Upgrade Decision Support Model (UDSM) for Enterprise Systems: Drivers and Processes

Gerald George Feldman

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Gerald George Feldman

Faculty of Computing, Engineering and the Built Environment (CEBE)

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Thanks be to God, for the strength and willpower.

This thesis is dedicated to my family:
For words of encouragement, support, and prayers, which was the fuel that kept me going. I will always appreciate what you have done, especially my brother Geoffrey for the many hours of proofreading.

ABSTRACT

Enterprise Systems (ES) have matured over the years, offering continuous improvement to the underlying technology and functionality, hence, it is reasonable to anticipate that organisations would upgrade their systems to realise the benefits of these improvements. However, the range of benefits and risks involved within upgrade projects, motivates only few organisations to upgrade; indicating that upgrade decision-making is not trivial, and requires a comprehensive consideration of the impacts, efforts, and benefits. To date, research on ES upgrade recommends practical guidance for managing and supporting upgrade projects, with few studies focusing on upgrade decision-making, yet the upgrade decision process remains one of the areas in post-implementation that is least explored.

This research investigates the interrelated aspects of ES upgrade phenomena to explore the drivers and decision processes. A qualitative survey design was adopted to explore ES upgrade decision-making process and through web-based questionnaires and semi-structured interviews, qualitative data from 41 respondents representing 23 organisations was collected, coded, and analysed. Drawing from the Technology-Organisation-Environment (T-O-E) framework and process view of decision-making to theorise the findings, this research proposes an Upgrade Decision Support Model (UDSM) to represent ES upgrade decision-making process. The model comprises of two phases namely exploration and evaluation. The evaluation phase consists of two processes, which are objective assessment and strategy selection. In addition, objective assessment includes three sub-processes these are technical analysis, functional gap-fit analysis, and impact assessment.

The study findings indicate that the decision to upgrade is an outcome of understanding the upgrade need, possible impacts, and benefits. Thus, asserting the importance of assessing the level of change, effort required and modifications to be reapplied prior to the upgrade decision. Additionally, the findings advocate that there is a relationship between upgrade drivers and the selection of an upgrade strategy, which guides the processes undertaken during the decision-making. This research contributes key insights on ES upgrade decision-making offering a thorough understanding of the drivers and processes. In addition, it presents decision makers with a methodical strategy for approaching upgrade decisions; hence, enables the identification of possible challenges and measures to overcome these issues.

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ABBREVIATIONS

CRM	-	Customer Relationship Management
DOI	-	Diffusion of Innovation
ERP	-	Enterprise Resource Planning
ES	-	Enterprise Systems
IP	-	Internet Protocol
IT	-	Information Technology
IS	-	Information Systems
MRP	-	Material Requirement Planning
MRPII	-	Manufacturing Resources Planning
PID	-	Project Initiation Document
RQ	-	Research Question
RPD	-	Recognition Primed Decision
SCM	-	Supply Chain Management
TAM	-	Technology Acceptance Model
T-O-E	-	Technology-Organisation-Environment
UDSM	-	Upgrade Decision Support Model
UTAUT	-	Unified Theory of Acceptance and Use of Technology

CHAPTER 1

INTRODUCTION

This chapter explains the importance of conducting this research, to support the growing interest in Enterprise Systems (ES) research, especially in the post-implementation phase. The chapter starts by presenting an overview of ES as the research domain and is followed by discussing the challenges that led to the research questions, which this research intends to address. Next, it summarises the thesis structure outlining the significance of each chapter in accomplishing the aims and objectives of this research.

1.1 Background

The shift in operating conditions and ever-changing business environments has led many organisations to adopt enterprise systems (ES) as a mechanism to gain competitive advantage and improve performance. There are many instances in literature where Enterprise Resource Planning (ERP) systems and ES have been interchangeably used for example (Beheshti & Beheshti, 2010), implying that ERP systems and ES are indistinguishable. Though, Davenport (1998; 2000) suggests that ES and ERP are different, as ES constitutes a variety of comprehensive systems in combination with other technologies to support supply chain optimisation, sales force automation, and customer service. While, Ward *et al.* (2005) describe an ES as a comprehensive, configurable, and integrated suite of systems and information resources, which support organisational-wide operational and management processes. on the other hand ERP systems are classified as a dedicated system that enables business processes integration on a specific technological platform to address organisation specific processing needs (Esteves & Pastor, 1999; Parr & Shanks, 2000; Nah & Delgado, 2006; Dittrich *et al.*, 2009; Elragal & Haddara, 2012). As such, Sheldon suggests that ERP is the “spinal cord and information flow that link top-management thinking and planning with marketing, sales, capacity, planning, procurement and customer services” (Sheldon, 2005, p.3). Hence, ERP systems are complex systems, offering a range of capabilities that simplify cross-functional integration of data and processes.

However, ES incorporates ERP and other systems such as Customer Relationship Management (CRM), Supply Chain Management (SCM) and so forth, providing a complete overhaul of the transactions processing systems landscape (Markus & Tanis, 2000; Shang & Seddon, 2002). Furthermore, Xu (2011) posits that ES encompasses capabilities to integrate and extend business processes within and outside of the organisation. Thus, ES is referred to as a holistic system that incorporates numerous systems; presenting a range of capabilities to support organisation-wide end-to-end processes, which enable integration, collaboration, interaction, and the processing needs of the entire organisation.

The adoption of ES has facilitated streamlining of business processes and improving productivity; however, there are many reports of failed implementation projects that resulted from the fact that organisations’ did not achieve the perceived benefits. According to Willis & Willis-Brown (2002) this could be related to the way organisations recognise the actual project completion, such that organisations that only consider system ‘go-live’ as the final stage fail to acquire the full potential of these systems. Thus, it can be explained that in order to realise the benefits of ES, it is important to understand the different phases and stages within the system lifespan (explained in section 2.2). According Willis & Willis-Brown (2002) there are two distinct phases namely, implementation and post-implementation. The implementation phase concentrates on planning and system selection with the purpose of ensuring the system deployment occurs without complications. The post-implementation phase begins after the system ‘go-live’ and includes system stabilisation and normal operation, along with functionality enhancements (Hecht *et al.*, 2011). Thus, upgrading is considered as one of the main activities in post-implementation, which ensures continuous improvements and effective management of the system.

Upgrading ensures the system is stable, operates efficiently, and can be expanded according to the organisation needs (Nah *et al.*, 2001; Motiwalla & Thompson, 2009; Ng & Gable, 2009; Hecht *et al.*, 2011). Therefore, upgrading can be defined as a process that intends to expand the existing system core capabilities by improving functionalities and taking advantage of new technology features offered in a new version (Vaucouleur, 2009). While Ng (2011) defines upgrading as replacing the existing version entirely or partly with a newer version from the same vendor or different vendor. The common attribute between these two definitions is upgrade results in functionality and features improvement when compared to the current installed version. However, it also signifies two upgrade dimensions: same system version-to-version upgrade and system-to-system upgrade. Same system version-to-version upgrade implies the current installed version is replaced with a newer version of the same system from the same vendor. While system-to-system upgrade means that the currently installed version is traded with another system altogether possibly from a different vendor, this could be because the new version of existing installed system does not support the organisation's requirements.

Therefore, in the context of this research, ES upgrade implies an improvement to the existing system version, through implementing a newer version from the same vendor offering additional features, functionalities, and enhanced technology capabilities. In addition, upgrade requires an extensive understanding and knowledge of the underlying system and business processes, as changes applied in one business module may affect other modules of the associated system (Rothenberger & Srite, 2009). Thus, according to Beatty & Williams (2006) the upgrade project team encompasses personnel that represent the functional and technical aspects of the system, along with database and systems administrators' to offer the diversified expertise needed to support upgrade projects. In addition, the team should include top management and user representatives in order to attain better support for the upgrade from management and end-users.

1.1.1 Problem Statement

By upgrading ES, organisations intend to gain improved performance and minimise maintenance costs, as well as re-examine and automate business processes (Beatty & Williams, 2006; Khoo & Robey, 2007; Olson & Zhao, 2007; Dempsey *et al.*, 2013). Additionally, Berinato (2005) suggests that organisations upgrade to take advantage of features introduced by continual improvements to the systems, such as service oriented architecture capabilities. Yet, the survey results from Hamerman *et al.* (2011) study reveal that more than 50% of the survey participants are still utilising systems, which are at least two versions behind the current release. These results indicate that not all organisations upgrade their systems when a new version is available, as organisations prefer to maintain control of their systems irrespective of the version release cycle. Moreover, Dempsey *et al.* (2013) mention high costs along with compatibility, reliability, and stability of the new version, as some of the reasons for not upgrading. According to Swanton (2004) upgrade costs are almost "50% of the original software licensing fee and 20% of the original implementation cost per user - £5.2m for a 5,000-user system". Likewise, Otieno (2010) suggests that upgrading ranges between 20% and 30 and Ng *et al.* (2003a) estimate it ranges between 25-33% of the initial implementation cost. Hence, over the years upgrade costs remain consistently high, thus it can have a significant influence on ES upgrade projects, specifically on the decision to upgrade.

Apart from costs, Khoo & Robey (2007) suggest that the impact of the new version on the existing version plays a critical role in upgrade projects. The impact can be due to either compatibility of the new version with the existing version or reliability and stability of the new version. One of the possible causes of compatibility issues is extensive modification applied to the existing system. Modification and customisation have been used interchangeably (see Light, 2001; Ng & Gable, 2009; Vaucouleur, 2009); however Brehm *et al.* (2001) argues that customisation is a mechanism for enabling or disabling already existing features and differs from modification. Thus, modifications refer to the alterations of the underlying code structure to include features and functionalities to fulfil the organisation requirements that are not included in the system. These changes are not always supported in the new version; hence, there is a high possibility to introduce consistency issues. According to Beatty & Williams (2006) these issues, normally would consume the majority of the upgrade time, specifically for testing all the imposed changes. Such suggestions propose that ES upgrade should not be taken lightly, as it involves huge financial commitment and effort to accomplish, to an extent Beatty & Williams (2006) advised upgrades be treated as new implementation projects.

Nevertheless, hesitation to upgrade to the new version implies organisations utilise outdated systems and risk losing continued technical support or obtaining support at a very steep price. Additionally there is a possibility of encountering bottlenecks in systems performance and functionality (Ng, 2001; Vaucouleur, 2009). Thus, it is possible for organisations to gain benefits from upgrading, yet the initial investment and risks associated with the process makes the decision not trivial, then again not upgrading can result in increased operational overheads, suggesting that upgrade decision-making is complex. In addition, the upgrade timing can be influenced by various factors that weigh in on the decision of when to upgrade

(Claybaugh, 2010). As a result, the decision to upgrade should be undertaken for the right reasons based on establishing a strong case, which should clearly make business sense.

Recent studies have addressed ES upgrades, proposing practical guidance for managing upgrade projects; such as best practise and lessons learned (Beatty & Williams, 2006; Zarotsky *et al.*, 2006; Wenrich & Ahmad, 2009), success factors (Whang *et al.*, 2003; Nah & Delgado, 2006; Olson & Zhao, 2007; Shi & Zhao, 2009; Leyh & Muschick, 2013; Scheckenbach *et al.*, 2014) and business process changes alignment (Cao *et al.*, 2013; Paradonsaree *et al.*, 2014). In addition, there are several studies (Khoo, 2006; Claybaugh, 2010; Otieno, 2010; Ng, 2011; Dempsey *et al.*, 2013), which explored these factors at length and proposed that the decision to upgrade is an output from the interaction of motivating and constraining forces. In addition, Khoo (2006), Otieno (2010), and Ng (2011) propose upgrade decision models, which conceptualise the upgrade decision-making process (explained in detail in section 3.1.3). Although these studies offered valuable insights into upgrade decision-making, Ng (2011) mentions that little is known about upgrade decisions; according to Dempsey *et al.* (2013) this could be associated with the fact that literature on ES systems upgrade is not mature. This supports the suggestions by Khoo (2006) and Otieno (2010) that exploring how organisations reach the decision to upgrade especially through adopting a process view of decision-making could enhance our understanding of ES upgrade decision-making. This implies that upgrade decision-making involves several processes, which evaluate the net benefits of adopting the new version and assessing how the changes affect the existing version (Goldstein, 2006; Ng & Gable, 2009). While Riis & Schubert (2012) propose transition processes, which illustrates the decision processes, however their research focused on vendors and resellers. Hence, considering processes involved in the decision-making from an organisation's view could provide insightful details on strategies for effectively minimising disruption and managing upgrade projects. Thus, this research seeks to investigate the inter-related aspects of ES upgrade, with the focus on the decision processes adopted by organisations during upgrade decision-making.

1.1.2 Research Questions

Upgrade is a continuous process recurring at least once every three years (Olson & Zhao, 2007), or depending on the vendors version release cycle. However, only a few organisations opt to upgrade their systems, despite the continuous improvement in the underlying technology and enhanced features and functionalities. Many organisations delay upgrading until the stability and reliability of the new version is established (Vaidyanathan & Sabbaghi, 2007; Urem *et al.*, 2011). This implies upgrading needs extensive planning and serious consideration of the impact and estimation of the required efforts (Dor *et al.*, 2008; Ng & Gable, 2009). According to Beatty & Williams (2006) it is important to assess the infrastructure and have mechanisms that ensure the systems will perform smoothly after the upgrade in order to take full advantage of the upgrade. Therefore, more effort is required to analyse how organisations reach the decision to upgrade and understand the significance for undertaking upgrades.

In addition, it is reasoned that organisations upgrade in order to gain improved performance and minimise maintenance costs, along with re-examining and automating business processes or keep within the vendors' release cycles. Due to these several reasons, organisations undertake different upgrade strategies, as Dempsey *et al.* (2013) suggest that an organisation can either undertake a technical or functional upgrade or a combination of both. Technical upgrade entails moving the existing system to the latest technology platform version and focuses purely on technology aspects of the system. Whereas, functional upgrade mainly focuses on functionality extension and optimising business processes based on the organisation's business needs and tactical direction. This may also involve consolidation of different systems, to provide better agility and flexibility to support systems integration and implementation of new business processes or automating existing manual processes. Several authors (Kremers & van Dissel, 2000; Khoo, 2006; Vaidyanathan & Sabbaghi, 2007; Claybaugh, 2010; Otieno, 2010; Ng, 2011; Dempsey *et al.*, 2013) explored and identified numerous factors influencing upgrade decision, yet only a few studies make reference of the upgrade strategies (Khoo, 2006; Zhao, 2007; Otieno, 2010). Additionally, most of the studies fall short in explaining how these factors influence the selection of an upgrade strategy and there is no evidence highlighting a direct association between the options and the drivers influencing the upgrade decision. Chapter 3 highlights further the issues that warrant consideration and provide extensive reasoning for exploring ES upgrade decision-making.

Thus, this research investigates the interconnected processes of ES upgrade decision-making to understand how the different processes facilitate the organisation to reach the decision to upgrade; and explore any association between the upgrade drivers and the upgrade strategy selection. This led to the formation of the two research questions, which aims to contribute towards the growing body of ES upgrade research.

RQ1: How do organisations reach the decision to upgrade their systems?

RQ2: What upgrade drivers' influence organisations to select a specific upgrade strategy?

1.1.3 Research Aims and Objectives

Against the backdrop of these two research questions, the aims of this research are:

(1) To explore ES upgrade decision-making processes among different organisations.

(2) To propose an ES upgrade decision support model, which offers systematic processes that assist ES decision makers to reduce the risks and complexity of upgrade decisions.

