rate the effectiveness of process mapping software in the context in which it was implemented, this will inturn contribute towards perceived benefits claimed by vendors..

Context	#	Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Quality Framework	1	Our organisation has a quality framework.					
	2	Our quality management system is very effective.					
	3	We are required to have a quality framework in order to obtain/maintain accreditation status (i.e. ISO)					
	4	The quality initiative is communicated well and is understood by the employees.					
	5	Our quality initiative is audited and reviewed regularly.					
Organisation Culture	6	The managers champion the quality initiatives in our organisation.					
	7	The managers of our company know that quality initiative starts with them.					
	8	The use of processes and procedures are emphasised during the induction of new employees.					
	9	The use of processes, procedures and business rules are encouraged in our organisation.					
	10	People who do not follow processes and procedures are reprimanded.					

Software implementation project	11	The software was implemented through a project structure.					
	12	The project/implementation was scoped properly.					
	13	The project manager/implementer had extensive knowledge of quality management programme principles.					
	14	The implementation was on time and on budget.					
	15	The project delivered what was required.					
Acceptance of the software	The employees of our organisation						
	16	The employees of our organisation refer to the published documents frequently.					
	17	The employees of our organisation update the documentation as a part of set reviews and continuous improvement.					
	18	The employees of our organisation encourage the use of the published documents.					
	19	The employees of our organisation constantly provide feedback on the processes.					
	20	The employees of our organisation take responsibility for the maintenance and the accuracy of the published processes.					
	21	The employees of our organisation are trained to use the processes effectively					
Realising User Expectations							
	22	By using process mapping software we are able to publish and maintain our processes more effectively.					
	23	By using process mapping software we are able to improve our existing processes.					
	24	By using process mapping software we are able to improve service levels.					
	25	By using process mapping software we are able to improve operational efficiencies					
	26	By using process mapping software we are able to instil a "quality management" culture in our organisation.					
	27	By using process mapping software we are able to reduce costs and improve profits					

Appendix C

Correlation matrix

	QF1	QF2	QF3	QF4	QF5	OC1	OC2	OC3	OC4	OC5	IP1	IP2	IP3	IP4	IP5	OA1	OA2	OA3	OA4	OA5	OA6	UE1	UE2	UE3	UE4	UE5	UE6
QF1	1.000																										
QF2	0.604	1.000																									
QF3	0.298	0.109	1.000																								
QF4	0.632	0.666	0.046	1.000																							
QF5	0.545	0.523	0.338	0.514	1.000																						
OC1	0.611	0.589	0.040	0.650	0.426	1.000																					
OC2	0.441	0.487	0.023	0.572	0.332	0.505	1.000																				
OC3	0.219	0.251	-0.127	0.396	0.169	0.417	0.392	1.000																			
OC4	0.488	0.402	0.051	0.560	0.453	0.449	0.392	0.554	1.000																		
OC5	0.331	0.315	-0.108	0.382	0.288	0.414	0.279	0.146	0.214	1.000																	
IP1	0.308	0.252	0.024	0.228	0.359	0.257	0.147	0.085	0.142	0.087	1.000																
IP2	0.370	0.529	-0.146	0.510	0.486	0.444	0.386	0.315	0.350	0.224	0.504	1.000															
IP3	0.333	0.266	0.055	0.277	0.311	0.246	0.187	0.003	0.255	0.135	0.418	0.370	1.000														
IP4	0.229	0.286	0.102	0.268	0.285	0.308	0.204	0.084	0.158	0.298	0.329	0.490	0.211	1.000													
IP5	0.180	0.382	0.065	0.397	0.368	0.298	0.142	0.245	0.288	0.232	0.343	0.553	0.373	0.409	1.000												
OA1	0.462	0.317	0.059	0.346	0.385	0.331	0.328	0.372	0.424	0.302	0.403	0.506	0.378	0.376	0.365	1.000											
OA2	0.473	0.395	0.143	0.445	0.652	0.251	0.172	0.239	0.353	0.096	0.366	0.469	0.221	0.118	0.405	0.466	1.000										
OA3	0.354	0.365	0.106	0.371	0.454	0.353	0.198	0.190	0.449	0.255	0.316	0.428	0.364	0.224	0.480	0.477	0.441	1.000									
OA4	0.279	0.262	0.006	0.419	0.272	0.408	0.369	0.525	0.449	0.200	0.099	0.353	0.274	0.162	0.321	0.486	0.218	0.387	1.000								
OA5	0.428	0.514	0.223	0.536	0.552	0.292	0.309	0.244	0.269	0.177	0.299	0.397	0.227	0.229	0.565	0.365	0.615	0.299	0.389	1.000							
OA6	0.423	0.522	-0.149	0.462	0.394	0.425	0.437	0.423	0.506	0.342	0.392	0.606	0.357	0.295	0.570	0.569	0.322	0.497	0.357	0.385	1.000						
UE1	0.169	0.242	0.049	-0.012	0.257	0.153	-0.048	0.050	0.087	0.139	0.317	0.289	0.203	0.157	0.235	0.317	0.125	0.403	0.102	0.201	0.238	1.000					
UE2	0.022	0.008	0.059	0.013	0.207	-0.024	0.013	-0.023	0.128	0.134	0.054	0.038	0.174	0.088	0.326	0.183	0.116	0.365	0.294	0.235	0.131	0.405	1.000				
UE3	0.077	0.321	0.102	0.188	0.300	0.117	-0.070	-0.039	0.166	0.133	0.059	0.335	0.284	0.185	0.510	0.279	0.301	0.467	0.277	0.380	0.277	0.394	0.578	1.000			
UE4	0.102	0.131	0.147	0.078	0.207	0.019	0.023	0.037	0.320	0.179	0.022	0.221	0.314	0.168	0.452	0.331	0.168	0.504	0.376	0.274	0.275	0.393	0.710	0.736	1.000		
UE5	0.396	0.371	0.111	0.387	0.422	0.203	0.085	0.164	0.273	0.274	0.121	0.304	0.305	0.136	0.388	0.383	0.343	0.366	0.184	0.396	0.373	0.365	0.490	0.610	0.535	1.000	
UE6	0.160	0.183	-0.020	0.250	0.398	0.214	0.181	0.117	0.308	0.182	0.206	0.355	0.285	0.304	0.409	0.418	0.397	0.441	0.470	0.424	0.351	0.322	0.590	0.662	0.617	0.457	1.000

Correlation Matrix