In order to achieve these aims, the following objectives are proposed for this research:

(i) Undertake an extensive literature review to identify existing and relevant ES upgrade models, along with theories to contextualise the decision processes and aspects related to ES upgrade.

(ii) To identify the decision processes and sub-processes undertaken during ES upgrade decision-making and establish key drivers influencing upgrade decisions by conducting a qualitative survey, which probes the respondents involved in recent ES upgrades.

(iii) Formulate an upgrade decision support model (conceptually) based on the analysed data from (ii) and using theories from (i).

(iv) Evaluate the proposed upgrade decision support model with respondents and draw conclusions on its usefulness and workability to support ES upgrade decision-making.

1.1.4 Research Scope

This thesis focuses on how organisations reach the decision to upgrade their ES, specifically concentrating on decision processes and the drivers that influence the decision to upgrade. However, instead of exploring all upgrade dimensions, it is limited to same system version-to-version upgrade (defined in section 1.1). It explores the decision-making processes that organisations undertake when upgrading the different systems encompassed within an ES landscape from an organisation perspective. This is achieved by probing different respondents that have been part of the upgrade project team (explained in section 1.1) and have been involved in at least one upgrade projects. As the aim was to explore the decision-making processes during ES upgrade, it was important to gather information, views and experience from the respondents, who were recently or currently involved in upgrade decision-making process. Thus, the research defined the upgrade period between previous 6 months to next 24 months.

1.2 Thesis Structure

Figure 1-1 highlights the chapters discussed in this thesis; and categorises them into the following research stages: research problem identification, literature review, research methodology, presentation of the findings, upgrade decision support model formulation, evaluation of the model, and finally conclusion.

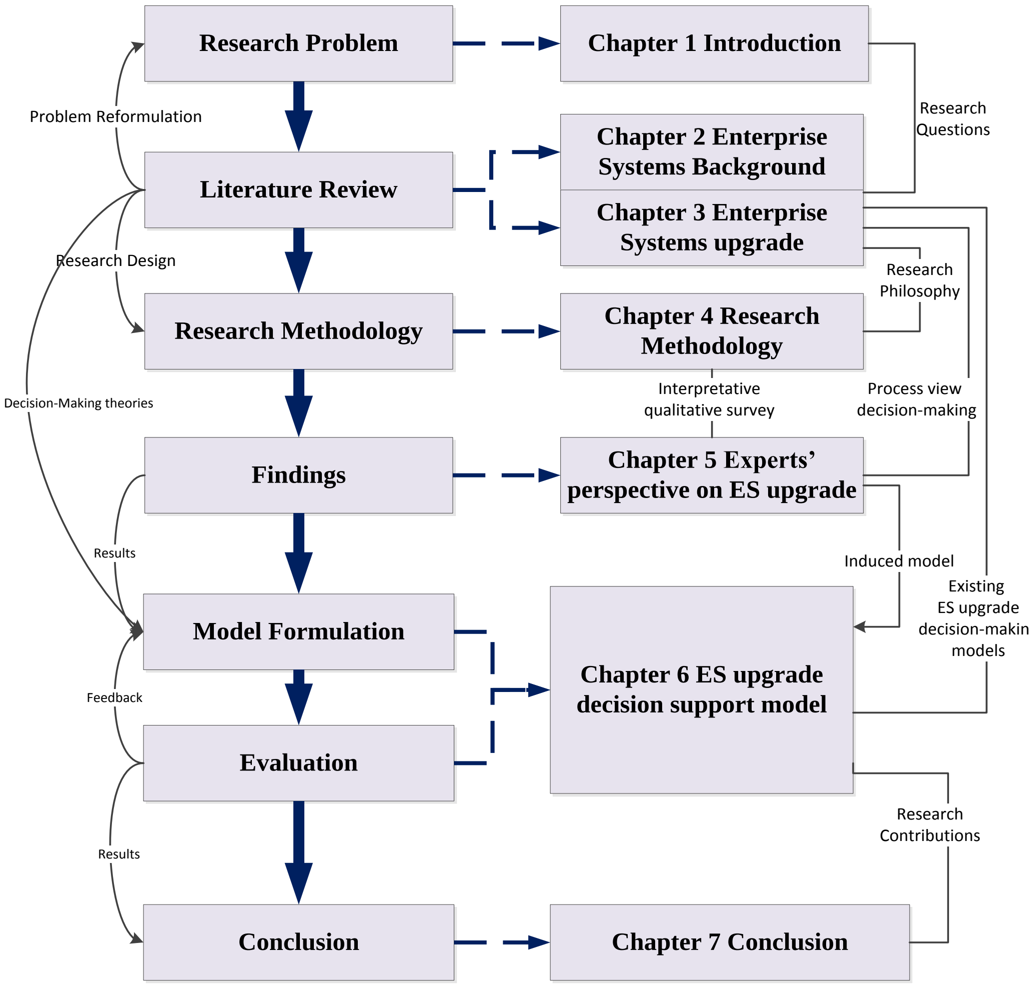

Figure 1-1: Research stages alongside the thesis outline

The first chapter focuses on identification of the research problem, and highlights the need for undertaking this research. Next, it introduces the research questions and their relevance to the research domain. Based on the research questions, two aims and four objectives were formulated in order to address the research questions effectively. The review of relevant literature is addressed in the second and third chapters. Whereby, chapter two presents a brief background of the research domain as whole and explores previous studies within this domain. Next, it establishes the focal point of this research by highlighting areas within the domain that were not extensively addressed in existing studies.

The third chapter offers a review of relevant ES upgrade literature and expands on the need to address the different research questions. As a result, it draws from ES upgrade literature to offer justification for conducting this research. In addition, chapter three draws from Tornatzky & Fleischer (1990) Technology-Organisation-Environment (T-O-E) framework and organisational decision-making theories specifically process view of decision-making as lenses for analysis. Based on the concepts identified from the literature and the theoretical lenses a conceptual research model is developed. This research model incorporates the logical outline of the decision-making process, which maps out the landscape of the literature in relation to upgrade decision-making. The model is used to guide the data collection and structure the analysis in order to draw out the theoretical constructs and providing a perspective to the findings.

The fourth chapter discusses the research methodology and philosophy. It also presents an extensive discussion on the reasons for designing this research as a qualitative survey study and outlines the data collection and analysis techniques utilised in this research. The findings of the research are presented in chapter five as subjective interpretation of the respondents' views and knowledge about ES upgrades. These findings are presented in a mixed form, which includes subject-expert comments and explanation of meaning in order to draw references about the ES upgrade decision-making processes and drivers.

The upgrade decision support model details and evaluation are conveyed in chapter six. In addition, chapter six outlines the different phases and processes undertaken during the upgrade decision-making and highlights the different categories of the drivers that influence the decision to upgrade. Next, it positions the model contributions and uniqueness by evaluating it to existing literature, in order to identify any similarities or difference. Additionally, it presents the views of the respondents who evaluated the model to justify its usefulness and workability. Chapter seven provides a summary of the key discussion points of this thesis, including the contribution from both research and industry perspective. In addition, it highlights the limitation as well as outlines future work that can be undertaken in respect to ES upgrade domain.

CHAPTER 2

ENTERPRISE SYSTEMS BACKGROUND

This chapter provides a short background of Enterprise Systems, highlighting the reasons for adopting such systems, and the associated challenges encountered during the implementation phase. Next, it explores the ES life cycle, to explain the different stages involved and how these stages differ from standard system life cycle stages. The last section focuses on post-implementation phase, highlighting the importance of this phase and outlines the current research trends, which builds the groundwork for undertaking this research.

2.1 Enterprise Systems Adoption

The perceived benefits of ES may differ from one organisation to another, however the promise of potential operational cost reduction, improved performance, increased competitiveness, efficient business processes, and real-time decision-making capabilities are cited as some of the key reasons for adopting ES (Esteves & Pastor, 1999; Nah *et al.*, 2001; Dittrich *et al.*, 2009). In addition, it was anticipated that the adoption of ES would provide reliable and timely access to information, and improve business efficiency (Davenport *et al.*, 2004; Grabski *et al.*, 2011); as ES eases integration of different processes, people, and technology to help streamline operations. Despite these advantages, predominant adopters of ES are large organisations (Teltumbde, 2000; Liang & Xue, 2004; Sharma, 2009). This inclination can be associated with huge initial investments and relatively longer implementation time, which in many cases can cause negative outcomes in ES projects, such as project failure (Davenport, 1998; Scott & Vessey, 2002). Such outcomes arise due to organisations underestimating the adoption process involved with ES systems. Previous research suggests that ES adoption is a complex phenomenon due to its intangible nature, which progresses over time, thus, the success of these systems is bound within the system life cycle (Stefanou, 2002). In addition Willis & Willis-Brown (2002) postulates that the full potential of ES would only be attained after implementation. This justifies the need to explore and understand ES not only from the adoption and implementation perspective, but also through the entire system lifespan.

2.2 ES Life Cycle

ES literature, specifically ERP studies have loosely defined system lifespan, which encompass several stages associated with configuring, implementing, and managing ES. According to Chang (2004) this involves several revisions of the initial implementation and goes beyond use and maintenance of these systems. Additionally, Shaul & Tauber (2013) suggest that there is a noteworthy difference from traditional IS life cycles, which only comprises of the following stages: development, implementation, and maintenance. This argument is supported by most of the authors of ES life cycle models, who claim that it is difficult to represent ES lifespan using only the three traditional stages, as these generic stages do not fully represent the complexity of adopting ES. Accordingly, they proposed life cycle models with varying number of stages (3 to 7) as shown in Table 2-1. Based on Worrell (2008) life cycle definition, these different life cycle stages can be explained as four main stages namely project initiation, implementation, stabilisation, and post-implementation. The project initiation stage focuses on defining the business case and features selection, and the implementation stage involves preparing and configuring the system.

Table 2-1: ES life cycle models in ascending order of the year published (adapted from Shaul & Tauber, 2013)

ARTICLES	STAGES IN LIFE CYCLE						
Cooper & Zmud (1990)	Initiation	Adoption	Adaptation	Acceptance	Routinize	Infusion	
Esteves & Pastor (1999)	Adoption	Acquisition	Implementation	Use and maintenance	Evolution	Retirement	
Markus & Tanis (2000)	Chartering	Project	Shakedown	Onward and Upward			
O'Leary (2000)	Decision	Selection	Design	Implementation	After going alive	Training	
Parr & Shanks (2000)	Planning	Project	Enhancement				
Ross & Vitale (2000)	Design	Implementation	Stabilisation	Continuous improvement	Transformation		
Shanks *et al.* (2000)	Planning	Implementation	Stabilising	Improvement			
Sumner (2000)	Planning	Analysis	Design	Implementation	Integration	Maintenance	
Somers & Nelson (2001)	Initiation	Adoption	Adaptation	Acceptance	Routinization	Infusion	
Rajagopal (2002)	Initiation	Adoption	Adaptation	Acceptance	Routinization	Infusion	
Stefanou (2002)	Business vision	Selection	Implementation	Operation	maintenance and evolution		
Al-Mashari (2003)	Setting up	Implementation	Evaluation				
Bajwa *et al.* (2004)	Awareness	Selection	Preparation	Implementation	Operation		
Chang (2004)	Planning	Design and build	Testing	Implementation	Knowledge	Up and running	
Hawking *et al.* (2004)	Planning	Build	Go live	Stabilise	Synthesise	Synergy	
Loh & Koh (2004)	Preparation	Implementation	Maintenance				
Berchet & Habchi (2005)	Selection	Deployment and Integration	Stabilisation	Progression	Evolution		
Bernroider & Mitlöhner (2005)	Consideration	Evaluation	Implementation	Stabilisation	Use & Maintenance	Extensions	
Motwani *et al.* (2005)	Pre-implementation	Implementation	Post-implementation and evaluation				
Esteves & Pastor (2006)	Preparation	Blueprint	Realization	Final preparation	Go on Live & Support		
Guang-hui *et al.* (2006)	Programming	Executive	Stabilisation	Ascending			
Pan *et al.* (2007)	Agenda Formation	Design	Implementation	Appropriation			
Ibrahim *et al.* (2008)	Feasibility	Planning	Package	Selection	Pre Implementation	Implementation	Post implement
Worrell (2008)	Project Initiation	Implementation	Stabilisation	Post-implementation			
Motiwalla & Thompson (2009)	Planning	Implementation	Stabilisation	Backlog	New module	Major upgrade	
Law *et al.* (2010)	Initiation stage	Contagion stage	Integration				

Colour codes: Orange – Project initiation, Green- Implementation, Light Blue – Stabilisation, and Yellow – Post-implementation

The stabilisation stage is concerned with eliminating `bugs' and ensuring normal operations, performance tuning, and training activities. Whereas the post-implementation stage ensures continuous improvement to the system and focuses on activities that ensure system extension (Worrell, 2008). These stages can be grouped into either implementation phase or post-implementation phase, which the next section explains, in order to outline the foundation of this research.

2.2.1 Implementation Phase

Organisations have invested heavily on ES implementation, for example Salmeron & López (2010) suggest that billions have been spent on ERP implementation. The main objective of implementing these systems was to address the maintenance issues of legacy systems, reduce development risk, provide timely access to information and improve business efficiency (Davenport *et al.*, 2004; Grabski *et al.*, 2011). These efforts resulted in a situation whereby organisations achieved better consistency and capability to automate business processes and improved competitive edge. Parr & Shanks suggest that ES specially ERP systems are becoming the “de facto industry standard for replacement of legacy systems” (Parr & Shanks, 2000, p.1). This can be associated with the generic business process offered in these systems and integration of different processes, which significantly reduces redundancies, making ES implementation more appealing when compared to developing systems in-house (Chang & Gable, 2001; Beheshti, 2006). In addition, Davenport *et al.* (2004) and Olson (2004) advocate improved business operations and standardised processes, as advantages for adopting ES. These result in reduction of complex interfaces and redundant processes, thus, allowing streamlining of processes, decrease in product development cycles, and enhance external collaboration. Likewise, it provides a platform for information integration across the enterprise, which assists acquiring accurate information that allows making timely decisions. The report from Panorama Consulting Solutions (2013) outlines several other advantages, such as:

- Reduction in maintenance efforts specially where legacy systems are concerned
- Increased collaboration and interaction
- Enterprise-wide information availability
- Improved productivity

However, each implementation project is unique because of the different organisational characteristics and implementation strategy. As a result, there are a number of instances, where organisations have failed to realise these benefits and end-up running into costly implementation, increased maintenance, and operational challenges (Davenport, 1998; Chang, 2004). According to Al-Mashari & Al-Mudimigh (2003) ES implementation results in significant changes to the organisation, which have to be planned carefully in order to fully gain the benefits presented by these systems. The planning includes selecting the right methodology and strategy that involves considering what changes are required and how to implement these changes, along with considering resources required for implementing the project. The terms implementation methodologies and strategies have been used interchangeably, yet some researchers (for example Holland & Light, 1999; Parr & Shanks, 2000) consider strategies as the approach and mechanism taken during system 'go-live' or deployment. As such, methodology implies the complete set of processes undertaken in an orderly manner to accomplish the adoption, planning, and deployment of the system.

Most vendors offer suggestions for implementation by providing their own methodology, however amongst the decisions organisations have to make are on implementation methodology and strategy. Therefore, one of the elements of planning would include selecting the implementation strategy, which could either be 'big-bang' or 'phased' (Holland

& Light, 1999). The big-bang approach goal is to replace all legacy systems features by implementing the whole system and all its functionality at once. Although the big-bang approach proposes a number of benefits, it is a resource intensive approach and requires longer duration, thus increasing the risk of failure (O'Leary, 2000). A phased approach sometimes referred to as a modular approach, involves implementing changes gradually starting with the basic necessary functionality, which co-exists with other legacy systems. Parr & Shanks (2000) caution that the difference between these approaches is too granular to offer any formal distinction. As a result, they propose an alternative classification that comprises of three approaches that is ‘comprehensive’, ‘middle-road’, and ‘vanilla’. A comprehensive approach involves implementing the physical aspects and functionality of the systems, across all the sites at once. Thus, it involves significant efforts for business process re-engineering, as this approach would not utilise the standard processes offered in systems. To an extent, this approach would either adopt implementing the functionality in a modular approach or opt for a big-bang approach. Middle-road is between comprehensive and vanilla approaches and involves some level of business process re-engineering, however this approach follows a modular implementation strategy. A ‘vanilla’ implementation approach implies the systems are deployed with standard functionality based on the generic processes, as this approach allows organisations to utilise the process model offered by the vendors. These generic processes are touted as best operating practices, however these are merely the vendors’ vision of how organisations should operate (Davenport, 1998). In addition, a complete ‘vanilla’ approach is not often practical (Light, 2005a); as there is a need to create a fit between the processes and system (Light, 2005b; Rothenberger & Srite, 2009). As Otieno (2010) suggests there will always be a gap between the functionality and organisation requirements, despite the extensive industry processes made available in these systems.

Creating this fit involves altering systems' processes to align with the organisation's business processes, a phenomenon referred to as modification. This involves introducing changes to the underlying system core infrastructure, in order to add functionality that can support the organisation existing business processes (Rothenberger & Srite, 2009). These changes propagate throughout the system life cycle, which results in increased maintenance efforts and complexity during upgrade. As vendors do not support extensive modifications, hence it increases maintenance costs and requires significant effort for maintaining these modifications (Brehm *et al.*, 2001; Vaucouleur, 2009). Despite implementation being an important milestone, ES projects are never complete at the implementation phase, since the deployment of these systems involves interaction of organisational, technological, and environmental aspects. Hence, organisations' need to give due consideration to the stages after implementation, commonly referred to as post-implementation phase that begins after the systems 'go-live'.

2.2.2 Post-Implementation Phase

On completion of ES implementation, the focus turns into efficient utilisation, stabilisation, and expansion of the implemented system, as the actual ES value becomes visible and realised during this period referred to as post-implementation phase. This is critical, because it ensures the system is stable and aligned to the organisation's processes, as well as catering for changes and new user requirements. Therefore, highlighting the importance of planning for continuous improvements and refinement of the system landscape (Willis & Willis-Brown, 2002). As a result, several stages have been proposed as part of the post-implementation phase to support organisations to manage their systems effectively and efficiently, in order to take advantage of the benefits offered by these systems. For example, Worrell's (2008) life cycle definition specifies two stages: stabilisation and post-implementation; while Motiwalla & Thompson (2009) ES life cycle definition offers four stages that is stabilisation, backlog, new module and major upgrade stages. The backlog stage deals with modification development, evaluating new requirements and processes to support business needs. The new module stage extends the implemented system with additional capabilities to support existing processes and improvement of performance, the major upgrade stage focuses on extending and expanding the existing systems depending on business needs and keeping pace with the vendor's version release cycle.

The fundamental distinction in these two life cycle models is the later model provides a clearer explanation of what activities (routine maintenance, supporting users, enhancements, and upgrade) are included in the post-implementation phase. Hence, suggesting there are two core activities maintenance and major upgrade that have to be considered during the post-implementation phase. In contrast, Nah *et al.* (2001) and Ng *et al.* (2002) suggest that post-implementation phase encompasses only maintenance as the main activity, which is divided into several sub activities such as bug fixing, user training, performance tuning, stabilisation, enhancement, and upgrades. In addition, Nah *et al.* (2001) categorises maintenance activities as corrective, adaptive, perfective and preventive (Figure 2-1); whereby each category addresses a different perspective of maintenance but collectively ensures the existing system operates efficiently and is sufficiently supported, as well as extended to fulfil the business needs.

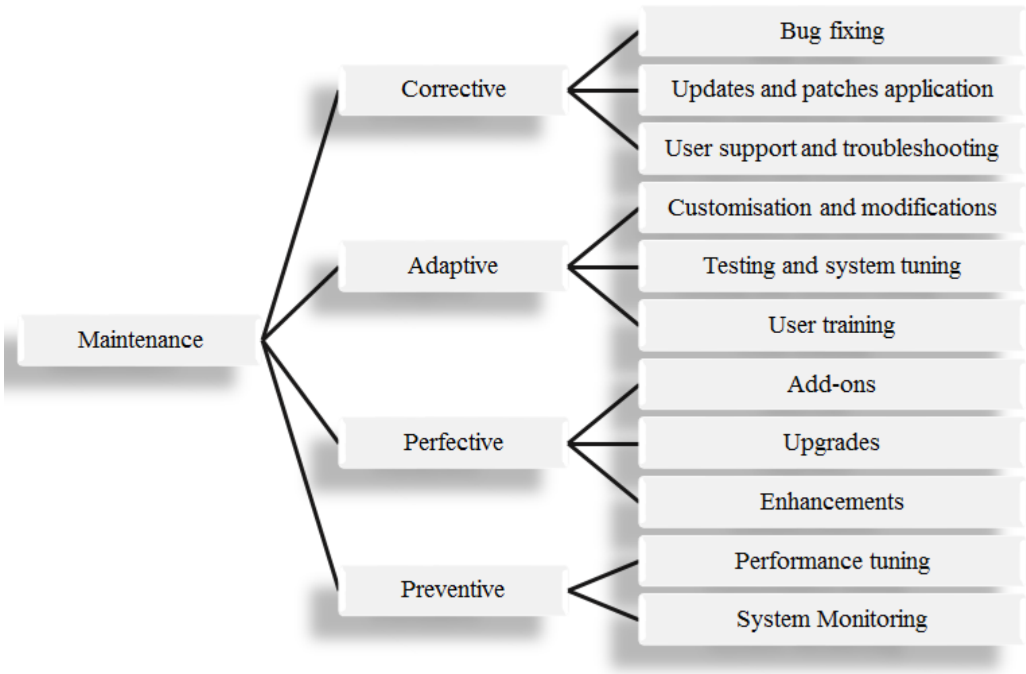

Figure 2-1: Maintenance classification (adapted from Nah *et al.*, 2001)

This categorisation posits that upgrade is part of maintenance activities, Hecht *et al.* (2011) support this argument and explain that different capabilities are required to support upgrade during maintenance. However, Botta-Genoulaz *et al.* (2005) postulate that maintenance and upgrade are separate stages, an argument supported by Motiwalla & Thompson (2009) explanation of the life cycle stages. Thus, this research considers maintenance and upgrade to be separate processes. Since upgrade focuses on improvement and extension of the existing system, and requires an in-depth planning, impact analysis and reapplication of modification, which demand greater resources (financial and human) and strategies to support the upgrade (Ng & Gable, 2009; Hecht *et al.*, 2011; Paradonsaree *et al.*, 2014). On the other hand, maintenance begins once the systems 'go-live' and focuses on user support, improvements, and operations stabilisation.

ES maintenance and upgrade differs from traditional maintenance and upgrade activities especially when considering systems developed in-house in twofold; firstly, ES are standard integrated systems, having greater level of complexity due to the amount of modifications applied to create a fit between organisation goals and generic processes. For example Ng

(2001) posits that upgrading to a new version reduces the enhancements and modification introduced to the systems. Thus, it requires more time and effort to maintain modifications, to avoid disruptions and demands great depth of systems' functional and technical knowledge to support smooth operation of the system. As a result, it involves different stakeholders, such as vendors, consultants, functional, business, and technical personnel. Secondly, ES maintenance and upgrade are mostly controlled by the vendors through frequently offering patches and new version (Nah *et al.*, 2001). Thus, ES maintenance and upgrade is a balance between different internal and external attributes which influence the process (Ng *et al.*, 2003a). Due to the need for balancing these different attributes, Wenrich & Ahmad (2009) propose the use of best practice and standards to support upgrade projects; however, they claim that this remains an uncharted domain. Although Botta-Genoulaz *et al.* (2005) suggest there is a growing interest in maintenance activities, reviews by Esteves & Bohorquez (2007) and Moon (2007) assert that there is inadequate representation of the post-implementation phase. Likewise, Schlichter & Kraemmergaard (2010) suggest that out of a pool of 1,196 journal publications analysed only 17 per cent represented post-implementation optimisation. Though the main focus of these reviews was on ERP systems; the findings highlight a significant uncharted research domain, which Grabski *et al.* (2011) concurs and postulate that there is need for more studies to concentrate on the post-implementation phase. In addition, Paradonsaree *et al.* (2014) and Scheckenbach *et al.* (2014) states that research on upgrades specifically on ERP systems is scarce, this argument supports Grabski *et al.* (2011) suggestions that further research is needed to explore post-implementation phase, such as ES upgrade challenges, decision-making, exploring the role of business process change, and measuring performance.

A synthesis of the selected literature on post-implementation phase (Table 2-2) indicates that there is a significant contribution with respect to maintenance research, specifically on maintenance standards and taxonomy, understanding the impact of modifications, best practice, and critical success factors. This includes support practices, exploring risks, and critical issues associated with operations and optimisation of the systems. However, there has been limited representation of upgrade; one possible explanation could be that upgrade is regarded as part of the maintenance activity as explained above. Thus, there is a necessity for further research to investigate and explore ES post-implementation activities such as upgrade process in order to support decisions and manage challenges (Esteves & Bohorquez, 2007; Olson & Zhao, 2007; Grabski *et al.*, 2011). This research intends to contribute towards ES post-implementation literature, by exploring ES upgrade decision-making (detailed explanation in chapter 3).

Table 2-2: Research trends in post-implementation phase

KEY AREA	MAIN FOCUS	ARTICLES
Maintenance	Impact of modifications	(Light, 2001; Davis, 2005; Worrell, 2008)
	Strategic planning and standards and taxonomy	(Nah *et al.*, 2001; Ng *et al.*, 2002; Ng *et al.*, 2003a; Ng *et al.*, 2006; Ng & Gable, 2009; Law *et al.*, 2010)
	Post-implementation best practices and success factors, including support practices and strategies	(Imtihan *et al.*, 2008; Wenrich & Ahmad, 2009; Al-Turki, 2011; Gallagher & Gallagher, 2012; Kiriwandeniya *et al.*, 2013)
	Risks taxonomy, risks and success, critical issues	(Salmeron & López, 2010; Pan *et al.*, 2011; Salmeron & López, 2011b; 2011a; Hustad & Olsen, 2013; López & Salmeron, 2014)
	Capabilities for successful maintenance	(Jain, 2010; Hecht *et al.*, 2011)
	Process change and transformation	(Davenport *et al.*, 2004; Yu, 2005; Goldstein, 2006; Bachman, 2010)
	User participation and satisfaction	(Wagner & Newell, 2007; Sternad *et al.*, 2011)
Maintenance and upgrade	Decisions factors and framework	(Ng, 2001)
	Maintenance and upgrade activities model	(Ng *et al.*, 2003b)
	Impact of modifications	(Cao *et al.*, 2013; Oseni *et al.*, 2013)

Table 2-2 continued		
Major upgrade	Critical success factors and upgrades challenges	(Whang *et al.*, 2003; Nah & Delgado, 2006; Olson & Zhao, 2007; Shi & Zhao, 2009; Leyh & Muschick, 2013; Scheckenbach *et al.*, 2014)
	Stakeholder involvement and acceptance	(Khoo *et al.*, 2011a; Khoo *et al.*, 2011b; Riis & Schubert, 2012)
	Upgrade triggers	(Kremers & van Dissel, 2000; Ng, 2001; 2006; Seibel *et al.*, 2006; Khoo & Robey, 2007; Vaidyanathan & Sabbaghi, 2007; Roberts, 2009; Claybaugh, 2010; Otieno, 2010; Urem *et al.*, 2011; Riis & Schubert, 2012; Dempsey *et al.*, 2013)
	Upgrade decision model	(Khoo & Robey, 2007; Otieno, 2010; Ng, 2011)
	Timing of upgrade	(Nicolaou & Bhattacharya, 2006; Ngwenyama *et al.*, 2007; Claybaugh, 2010; Kankaanpää & Pekkola, 2010)
	Best practice and lessons learned	(Beatty & Williams, 2006; Zarotsky *et al.*, 2006; Wenrich & Ahmad, 2009)
	Impact of modification, business process alignment and strategic resilience	(Dor *et al.*, 2008; Vaucouleur, 2009; Urem *et al.*, 2011; Cao *et al.*, 2013; Teoh & Zadeh, 2013; Paradonsaree *et al.*, 2014)

2.3 Chapter Summary

This chapter provided an overview of ES, expanding on the two different phases of the system lifespan, namely implementation and post-implementation. The focus of the chapter has been on these two phases, in order to provide a foundation for understanding the ES domain and illustrate its dynamic nature. In addition, it highlighted important aspects of the post-implementation phase, which aided in identifying areas that need further exploration in order to contribute towards ES post-implementation phase. The next chapter expands on the recent ES upgrade research, in order to demonstrate the importance of addressing the questions posed in this research.

CHAPTER 3

ENTERPRISE SYSTEMS UPGRADE

Upgrades are considered an essential component of the ES post-implementation phase, since it is during this phase the benefits of ES are realised as explained in chapter 2. This chapter begins by providing an overview of ES upgrade and offers an explanation on the different upgrade philosophies. Next, it positions ES upgrade as an assimilation process and explores research trends, to identify and classify the drivers' that influence the organisation to upgrade. Next, it draws from ES upgrade decision-making literature to provide a detailed landscape and justify the importance for conducting this research. Lastly, it argues for the need to use decision-making theories and proposes a process view of decision-making as a lens for analysing the upgrade decision processes.

3.1 Upgrade Overview

Prior to exploring upgrade literature, it is important to recap on this study scope. As proposed in section 1.1, upgrade implies implementing a newer version to replace the existing version by extending its capabilities through enabling other processes and features, which were not included in the original implementation. Acknowledging that upgrade could involve replacing the existing ES with a different system from either the same vendor or different vendor altogether. However, in context of this research, upgrade is limited to implementing a newer version of the same system from the same vendor, which offers new functionality to address organisations expansion and improvement needs.

Upgrade is an important aspect in the systems lifespan, as it enables organisations to take advantage of newer technology features and processes to support continuous growth. In addition, Nicolaou & Bhattacharya (2006) point out that upgrade considerably influences the organisation's performance and competiveness. However, there is a significant difference between the initial implementation and upgrade, as the initial implementation will only happen once, upgrades are recurring throughout the system's lifespan (Zhao, 2007). Secondly, the efforts are significantly different, as an upgrade involves extending existing systems, which have been operational for some time. Despite these differences, Beatty & Williams (2006) advise to treat upgrades as new implementation projects; since, in addition to justifying the business needs, ES upgrade is a complex phenomenon, which requires to be undertaken at an appropriate time that guarantees minimal disruption to the system. Thus, implying the same level of preparation and planning as in the initial implementation is required when upgrading, otherwise there is high risk of not achieving the desired outcome. The upgrade timing plays a critical role, as there are numerous internal and external factors (for example business needs, vendor support) that affect the upgrade timing (Claybaugh, 2010). On that basis, there is a necessity for organisations to adopt efficient strategies to effectively plan and manage upgrade projects.

Although major ES vendors offer strategies, methodologies and best practices to manage and support upgrades, the focus of these strategies and methodologies are vendor specific. Hence, not supporting all the organisation needs, as most organisations would have multiple systems from various vendors. This necessitates organisations to employ their own informal strategies and methodologies, along with relying on informal philosophies when contemplating upgrading their ES to the latest version. According to Seibel *et al.* (2006) most of these strategies are undocumented but regarded as common philosophy among management circles, these include either:

- Upgrade to the latest version whenever the vendor releases a new version, or

- Adopt every alternate version between the releases, implying the organisation skips one version between the new versions, or
- Only upgrade when there is a need, such as influences from internal and external factors.

Ng (2006) explains that there is a tendency for upgrading whenever there is a new version in order to avoid losing support or paying a high premium for support. Generally, this results in changes only to the technical aspects of the system, without affecting any functionality or business processes. Normally when organisations consider upgrading in order to support business requirements, it is referred to as persuasive upgrade. Many organisations follow persuasive upgrade philosophy, because of the different internal and external drivers, which motivates undertaking upgrades (Khoo & Robey, 2007; Otieno, 2010; Dempsey *et al.*, 2013). Depending on the philosophy followed and the motivation, the upgrade can be regarded to as either a technical or a functional upgrade. Therefore, it is important to understand what drives organisations to upgrade their systems and how these will affect the strategy adopted.

3.1.1 ES Upgrades as an Assimilation Process

Drawing from Information Systems (IS) innovation taxonomy by Swanson (1994), which suggests that an assimilation process results from three scenarios. These are, firstly to enhance efficiency of the IS tasks, secondly to improve administrative functions and lastly to enrich the features embedded in the core systems. In comparison to ES upgrades, Khoo & Robey (2007) propose that upgrade introduces changes to the existing business processes and implementation of new functionalities. In addition, upgrading expands core system capabilities by taking advantage of new technology features (Vaucouleur, 2009). Lastly upgrading ensures that the system is stable and operates efficiently, and can be expanded according to the organisation's needs (Nah *et al.*, 2001; Motiwalla & Thompson, 2009;

Hecht *et al.*, 2011). As such, upgrading results in productivity and performance improvement, minimisation of maintenance efforts, and competitiveness, hence, it can be argued that ES upgrades can be considered as an assimilation process. Similarly, Claybaugh (2010) positions ES upgrade as an technological assimilation, in order to study the upgrade of ERP systems. Claybaugh (2010) argues that considering upgrade as assimilation of technology allows comprehending the factors affecting the decisions as organisations' are at different stages of the assimilation processes.

The body of literature on adoption of ES encompasses several theories such as technology acceptance model (TAM) (Davis, 1989); Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh *et al.*, 2003); Diffusion of Innovation (DOI) (Rogers, 2003); and T-O-E framework (Tornatzky & Fleischer, 1990). However, both TAM and UTAUT are concerned with the usefulness and ease of use of an adopted technology. Thus, these theories are more suitable when assessing the usefulness of technology adoption, and not during the assimilation process. On the other hand, T-O-E framework and DOI are appropriate theories for studying the decisions during the assimilation process. T-O-E framework suggests that the assimilation decision is influenced by external and internal factors, including the characteristics of the technology. As a result, these drivers are classified in three contexts: technology, organisational and environmental. Technology context represents existing new technologies relevant to the organisation. Organisational context describes the internal measures such as scope, size, managerial structure, and availability of resources. Environmental context refers to the field in which the organisation operates, this includes elements such as government legislation and vendors' support (Tornatzky & Fleischer, 1990). However, Rogers (2003) DOI theory, posits technological characteristics, organisation's internal characteristics and external characteristics as drivers for any adoption or assimilation decision. The external characteristics refer to the environmental context, the internal organisation characteristics, which include leader characteristics, are identical to the organisational context, and technological characteristics resemble the technology context. Thus, according to Zhu *et al.* (2006) and Wang *et al.* (2010) the T-O-E framework demonstrates similar characteristics with those of DOI theory. The literature demonstrates that T-O-E framework has an established theoretical base and consistent empirical support for studying ES upgrades specifically on assimilation and adoption of an innovation (Oliveira & Martins, 2011). For example, there is an extensive use of T-O-E framework in the literature, with various studies focusing on ES adoption (for example Raymond & Uwizeyemungu, 2007; Chong & Ooi, 2008; Pan & Jang, 2008; Claybaugh, 2010; Hongjun & Xu, 2010; Shahawai & Idrus, 2010; Safavi *et al.*, 2014). Against this backdrop, this research adopts T-O-E framework (Figure 3-1), as an investigative lens for analysing and studying the drivers that influence ES upgrade decisions.

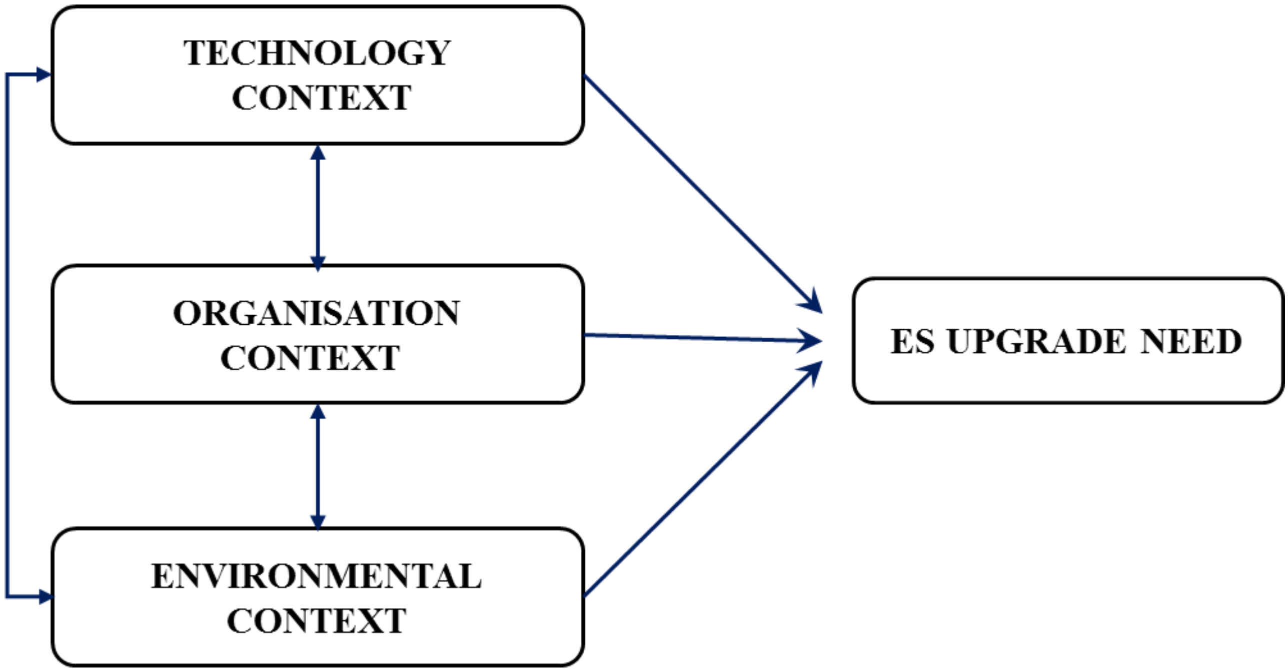

Figure 3-1: T-O-E view of ES upgrade

3.1.2 The Need to Upgrade

There are several reasons that influence organisations to upgrade their systems; this section outlines the different studies that have focused on exploring these various drivers. As one of the early contributors to ES upgrade, Kremers & van Dissel (2000) examine upgrade issues from both vendor and customer perspectives and propose four categorises for each group. Their findings demonstrate that upgrading also benefits vendors, such as ensuring customer lock-in, solidifying the customer base, and allowing vendors to support only fewer versions. Several other studies have expanded and provided different explanations from the organisations perspective these studies are explained below.

Farbey *et al.* (1993) propose an eight-step model that effectively communicate the changes applied during projects to the different stakeholders involved. This model can be interpreted in a number of ways, and one of the many interpretations explains the need for upgrading. The upgrade interpretation explains how the different attributes, benefits, risks, and uncertainty associated with the changes, can influence upgrade decisions. Most of the steps outlined in the model (Figure 3-2) proposed by Farbey *et al.* (1993), have a direct or an indirect association to ES upgrade; however mandatory changes, automation, and 'direct value add' exhibit a close affiliation to the issue of why organisations upgrade.

- Mandatory changes are considered unavoidable and performed to fulfil certain external requirements, which can result in undesirable effects when not implemented. For example, the withdrawal of vendor support would imply increase in maintenance costs; thus, it is easier to quantify benefits and costs.
- Automation refers to the need of adjusting business process using some of the built in functionality or implement add-ons to support existing methods, improve performance and reduce operational costs.

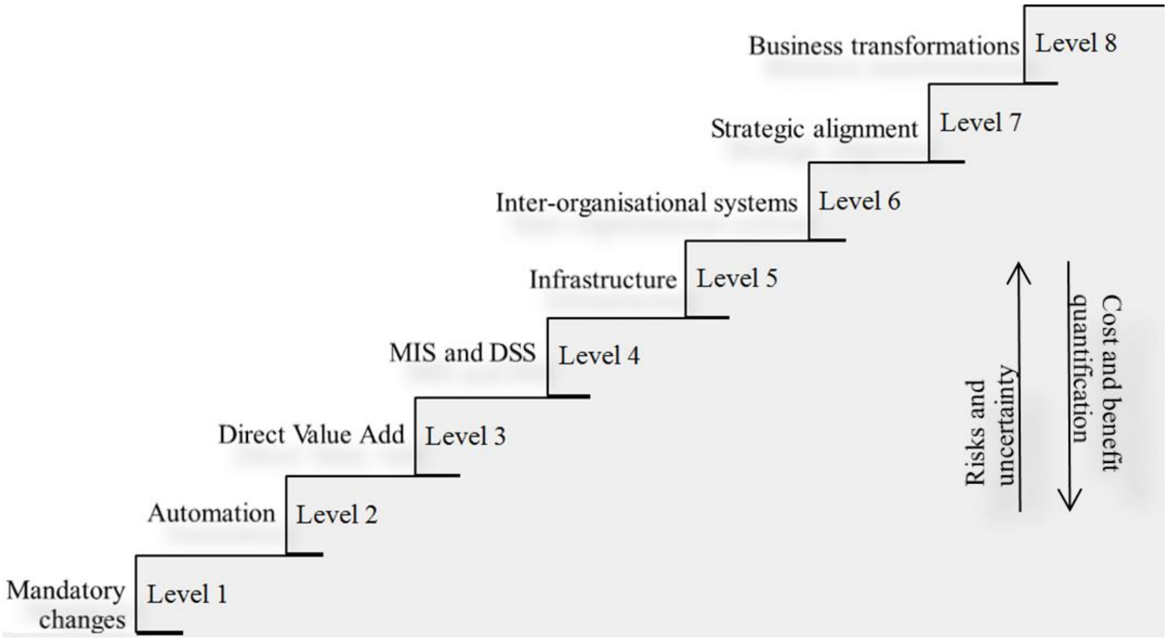

Figure 3-2: Eight step project model (adapted from Farbey *et al.*, 1993)

- 'Direct value add' examines the benefits that the changes can introduce, and is concerned with providing a new dimension of operating, generally achieved by adopting new features or extending existing system capabilities.

Kremers & van Dissel (2000) classify the upgrade reasons as functional, technical, organisational and environmental. Functional category includes all the reasons that driver organisations to upgrade their systems to fulfil their operations; for example, one of the frequently mentioned reasons is need for new functionality to support their business needs. The technical category encompasses maintenance and support from vendor, as well as compliance to new standards, and performance improvement. The organisation category entails factors, which are internal such as expansion, and integrating different data and information sources. The environmental category defines all the reasons that are external to the organisation such as improving collaboration with the value chain or remaining competitive.

Based on the findings from two case studies Khoo & Robey (2007) propose two forces that either motivate or inhibit upgrade decisions, as means to categorise the upgrade drivers. The motivating forces are factors that positively influence the organisation to upgrade their ES; these are new functionality, vendor support, and collaboration. The inhibiting factors cause the organisation not to consider upgrading their systems; this includes costs and risks associated with upgrades. In another study, Otieno (2010) collects and analyses data from three case organisations to address why organisations opt to upgrade their systems, however, Otieno classifies these factors in a similar manner to Khoo & Robey (2007). Similarly the research by Dempsey *et al.* (2013) identify factors that influence organisations to upgrade through a single case organisation and group these factors as motivating and inhibiting factors. Whereas, Claybaugh (2010) focuses on understanding how the different upgrade drivers influence the decision to upgrade. Claybaugh identifies drivers from existing IS literature and classifies them into three contexts, that is technological, organisational, and environmental. Based on responses from 190 experts, Claybaugh analyses the influence of these factors on the decision to upgrade.

Table 3-1 represents a summary of the drivers identified from ES upgrade literature, covering articles published in academic journals and conferences in the last 10 years. As these studies have extended factors offered in earlier studies, hence the drivers explained are more up-to-date and reflect on upgrade projects undertaken within this decade. All of these studies provided useful explanations on the numerous reasons that influence upgrade decisions.

Table 3-1: Factors influencing upgrade decisions

Reasons for upgrading	Articles						
	Seibel *et al.* (2006)	Khoo & Robey (2007)	Vaidyanathan & Sabbaghi (2007)	Roberts (2009)	Claybaugh (2010)	Otieno (2010)	Dempsey *et al.* (2013)
Continuous vendor support	✓	✓	✓	✓	✓	✓	✓
Technology advancements	✓	✓	✓		✓	✓	✓
Technology obsoleteness	✓			✓			
Maintenance cost		✓	✓		✓	✓	✓
Improve usability		✓	✓	✓		✓	✓
Standardise functionality	✓	✓			✓	✓	✓
Improve decisions capabilities	✓			✓			
Benefits realisation	✓	✓	✓		✓		✓
Improve external collaboration			✓	✓			
Gain competitive advantage							✓
Processes consolidation	✓	✓	✓		✓	✓	✓
Legislation compliance	✓	✓		✓	✓	✓	✓
Integration of systems	✓	✓	✓	✓	✓	✓	
Adapt new functionality	✓	✓		✓	✓	✓	✓
Management of modification	✓	✓		✓	✓	✓	✓
Automation		✓			✓	✓	
Improve ways of operating	✓		✓	✓		✓	
Attain better scalability			✓		✓	✓	✓
Restructure business processes		✓	✓		✓		✓
Increase performance	✓		✓			✓	✓

Despite the different approaches used to categorise these drivers, most of the reasons display similarity and common themes across these studies can be identified. However, most of the studies are centred on ERP systems with the exception of (Khoo, 2006) and (Vaidyanathan & Sabbaghi, 2007). Thus, it is not clear whether similar drivers would influence ES upgrade. Nevertheless, ERP systems are an integral part of ES; therefore, these drivers provide a starting point when probing respondents on what motivates organisations to upgrade their ES.

3.1.2.1 Environmental Factors

These external factors define conditions that give the organisation little choice but to upgrade their systems. Mostly these factors would be initiated by different external stakeholders, such as vendors, partners, consultants, and legal entities (Khoo, 2006). For example, the frequent versions release cycles introduced by vendors creates a dilemma of when it is appropriate to upgrade. Since on one hand, vendors provide organisations with the flexibility of not upgrading frequently, as they support multiple versions (Khoo & Robey, 2007). On the other hand, vendors use high license fees and support pricing schemes for older versions as a technique to encourage organisations to upgrade their systems (Sawyer, 2000; Ng, 2001). Thus, it is important to contemplate the benefit of frequently upgrading against upgrading only when it is necessary for the organisation. However, when vendors ultimately remove support for the older versions, as a means to reduce their operating costs, organisations are forced to upgrade (Kremers & van Dissel, 2000). This is mostly applicable to organisations that are depending on vendors for support, and have to upgrade to keep within the vendor release cycles in order to ensure continuous support.

The above explanation highlights the role of a single environmental stakeholder and demonstrates the critical role of such factors have on upgrade decisions. Yet, the literature portrays a mixed reaction on the significance of environmental factors in influencing upgrade decisions. For example, Otieno (2010) suggests that business needs which include the requirement for new functionality and automating processes have more priority when compared to environmental factors. Whereas Claybaugh (2010) has demonstrated that there is a mutual degree of influence from organisational and environmental factors on upgrade decisions. Thus, it is important to establish whether environmental factors have any influence on upgrade decisions and determine the extent of that influence on organisations' decisions to upgrade their systems.

3.1.2.2 Organisational Factors

These generally originate from the need to achieve the strategic direction of the organisation, such as access to important information, which support making decisions and improve productivity (Beheshti & Beheshti, 2010). Important information in this context represents accurate, timely, and relevant information that enables making decisions with ease. Another aspect is to leverage ES in order to gain competitive advantage by improving productivity and increasing financial performance through aligning business strategies with functionality (Ng *et al.*, 2003a; Nicolaou & Bhattacharya, 2006). Alignment of the system can be achieved through expanding the existing systems capabilities through either modifying the system or implementing new features. According to Otieno (2010) the addition of new features to facilitate aligning of the system's functionality to organisation strategies could be accomplished by upgrading to a newer version. Thus, considering and planning for alignment may result in the organisation upgrading their system to take advantage of the new version features, in order to achieve existing and future goals.

Normally, these organisational needs result in business transformations, which ensure the organisation adapts to the changing economic and market conditions. Worrell (2008) suggest that in order to support the transformations, the organisation requires eliminating redundant processes and re-engineering some of the processes or implementation of new business processes. Some of these new processes are available in the new versions, hence supporting the need to upgrade in order to be competitive. However, Farbey *et al.* (1993) rightly suggests that information technology (IT) and ES are only part of the answer when an organisation attempts to compete successfully. Nevertheless, these systems have matured over the years, necessitating organisations to upgrade their systems in order to take advantage of new technologies and capabilities to support their systems and business processes.

3.1.2.3 Technological Factors

Technological reasons are concerned with how technology advancements benefit the organisation; however, what one organisation perceives as a benefit is not always reciprocated in another organisation (Claybaugh, 2010). Additionally, Markus & Tanis (2000) suggest that it is possible for two organisations to achieve the same benefit (for example improved productivity and reduced operational costs) but gain different value from the benefit. Therefore, the benefits and added value for upgrading is achieved by comparing the new version against the existing version to gauge the usefulness and contribution of both versions (Ng, 2011). The new version value, materialises from its contribution of new functionality, improved business process and technologies (Dempsey *et al.*, 2013). Thus, the manner in which an organisation perceives the value add from the system, defines the philosophy, which the organisation will follow when upgrading. For example, an organisation that believes the new version would provide better capabilities, and result in benefits, would opt to upgrade as soon as a new version is available. Consequently, such an organisation would be utilising a different version from other organisations, thus gaining competitive advantage. However, attaining these benefits is dependent on matching the new version functionality to the organisation’s requirements. From the above explanation, there have been suggestions that it is essential to understand the new version functionality and benefits of the new version as organisations are more likely to upgrade when the benefits are known (Claybaugh, 2010). Though, the assumption in this case is mapping of functionality occurs when the organisation is making the upgrade decisions, yet Ng & Gable (2009) suggest that such an activity would be conducted after the decision to upgrade is reached. Such diverse explanation presents contradicting evidence on the influence of new version benefits on the decision to upgrade. Thus, establishing when the evaluation of functionality occurs, it could also highlight the role of the perceived benefits play on upgrade decisions.

Additionally, Davenport *et al.* (2004) suggest that integration of different ES instances is an on-going process due to mergers and acquisitions, this frequent changes in business structures and processes, dictates the need to implement technologies that support integration with other systems (Olson & Zhao, 2007). Generally, these new technologies are made available with the latest versions, however due to improvements in the new version there may be a necessity to upgrade the infrastructure that supports these systems, to avoid performance bottlenecks and incompatibility issues (Farbey *et al.*, 1993). According to Whang *et al.* (2003, p.1035) it is common for changes to the operating system and database system to occur 'due to the higher version requirements', citing a case of an organisation that increased their memory capacity for the database and application servers to support the new version. This implies that it is important to consider hardware changes and their impact when upgrading. Another issue to consider when upgrading is the compatibility of these changes on the existing version's functionality or prior modifications implemented to the system. Claybaugh (2010) suggests that there are fewer problems encountered during upgrades as compared to initial implementation. Yet, Beatty & Williams (2006) posit that handling complexity introduced by compatibility issues during upgrade is the main challenge, which consumes most of the time and effort allocated for testing. On the other hand, overcoming complexity is regarded as one of the reasons organisations opt to upgrade their systems, particularly when there are inter-organisation systems. Consider the following situation, in order to improve supply chain management, an organisation integrates their ES with their supplier systems (Ng, 2001). Hence, when the supplier upgrades their system, it may be necessary to upgrade the connected systems, in order to remove any reliability issues that can hinder smooth operations. Hence, understanding the new version's impact on the existing system could facilitate identifying the changes required and the challenges that may arise by introducing these changes. Thus, the consideration of strategies to address these challenges could influence the decision to upgrade, depending on the level of effort and financial investment.

3.1.3 Upgrade Decision Models

Another key area in ES post-implementation is on upgrade decision-making, which reflects on how these different drivers influence upgrade decisions. As one of the earlier researchers in the field of ES maintenance and upgrade, Ng (2001) explores the upgrade decision process through a single descriptive case study, and analyses maintenance data collected from a single case organisation to examine the maintenance and upgrade practices. As a result, Ng (2001) proposes a decision framework that takes into account the decision alternatives and trade-offs, aiming to aid maintenance and upgrade decision makers. The proposed framework propositions guidelines for managers to justify costs and benefits of decision alternatives, as well as a reference for reducing maintenance costs, improving maintenance activities and lastly control upgrade frequencies (Ng, 2001). Although this framework proposed by Ng (2001) offers useful analysis on maintenance and upgrade decisions, it positions upgrades as a part of maintenance process; and by combining both domains, makes it difficult to understand the processes involved in upgrade decisions only.

On the other hand Seibel *et al.* (2006) explores upgrade decision for commercially available applications and proposes a statistical upgrade decision support model with an expectation efficacy of 76.6%. Their model takes into account 4 decision attributes, these are business goals, license cost, current product retirement status and external factors; the interaction of these four attributes would result in either a decision to upgrade or possibly to upgrade or not to upgrade. Although, this model proposed by Seibel *et al.* (2006) offers a significant contribution in terms of statistically predicting the upgrade decision outcome, it does not highlight the processes that the decision-makers follow to reach the upgrade decision.

A study by Khoo (2006) explores what motivates organisation to upgrade their system and adopts a case study approach to compare upgrades of two widely used systems (ERP systems and Microsoft windows). As a result, Khoo (2006) proposes a theoretical decision model that reflects how these factors interact with each other to guide the decision, and account for the risks and mitigation strategies. The proposed model, does suggest that the decision to upgrade is a result from the interaction between the motivating and mitigating forces, however it falls short in explaining the different processes involved during upgrade decision-making. In addition, by considering these different internal and external forces, the proposed model avoids outlining the rational criterias for upgrade decisions.

In another study, Vaidyanathan & Sabbaghi (2007) investigates SCM software upgrade and integration issues, and identify eight major factors. Based on these factors a customer decision framework is proposed. Each of the factors reflects the issues that an organisation needs to address when making a decision. However, the combination of integration and upgrade makes it difficult to segregate which factors and their influences the upgrade decision-making process.

In one of the more latest ES upgrade studies Otieno (2010) proposes an upgrade decision model, which highlights the interactions of the different factors that either motivate or inhibit the decision to upgrade. This model provides insights as to why organisations upgrade their systems, thus providing practical strategies and recommendations to support practitioners during upgrade projects. However, this model bears similarities to the model proposed by

Khoo (2006) and therefore suggests that the decision to upgrade results from the interactions of the two forces (motivating and mitigating).

One of the most recent studies by Ng (2011) proposes a conceptual upgrade decision model, which draws from symbolic interactionism, institutional theory, and incentive theory to identify how the intrinsic and extrinsic factors influence the decision to upgrade. The use of incentive theory implies that the organisation that perceives gaining benefits would mostly likely upgrade their systems, while organisations that do not foresee any benefits would be reluctant to upgrade. Ng (2011) aims to explain empirically the cause-effects of the different factors on the decision to upgrade through the proposed model.

All of the above models have highlighted that the decision to upgrade is based on how the difference factors influence the decision makers (Figure 3-3), and explain why organisations reach the decision to upgrade. However, they fall short in explaining the different processes involved during the decision-making, hence do not offer clarity on how organisations reach the decision to upgrade.

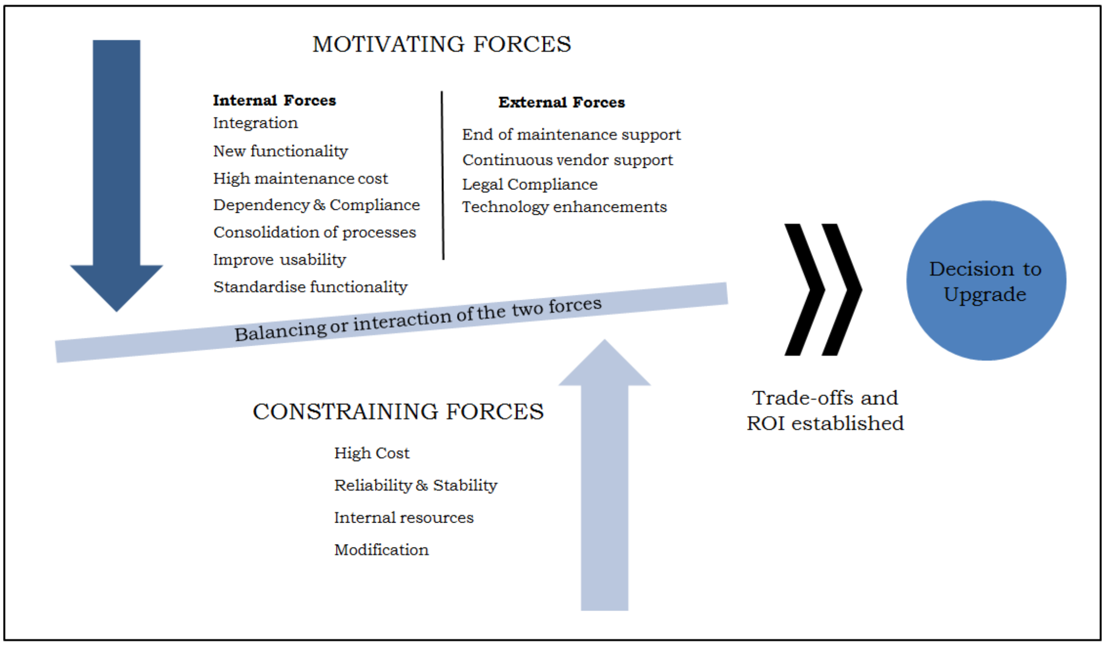

Figure 3-3: Representation of previous upgrade decision models

Khoo (2006) supports this argument and mentions that future studies could deliver enhanced explanation and extend the findings presented on upgrade decisions by adopting a process view of decision-making. Likewise, Otieno (2010) suggests that further extension of his proposed upgrade model can potentially capture the dynamic nature of upgrade decisions and proposes future research to undertake a process view of decision-making to get a comprehensive understanding of the decision processes.

Riis & Schubert (2012) explore the decision processes when upgrading to a new version, focusing on ‘independent software vendors’ and ‘value added resellers. Their findings suggest there is a ‘pull’ and ‘push’ mechanism between the different stakeholders, such that they propose a transition process for ES upgrades, from the software vendors and resellers perspective. Thus, from the independent software vendors, there are three processes, namely strategizing, upgrading, and selling. In this scenario, upgrading refers to making changes to the add-ons, based on the output from the strategizing process, and then the value added resellers will sell these add-ons. While from the value added resellers another three processes are proposed, that is strategizing, implementing, and increasing experience. Since the value added resellers are responsible for implementing the upgraded add-ons depending on their availability, thus the decision is based on their implementation experience. In both perspectives, strategizing refers to the process of understanding the new version and its benefits and shortcomings, when compared to the existing version.

The findings from Riis & Schubert (2012) offer insightful details on the upgrade decision process; however, their work concentrated on the role of the vendors and add-on resellers. In addition, Riis & Schubert (2012) highlight that organisation have a major role to play on upgrade decisions, as they can either push to remain with the existing version, or pull for the new version depending on their needs. Thus, exploring the decision processes from an organisation perspective could highlight additional processes, which could supplement and extend the proposed substantial theory. Hence, this research explores ES upgrade decision-making, specifically the decision processes from an organisational perspective, with the aim of examining the different processes involved during upgrade decision-making.

3.2 Organisational Decision-Making

This section draws from decision-making literature to explain the processes and models, which will allow identifying an approach that can be utilised to analyse and place the data collected from respondents into context. Decision-making has been explained in many different contexts, one of the contexts is that of organisational decision-making. Huber (1981) suggests that in organisational decision-making a unit (single person or a small team) undertake decisions on behalf of the organisation to fulfil the organisation needs and interests; yet he acknowledges that personal interest and goals can influence organisation decisions. Additionally, Simon (1979) defines organisational decision-making as set of processes undertaken to address the organisations' decision problem from start to completion. These processes include the identification of the need, formulating and evaluating alternatives, selection of the best alternative and finally implementation of the decision. Therefore, implying it is important to evaluate and consider all the alternatives against the organisations goals, values, and objectives. Thus, based on Simon's definition, it can be summarised that organisational decision-making is a process that facilitate selecting a reasoned choice from a set of alternatives in order to achieve a certain organisational requirement.

The literature suggests numerous decision-making models and loosely classifies these models into either normative, descriptive, or prescriptive theories, which is grounded on the approach used to observe and investigate the decision-making process (Bell *et al.*, 1988). Authors of each of these three theories attempt to answer a specific kind of question related to decision-making. Therefore, in normative theories, the main concern is with how the decision should be made. The models are based on exploring the interaction between empirical, abstract and mathematical representations to advocate acceptable choices, and are normally guided by theoretical soundness rather than the empirical validity (Bell *et al.*, 1988). While descriptive theories addresses how decisions are actually made and why such decisions are made. The models from this theory, symbolises the extent to which the decision processes are represented in relation to the perceived processes inferred from the empirical data, thus the model relies on empirical validity (Dillon, 1998). On the other hand, prescriptive decision-making is concerned with enabling people to make better decisions and incorporates the theoretical soundness of normative decision-making and observations of descriptive decision-making theory (Dillon, 1998). Given that, this research explores how organisations reach ES upgrade decisions, hence a descriptive decision theory is an ideal approach to contextualise ES upgrade respondents' views and experience on ES upgrade decision-making processes.

3.2.1 Descriptive Decision-Making Models

One of the essential characteristics of descriptive decision-making is that alternatives are initially unknown; hence, the decision maker has to search and develop alternatives that fulfil the requirements to solve the decision problem. Thus, there is a need to contemplate the feasibility and risks of each alternative in relation to the problem or opportunity (Simon, 1977). These processes of searching for information and formulating alternatives are categorised and represented as three phases in Simon's process model of decision-making, illustrated in Figure 3-4.

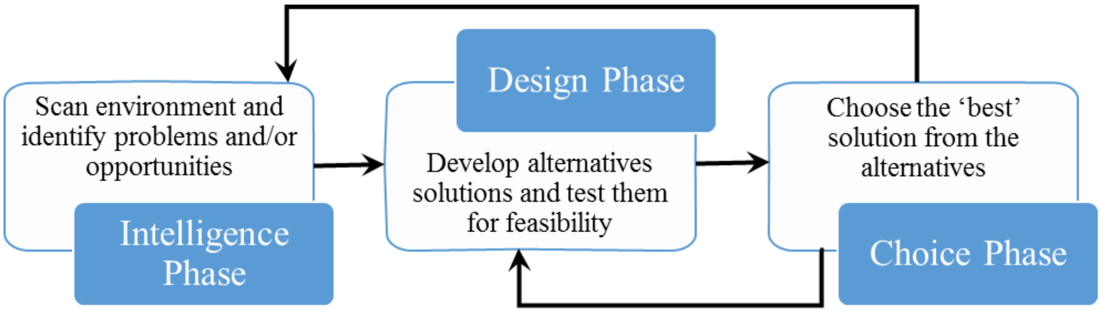

Figure 3-4: Decision-making process model (adapted from Simon, 1977)

The three phases namely intelligence, design, and choice appear to be sequential allowing continuous flow from one phase to another. However, in an actual decision-making environment, the progression is complex since new problems may arise in any phase, which may require gathering additional information, as a result each phase within itself can contain the three phases (Simon, 1977). Therefore, the process model is ideally a complex recursive set, which are dependent on the decision requirements.

The intelligence phase predominantly identifies if there are any concerns to address, principally in relation to organisations objectives. The process involves scanning the environment to identify any challenges and (or) opportunities that can support the organisation's requirements and goals. Next, the scale of problem or opportunity is determined and described, in order to outline if it calls for a decision. Therefore, the intelligence phase is about recognising the need for a decision, and once the need is established, the design phase commences. The design phase includes investigating and understanding the problem or opportunity presented, so that alternatives can be formulated. In addition, the alternatives are analysed to determine their feasibility in respect to the defined need. Once the alternatives are tested and evaluated, the choice phase begins, this is where the actual decision in which a 'best' alterative is selected. 'Best' is regarded as the most probable alternative that fulfils the course of action that satisfactorily addresses the decision problem.

Simon (1977) associates this approach with bounded rationality, in which it is theorised that decision makers are restricted due to incomplete and inaccurate knowledge of the consequences of actions, cognitive capacity, and time to reach the decision. The principal characteristics of bounded rationality are embedded in the process of searching for alternatives and 'satisficing' decision (Barros, 2010). Satisficing theory was introduced in 1957 by Herbert A. Simon, and was based on the premise that in most situations decision makers have limits which they cannot exceed (Dillon, 1998). Therefore, decision makers select an alternative, which fulfils most of the requirements without fully examining all possible alternatives. Thus, satisficing theory is mostly concerned with exceeding the minimum requirements, instead of maximising value of the given choice. Possibly satisficing concept is one of the oldest descriptive decision-making theories and is mostly linked to bounded rationality.

The Garbage Can Model of organisational choice proposed by Cohen *et al.* (1972) is another descriptive decision-making model; in which organisations or decision situations are treated as organised anarchies that are 'characterised by problematic preferences, unclear technology, and fluid participation' (Cohen *et al.*, 1972, p.1). The model is characterised by learning from mistakes; in addition, it suggests that the decision processes are not planned and are normally messy in nature. Thus, implying that in any decision situation, organisations have loosely defined ideas instead of a set of preferences (Cohen *et al.*, 1972; Boer, 1998). According to Cohen *et al.* (1972) the decision-making processes in organisations can be symbolised as a garbage can, which would be filled with problems or opportunities that call for decisions, along with all alternatives, and possible choices. Hence, the outcome of the harmonisation between the problems, suitable solutions, participants, and choices leads to the decision. The difference of Garbage Can Model from other descriptive decision-making models lies on the concept of harmonisation, which indicates for each problem pursued, numerous choices are available. Whereas, other descriptive models suggest that for each decision situation it is important to determine the most applicable solution.

Klein's (1989) Recognition Primed Decision (RPD) model is one of the latest contributions to descriptive models. The model adopts the fundamentals of naturalistic decision-making, which is grounded in exploring and understanding decision-making in its natural environment (either within an organisational or real-life context). RPD model demonstrates how previous experience plays a critical role in facilitating rapid identification of goals, provides appropriate outcomes, and suggests consequences for that given decision situation. These previous experiences are described as patterns, which assist in making rapid decisions (Klein, 1989). However, if a situation cannot be associated to a pattern, then it will require more time to gather relevant information and fully analyse the situation. Based on these patterns the decision maker can promptly associate the decision situation to a relevant pattern, and mentally simulate the course of action that is likely to succeed (Turpin & Marais, 2004). The idea of pattern matching supports intuitiveness, while mental simulations reinforce the reasoned perception (Klein, 1989). This concept builds on the idea of selecting the best option, therefore having similarities to Simon's (1977) concept of satisficing decisions based on this particular aspect. Hence, the RPD model balances awareness and investigation, which simplifies assessing the decision situation and identifying a reasonable outcome, without generating numerous alternatives.

Understandably, there are many more other descriptive models, which concentrate on specific characteristics of organisation decision-making. The key aspect that should be noted is that these models are abstractions that represent and simplify complex decision-making processes. Although Boer (1998) describes the above models as a descriptive process view of decision-making, he acknowledges that decision-making in organisations is disjointed, for example analysis and evaluation are not undertaken sequentially. Nevertheless, these models share a similar ideology that decision-making in organisations cannot be fully rational, possibly because of the decision makers reasoning capacity or environment limitation. Simon (1977) outlines a number of other organisation settings that can influence decisions, such as decision objectives, definition, and criteria. This does not imply that all organisation decisions are irrational; rather it suggests the necessity to refine and extend the scope of rationality so it effectively represents the reality of decision-making in organisations. In other words, it is important to embrace an extensive concept of rationality, which will provide more focus on the process of reaching a decision, instead of the decision output.

3.3 Synthesising Upgrade Decision-Making

Reflecting on ES upgrades, a process view of decision-making offers an effective lens to analyse respondents' views on how the decision was reached and categorise the processes involved. The reason for adopting this particular analytical lens originated from the idea that ES upgrade is a complex process, which requires huge investments (monetary, resources, and time). Additionally, it requires selecting the best alternative that addresses the organisation's needs, which is dependent on gathering information about the new version, detailed planning, serious consideration of the impact, and estimation of required efforts (Ng, 2001; Dor *et al.*, 2008; Ng & Gable, 2009). Although, Ng (2001) considers that such complex processes would be difficult to incorporate in decision models, Khoo (2006) and Otieno (2010) suggests that investigating upgrade decision-making processes, would provide a detailed understanding of the ES upgrade phenomenon. Therefore, this research derives the following conceptual upgrade decision support model (Figure 3-5), from the understanding of previous literature on ES upgrade.

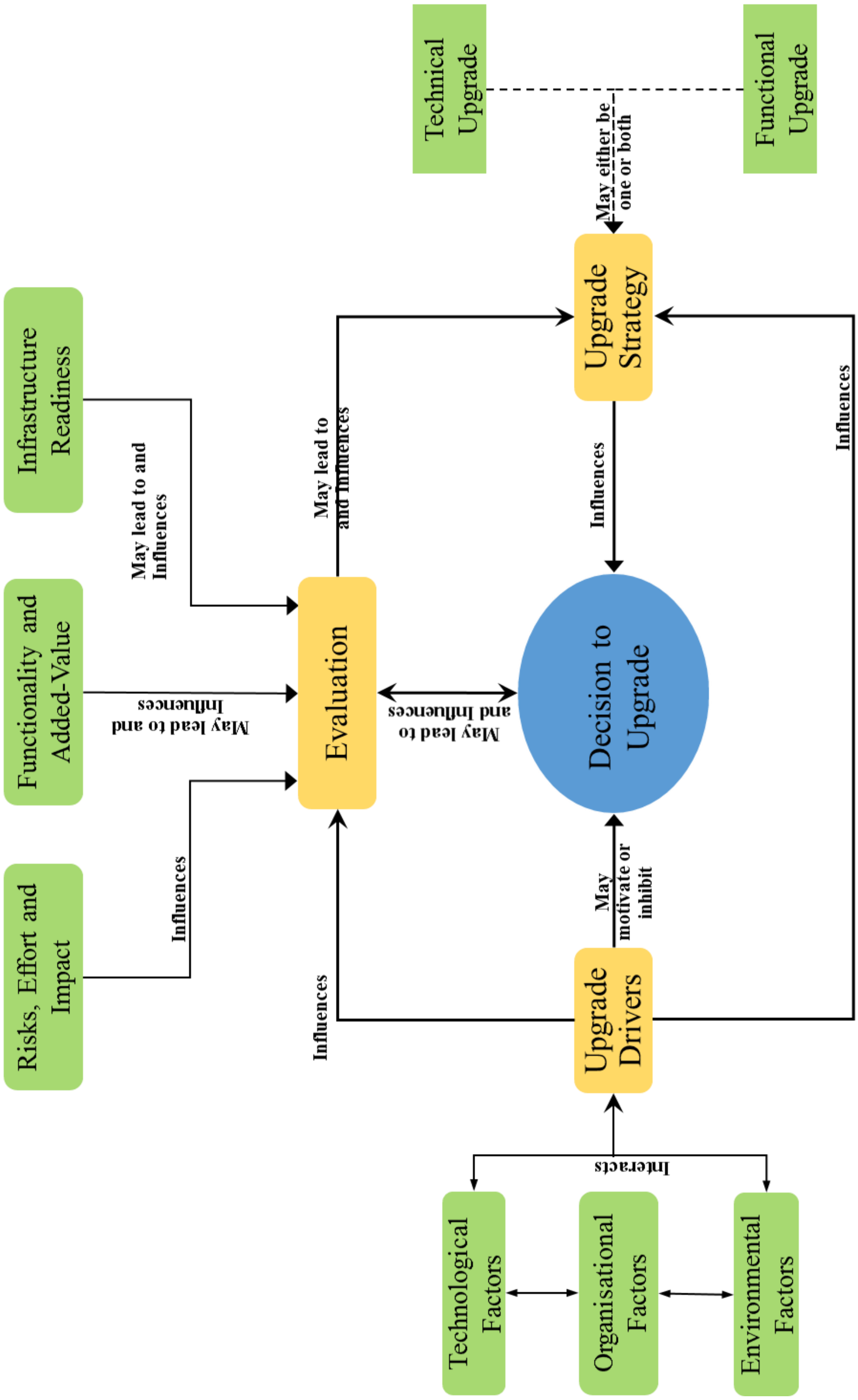

Figure 3-5: The conceptual ES upgrade decision support model

It is considered that in-depth planning and gathering information to support the decision situation can be associated with identifying the drivers that influence upgrade decisions. These drivers (discussed in section 3.1.2) outline the requirements, which would be utilised to evaluate the new version. The evaluation would also include the comparison of functionality between the new and existing version, in order to determine the feasibility for undertaking an upgrade.

In addition, Whang *et al.* (2003) assert that there is a high possibility for an upgrade to result in changes to the underlying infrastructure that support the system. Therefore, it is anticipated that upgrade decisions would take into consideration the required infrastructure changes, as these could increase the costs, duration, and effort required to complete the upgrade. In addition, previous literature suggests that it is important to assess the risks and impact associated with the upgrade, along with identifying the effort required to support the upgrade processes. However, several studies, for example Ng & Gable (2009) and Khoo (2006) suggest that such processes are undertaken after the decision to upgrade is reached. Nonetheless such activities are important in determining the upgrade strategy and resources involved to achieve the objectives, thus it is important to establish when such activities are undertaken during the upgrade decision-making and what influence the outcome of such processes have on the overall upgrade decisions.

Dempsey *et al.* (2013) suggest that organisations could either take a technical or functional or combine both upgrade strategies at a given time. Thus, it is anticipated that the upgrade drivers or outcome of the evaluation influences the selection of the upgrade strategy. However, there is very limited evidence from previous research to suggest how this association influences the selection of the upgrade strategy and the overall upgrade decisions. However, establishing the association between upgrade drivers, the output from the evaluation and the upgrade strategy selection would offer a detailed understanding of upgrade decision-making and the decision processes.

Thus, the conceptual model (Figure 3-5) provides a generic frame of thinking to assist with designing the data collection instruments and structures the analysis, in order to gain a detailed understanding of ES upgrade decision-making process. Hence, encouraged identifying the decision processes and the associated interconnections with their dependencies, in order to represent upgrade decision-making process adopted by organisations during ES upgrade.

3.4 Chapter Summary

This chapter presented research trends in ES post-implementation, specifically on upgrades and identifies the need to explore how upgrade drivers influence upgrade decisions. In order to address the influence of these factors effectively, the research positions ES upgrades as an assimilation process. This allowed the utilisation of the T-O-E framework to analyse the different factors influencing upgrade decisions and categorise them into technological, environmental, or organisational context. Secondly, this chapter addresses how the decision to upgrade is reached, based on how these different upgrade drivers influence upgrade decisions. In addition, it highlights the need for further research on identifying the processes involved in upgrade decision-making. As a result, a conceptual upgrade decision support model is propose to contextualise the decision processes. Additionally, this research draws from process view of decision-making concepts to analyse the respondents' views on upgrade decisions. The next chapter describes how the respondents' views and experience on ES upgrade was collected and analysed.

CHAPTER 4

RESEARCH METHODOLOGY

The chapter begins by positioning this research as a qualitative study and offers the reasoning for adopting such a stance. Secondly, it outlines the research design and justifies the choice of qualitative survey as the suitable approach to address the research aims. It also explains the strategies utilised for sampling respondents who have been involved in ES upgrades. Thirdly, it explains the data collection techniques adopted as a means to achieve the research objectives. Lastly, it describes the strategy and techniques applied to analyse the data gathered and evaluate the findings about ES upgrade decision-making processes.

4.1 Philosophical Perspectives

Generally, any research is guided by an underlying ontological and epistemological assumption which demonstrates the consistency between the philosophical underpinning and research strategy (Myers, 1997). According to Creswell (2009) the ontological assumptions are associated to the way reality is constructed, which theorises that the reality is a reflection of what is in the world or the product of human minds. The epistemological assumptions stems from the relationship between the 'knower' and 'known', for example, how the researcher understands the phenomena and presents the findings to others. Based on these two assumptions, Orlikowski & Baroudi (1991) outline three philosophical stance for enterprise Information Systems (IS) research, these are positivism, interpretative and critical.

The ontological assumptions of positivist studies posit that objective social reality can be measured independently from the researcher; while the epistemological assumptions is that the relationships between the cause and effect can be defined and tested using a scientific inquiry method (Khazanchi & Munkvold, 2000). According to Bryman (2012) positivist studies support empirical testing of existing theories, and according to Orlikowski & Baroudi it results in improvement of the "predictive understanding of phenomena" (Orlikowski & Baroudi, 1991, p.5). In addition, Orlikowski & Baroudi explain that a positivist study must have quantifiable propositions that can test hypotheses based on inferences drawn from a representative sample.

On the other hand, Myers (1997) explains that critical studies are grounded on the idea that reality is constructed historically and people create and recreate reality. Thus, through critically evaluating the reality, a researcher understands and transforms the reality of the phenomena under investigation, based on the researcher subjective perspectives (Orlikowski & Baroudi, 1991). This implies that the social conditions, the surrounding events and relationships of an element under investigation need to be studied in their entirety, in order to draw meaningful insights (Orlikowski & Baroudi, 1991). Whereas, interpretive studies embraces the idea of understanding the meaning that people assign to a phenomena under investigation. Normally the researcher provides an account of what they understood from the respondent's perception of the subject (Walsham, 2006). Thus, the subjective reality portrays that knowledge and thereof reality is created from the social constructs which cannot be studied in isolation from the people (Myers, 1997). From an IS perspective, according to Walsham (1993) these studies are concerned with producing "an understanding of the context of the information system, and the process whereby the information system influences and is influenced by the context" (Walsham, 1993, pp.4-5). Thus suggesting that both technology and its surrounding environment are important dimensions to consider when exploring IS related concepts such as ES upgrade. Walsham (2006) explains that the importance of interpretive research has significantly improved when compared to the early 1990s, and are now well accepted within the IS field. On that backdrop, this research adopts an interpretive stance because upgrade decisions are reliant on environmental, organisational, and technological variables as explained in section 3.1, and represented in the conceptual ES upgrade decision support model (Figure 3-5). Furthermore, adopting an interpretative stance provided an opportunity to conduct the investigations about the decision-making processes and drivers by probing different respondents' experiences and knowledge; thus allowing to account for their subjective reality about ES upgrades. The next sections outline the research approach and design that enabled the research questions to be addressed.

4.2 Qualitative Approach

According to Kaplan & Maxwell (2005) quantitative approaches are useful when the research focuses on studying static characteristics, in which the relationships among the variables can be evaluated through clear-cut measurements and structured data-collection instruments. However, Kaplan & Maxwell (2005) explain that if the research aims to study the 'dynamics of a process' such as decision making, then a qualitative approach is more appropriate, as it allows the participants to freely express their views and not be bound to fixed-response questions (which are generally associated to quantitative approaches).

This research investigates ES upgrades decision-making processes; hence, a qualitative approach was considered appropriate, due to several reasons. First, the goal of this research was to understand the processes during ES upgrade decision-making; a phenomenon that is very dependent on gathering information, views, expertise, and knowledge from respondents involved in the upgrade processes (Rogers, 2003; Kaplan & Maxwell, 2005; Silverman, 2005). As Mason (2002) explains that people who are regularly involved in the process possess the necessary knowledge and experience, for example the respondents involved in the upgrade process, hence it is necessary to speak to and gain their accounts. Hence, such knowledge and experience is difficult to measure and is subjective to the people involved in the process, thus it is important to derive meaning and relationships in order to formulate a better understanding of the processes (Denzin & Lincoln, 2011). Hence, a qualitative approach provides an opportunity to collect rich descriptive data from the respondents, in order to gather a detailed understanding of the processes.

Second, this research intends to provide a holistic account of the decision-making process across different organisations; hence, it required gathering an account from different organisations that are planning to upgrade or have upgraded their ES. Since each organisation could approach upgrades differently, thus the decision processes could be significantly different. In addition, the upgrade processes involve different stakeholders, who have different roles to address the technical, functional and management aspects of the upgrade. According to Skok & Legge (2002) when multiple stakeholders are involved there is a likelihood of obtaining diversified perceptions and interpretations by abstracting and formulating relationships based on the meanings the respondents attach to the subject under investigation, which yields detailed insights. Therefore, it was important to understand the upgrade decision processes by studying the different reasons and attitudes attached by these organisations and stakeholders. According to Snape & Spencer, qualitative research is "a unique tool for studying what lies behind, or underpins, a decision, attitude, behaviour or other phenomena" (Snape & Spencer, 2003, p.28). Therefore, employing a qualitative line of inquiry enables identifying the different drivers influencing upgrade decisions and the processes followed to reach the decision to upgrade. This resulted in generation of new ideas and norms such as the ES upgrade decision support model.

4.3 Research Design

This research design aimed to establish the connection between the research questions and the data and eventually with the conclusions. Hence, the research design was governed by methods required to answer the research problem unambiguously and provide the overall logical sequence of inquiry followed when conducting this research. From a qualitative study perspective a "research design should be a reflexive process operating through every stage of a project" (Hammersley & Atkinson, 1995, p.24). This research implements a qualitative survey design, which comprises of three main stages, that is data collection, qualitative analysis and model formation, and evaluation as outlined in Figure 4-1.

The data collection stage represented by the yellow boxes included self-administered web-based questionnaires and semi-structured interviews. The questionnaires' main purpose was to establish the attitudes and experiences of the respondents' involved in ES upgrade projects. The second intention was to establish the reasons that influence upgrade decisions identified from the literature were still valid across multiple organisations during the time of undertaking this research. The output from this stage helped to obtain a high-level view of the decision-making processes. The next step was conducting semi-structured interviews to supplement and obtain clarification on some of the diversified themes identified from the survey. The pool for the interview was drawn from the web-based questionnaires respondents' and LinkedIn (a social media site for professionals) as explained in section 4.3.2.2.

The second stage qualitative analysis and model formation illustrated by the orange boxes, was concerned with making sense of the data and using the interpretations from the findings to refine the model. This involved reading the data in its entirety and assigning codes, which allowed understanding the meaning attached to the data, identify common themes and theoretical constructs. The output from the analysis allowed the enhancement of the conceptual ES upgrade decision support model.

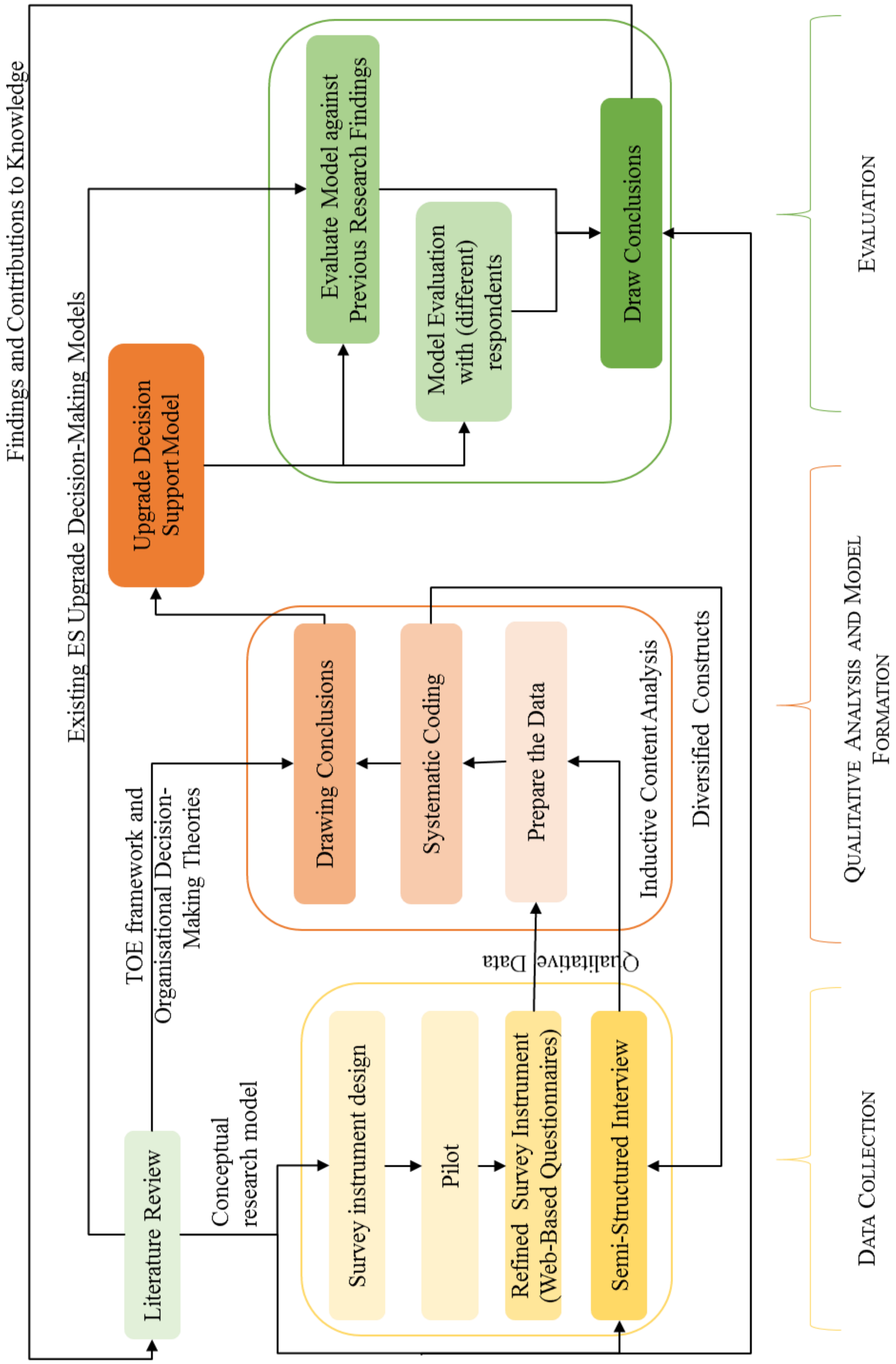

Figure 4-1: Research design

The third stage, EVALUATION was concerned with improving the rigor of the findings. Hence, the proposed model was presented to different respondents to gauge its acceptability, significance, and applicability. In addition, the model was compared and contrasted against other ES upgrade decision-making models, in order to relate this research's findings to the body of knowledge.

4.3.1 Qualitative Survey Strategy

The use of surveys has been widely accepted in IS research (Pinsonneault & Kraemer, 1993; Oates, 2006); however, it is normally associated with quantitative research (see Pinsonneault & Kraemer, 1993; Lewis, 2003; Creswell, 2009; Groves *et al.*, 2009). Contrary to this belief, Fink (2003) and Jansen (2010) argue that survey is a viable approach when conducting qualitative research and explain that the purpose is to study the diversity and depth within the research questions. In addition, Kaplan & Maxwell (2005) include survey questionnaire as one of the main data collection sources in qualitative survey, but explains that this is only sustainable when the survey instrument includes open-ended questions. Fink (2003) defines qualitative survey design logic as an approach for collecting information from respondents based on their knowledge or experience in order to describe, compare or explain the subject under investigation.

There are several reasons for adopting qualitative survey. First, to address the research questions, there was a need to attain realistic information from a sample of the population whose organisations were upgrading or planning to upgrade their ES. Thus, survey was one approach that enabled the researcher to engage and collect the same kind of data from a cross-sectional sample of the respondents (Oates, 2006). In addition, Denscombe (2010) explains if the research is after factual information and needs inclusive coverage than the use of surveys would yield the best outcome. Second, there was a necessity to correlate information obtained from previous studies with the respondents, in order to ascertain the upgrade drivers and decision processes. Hence, the use of qualitative survey facilitated the researcher to examine the current state of affairs and realise ES upgrades dimensions. In addition, it facilitated exploring the meanings that the respondents attach to ES upgrade (Fink, 2003). For the above reasons, qualitative survey was regarded as a valid approach to collect data from respondents to describe, compare, and explain the interconnected aspects of ES upgrade decision-making. As a result, the use of qualitative survey allowed narrowing down the focus of the emerging trends and identifying the areas requiring further exploration within the research scope.

4.3.1.1 Accounting for Rigor in the Design

Although the research design outlines the logical sequence of processes, one main concern of qualitative approach is on the rigor of the study. According to Guba & Lincoln (1994) rigor can be improved by ensuring dependability, credibility and transferability of the findings; which can be achieved by using triangulation and respondent validation (Silverman, 2005). There are many different types of triangulation approaches, for example Denzin & Lincoln (2011) distinguish the triangulations approach as within method and across methods. Whereby, within methods focuses on using multiple techniques for collecting data and across method concentrates on using two or more different research methods. Based on this example, this research embraces within method triangulation (data source triangulation), respondent validation, and comparison with previous research findings (Figure 4-2) as strategies to increase confidence in the findings.

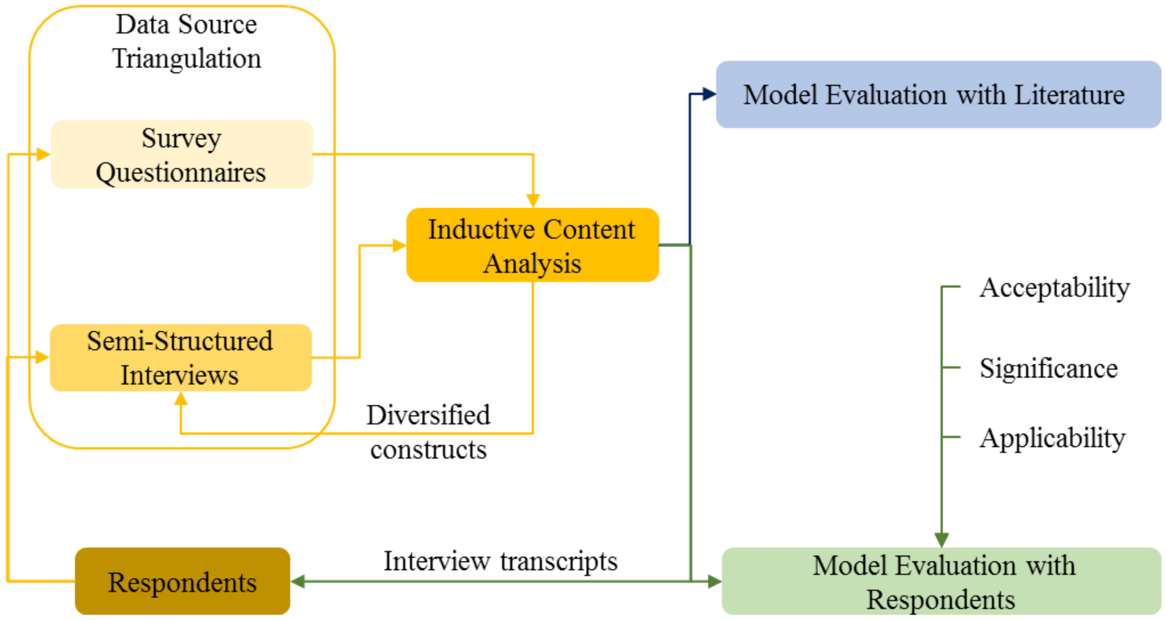

Figure 4-2: Strategies to improve findings' confidence

The within method triangulation is shown by the yellow boxes and arrows, and was achieved by using two data collection techniques; these are survey questionnaires and semi-structured interviews. This enabled crosschecking the data between these two data collection techniques, which allowed to saturate the theoretical constructs along with complementing the deficiencies and biases that may arise when using a single method (Creswell, 2009). The green box and lines represent respondent validation, which was applied in twofold:

- First, the summary of each interview was sent to the interviewees to validate its contents for accuracy and if necessary amendments were made to the interview summaries.
- Second, the proposed model was evaluated by presenting it to a different group of respondents with similar upgrade experience and knowledge, to assess the accuracy of the findings.

However, according to Hammersley (1992) cited in Lewis & Ritchie (2003) it is not possible to confirm with certainty the findings adequacy, though it can be judged based on acceptability, significance, and applicability of the findings. Thus, these three criterias were utilised to engage the respondents when evaluating the model in order to judge the integrity of the research evidence. In addition, the proposed model was compared and contrasted against previous research findings, which according to Silverman (2005) is regarded as a main criteria for assessing the findings in qualitative research.

4.3.2 Data Collection Techniques

There is no single approach for undertaking qualitative research (Myers, 1997); hence, this research makes use of two data collection techniques web-based questionnaires and semi-structured interviews. The next section offers the justification for selecting these two techniques.

4.3.2.1 Wed-Based Questionnaire

In order to capture the respondents understanding of ES upgrade process, the questionnaire logic was adopted from previous studies (Zhao, 2007; Claybaugh, 2010). However, suitable modifications were introduced to make it appropriate for this research. Table 4-1 illustrates the five major sections of the questionnaire. The instrument included both open-ended and close-ended questions (see appendix A). The closed-ended questions asked the respondents to indicate their level of agreement or disagreement based on a five point Likert scale and yes or no answer options. The open-ended questions supplemented the closed-ended questions, to encourage the participants to provide a descriptive account of their experiences of ES upgrades, which was an important aspect for this research.

Table 4-1: Questionnaire themes

Survey Questions	Description
Demographics	The questionnaire contained three questions aiming to elicit information about the organisation, the participant role, and their specialised experience. These set of questions allowed understanding of the study population background and ensuring that study targets only the intended participants. In addition, it allowed gathering experience of the respondents, as this was one of the factors that helped to include respondents into the interview pool (explained in section 4.3.3.1).
ES Upgrade experience	This section objective is to ascertain the respondents' involvement and experience in recent upgrade projects undertaken by their organisation. There were three questions presented, which collected information about the different enterprise systems used in the organisation and when they were upgraded. These questions would determine which questions the participant would be asked next depending on the answer provided, as some questions will be skipped to accommodate for different ES upgrade states.
Decision-making process	These questions provided an opportunity to identify the different processes followed when making the decision to upgrade. In addition, it outlines the reasons for selecting a specific upgrade strategy. Lastly, it assessed how upgrade drivers identified from the literature would influence the decision to upgrade the different systems. In addition, it facilitated identifying any other reasons for upgrading and gauging their influence and relationship on the upgrade strategy selection.
New Version evaluation	The intention of this category was to identify the importance of understanding the functionality of the new version and highlight how to obtain the functionality details. In addition, it aimed to identify the importance in measuring the impact of the new version on the existing version and techniques used to measure the impact.
Decision-making tool	These questions intended to elicit the usefulness and importance of decision-making tools to support the upgrade decision makers. In addition, obtain the processes incorporated into the decision-making tool, if they would be regarded useful. When respondents consider such tools of no importance, then, they had to provide an explanation of why such tools were not useful. Overall, this section aimed to identify the different functionalities that should be included in a decision support tool. However, it also facilitated identifying decision processes, which the respondents considered useful in supporting ES upgrade decision-making process.

In order to improve the quality of the survey results, several response scenario were undertaken to test the questionnaire logic, to determine if the questions were appropriate and establish the time it takes to complete it. This was then followed by a pilot study, which involved five respondents who were recently involved with ES upgrade projects. The questionnaire was appropriately modified and revised, based on the results and feedback received from the pilot study.

This research opted to use online medium to disseminate the survey instrument. According to Denscombe (2010) the use of web-based questionnaire as a data collection instrument has several advantages. First, the structuring tools and logic validation techniques within web-based facilities make it reasonably easy to design and administer. This ensures the collection of precise and valid responses, consequently improving the integrity of the data collected. Second, the cost of administering is relatively less as compared to other methods, such as postal questionnaires. Third, it can cater for large sample size and one of its main features is that data is captured electronically. From the researcher's standpoint, this eliminates the need to re-enter the data and thereby reduces the likelihood of transcription errors. Fourth, it supports a quick turn-around between the delivering and receiving of responses, resulting in prompt data analysis. Web-based questionnaires are self-administered, allowing the participants liberty to complete the survey at their own convenient time.

The design and hosting of the web-based questionnaires was achieved with an open-source third party website named Lime Service (www.limeservice.com). The reason for selecting an external service for hosting the questionnaires was to cater for technical errors such as incompatible issues that may arise with respondent web browsers and avoid website crashes, as well as to provide the ability to handle the web traffic when the need arises. The web-based questionnaire included an indicator to show progress and number of pages on each screen.

4.3.2.2 Semi-Structured Interviews

A survey questionnaire does not provide conclusive answers to all questions in a complex problem, as the investigator cannot probe in detail some of the phenomena (Bryman, 2012). Therefore, it was important to identify an alternative approach that can supplement and correlate the web-based questionnaire theoretical constructs. Thus, this research utilised semi-structured interviews to inquire for extra information depending on emerging ideas and views (Denscombe, 2010). The uses of semi-structured interviews allowed exploring complex issues and gather respondents' opinions and experiences, in order to gain rich detailed insights on ES upgrade decision-making. In addition, semi-structured interviews offer the flexibility to pursue a specific line of inquiry to gain valuable insights based on the respondents' knowledge and depth of the information shared. This also allowed identifying aspects that the respondents regard as important when making upgrade decisions, as interviews offer a platform to share views and experience at length and freely. Thus, semi-structured interviews were an ideal technique to explore the upgrade processes.

The interview guide (Table 4-2) was prepared based on constructs identified after analysing the questionnaire data. The interview guide focused on three main areas that are the decision-making processes, evaluation of functionality, and measuring the impact of the new version on the existing systems. Since these areas were identified as important from the initial data analysis and needed further clarification.

Table 4-2: Semi-structured interview protocol

Interview questions
Your organisation has recently upgraded or is currently upgrading its Enterprise System, could you please describe you involvement in the upgrade process?
How was the decision to upgrade reached (for example was any formal discussion or process followed)?
Was any specific set of activities agreed and followed as part of the upgrade?
What were the reasons for adopting those activities and following that specific order?
In your opinion, when do you think is the right time to evaluate the functionality of the new version and why?
In your opinion, when do you think impact assessment needs to be performed and why?

More than one approach was utilised to conduct the interviews depending on the interviewee location and availability; these approaches were face-to-face or video conference or telephonic interviews. Each interview took between 30 to 45 minutes and the session was documented by taking notes and recording the discussions. According to Walsham (2006), this approach allows referring back to key points discussed during the interviews and it also presented a mechanism for gathering direct quotes. However, the use of recording devices can lead the interviewees being reserved and not openly providing information (Walsham, 2006). Hence, the interviewees were informed that the recordings will only be used for this research and were assured that their comments would be anonymous; in addition, they were offered the option of the session not being recorded if they were uncomfortable.

4.3.3 Participant Selection

Generally qualitative research comprises a relatively small sample size, as what matters most is uncovering meaning and perceptions from the respondents (Patton, 2002). Thus, in this research the decision about when the respondents' size was regarded sufficient to address the research aims and objectives was based on identifying the saturation point. This process required determining the point in which collection of new data no longer added new dimension to the phenomena under investigation (Jane *et al.*, 2003). Thus, saturation results from comparing the data constantly, until an empirical confidence about the results is achieved. However, there have been criticisms on the use of saturation as a mechanism to determine the sample size; for example Dey (1999) points out that the cut-off point can be placed too early, which may potentially result in losing new emerging themes. Though, Guest *et al.* (2006) suggests that the researcher's experience and qualities play a significant role in determining the saturation point and according to Jansen (2010) the saturation point in a qualitative survey is determined by the relevant level of diversity.

In order to define the diversity, this research targeted respondents who have experience in managing ES and were involved in at least one upgrade project to provide insights into the upgrade decision-making process. Although, the targeted respondents reasonably homogeneous, they represented diverse roles, such as functional (business) users, technical leads and database managers, systems administrators, chief information officers, project managers, end-users and consultants. Despite the diversity in knowledge and experience, the group consisted primarily of a sample, whose primary role concentrated on managing enterprise systems and business continuity, which includes undertaking upgrades. Two non-probabilistic sampling techniques that is snowballing and purposeful sampling were utilised, the next section provides details on utilisation of these techniques in this research.

4.3.3.1 Web-Based Questionnaire Participants

As web-based questionnaires are used to target large sample sizes (Baatard, 2012); hence snowballing and purposeful sampling techniques were used to select the appropriate respondents. According to Denscombe (2010) purposeful sampling intends to identify specific respondents within the subject domain who can provide valuable contribution to the research. Thus, as part of the purposeful sampling strategy, several trade press reports and blogs were reviewed to identify leading ES vendors. According to a report from Panorama

Consulting Solutions (2013) the following vendors SAP and Oracle are the top two vendors whose ES (specifically ERP) are frequently adopted by large organisations, thus they hold the largest market share. Based on the above report, it was understood that members from SAP and Oracle user groups could provide a rich diversified pool of respondents. The user group members represent organisations from across the UK and Ireland. Whereby SAP user group symbolises organisations who are utilising SAP systems and Oracle user group comprises of organisations with systems from either Oracle, JD Edwards, PeopleSoft or Primavera. In order to get access to the user group members, the administrators of these two user groups were contacted via email to request contact details of their members for research purposes. The email discussed the objective and prospective outcome of the research to increase the chances of getting access to the user group members. The administrators instead of offering direct access to their members, they offered to publish the email request about the research in their monthly bulletins, in order to request their members to participate in the study.

Secondly, a snowballing technique was used to identify a small group of respondents to participate in the research. According to Bryman (2012) snowballing technique allows to target a small group and requesting this group to pass on the information to their colleagues. Therefore, this approach involved searching LinkedIn website for respondents based on the description provided in their profiles, such as experience in upgrading ES and years of experience. Thus, this technique facilitated searching for respondents who may not be part of the two user groups, in order to gather a different perspective, specifically in regards to upgrading different systems. Once the group was identified, they were contacted via email inviting them to participate in the research and politely requesting them to forward the questionnaire to other respondents within their network with similar expertise

4.3.3.2 Semi-Structured Interview Participants

A purposeful sampling strategy was utilised to select the semi-structured interviews participants. Based on the suggestion from Olson & Zhao (2007), who explained that upgrade is a continuous process recurring at least once every three years; the level of experience was set at 6 or more years. Hence, these respondents would have been involved in more than one upgrade project. The selection process utilised expert's information provided during the web-based questionnaire, this only included respondents who agreed to participate in further discussions on the subject. Additionally invitations were sent out to respondents sourced from LinkedIn to supplement the interview respondents' pool and allow for a different perspective on ES upgrade projects. This group principally acted as a control removing any preconceptions about the study, thus offering the researcher an opportunity to crosscheck the initial findings, thus gaining a deeper level of understanding of the upgrade decision-making processes and drivers.

4.4 Qualitative Data Analysis

Qualitative data analysis is generally a complex task, which requires careful analysis to identify the meaning attached to the data, with the intention of formulating appropriate themes based on the relationship of the attached meanings (Miles & Huberman, 1994). According to Creswell (2009) the analysis of qualitative data adopts a funnel approach, whereby the data is organised as an abstraction, then grouped in order to identify the relationships between the different themes. As stated by Kaplan & Maxwell (2005) data analysis is an iterative process which involves constantly analysing the data, this helps to determine if additional data collection strategies can be adopted to ensure a coherent interpretation of the concepts is attained. In order to holistically make sense of the data and understand the trends presented, this research's overall qualitative data analysis strategy followed the principles of inductive content analysis. From a qualitative perspective, Patton defines content analysis as “any qualitative data reduction and sense-making effort that takes a volume of qualitative material and attempts to identify core consistencies and meanings” (2002, p.453). Content analysis depends on a specific defined unit of analysis, which can be either a theme or pattern to derive the relevant meaning and the synthesis of the data can be conducted either inductively or deductively (Patton, 2002). An inductive content analysis process helps to identify the thoughts and ideas presented in the implied views of how the upgrade process happens in different organisations. The critical advantage is the capability to handle vast amount of data even from different sources to provide substantiating evidence to the research findings. Although, several steps are involved in an inductive content analysis approach, there is no definite set of rules on how to analyse the data, as the essence is to breakdown the data chunks into smaller groupings (Patton, 2002). This research follows these three steps, namely preparing the data, systematic coding and drawing conclusion; as illustrated in Figure 4-3, the next section provides a description of the steps followed during the inductive content analysis.

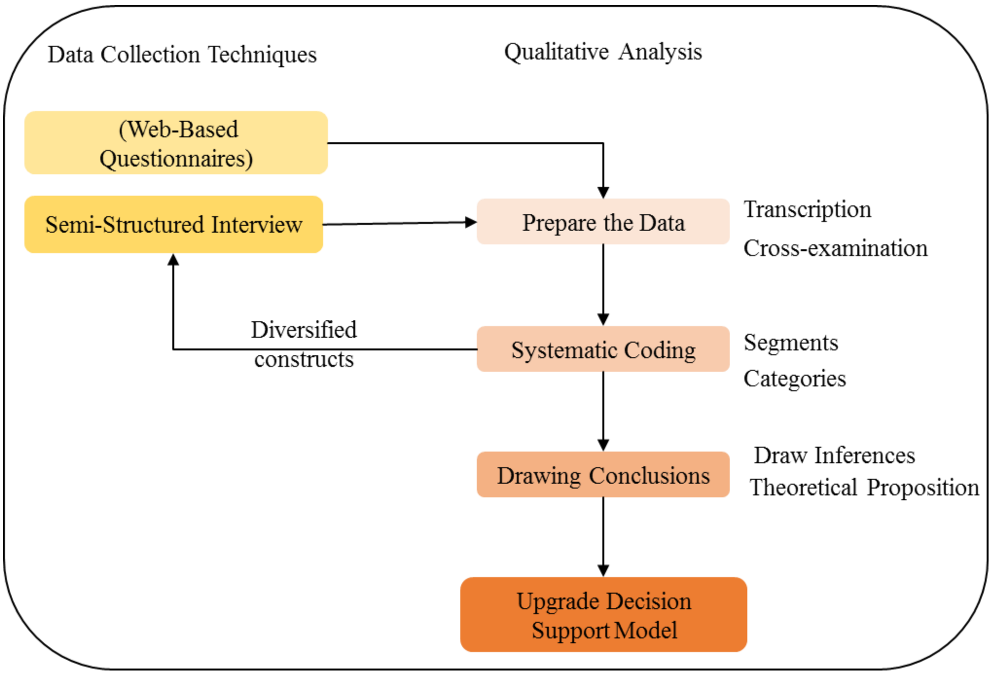

Figure 4-3: Inductive content analysis stages

4.4.1 Preparing the Data

The first step involved transcribing the interview notes and open-ended questions into a written form, as this allowed the researcher to cross-examine the data in order to understand what is happening, along with when and why it is happening. According to Dey (1993) these are the fundamental questions to ask oneself when reading research data. The next step was to study the data as a whole to get an idea of what the respondent has conveyed, in order to get a broader picture on how it reflected the research questions. This step implemented the suggestion by Schilling (2006), specifically when preparing the interviews data, hence it considered (i) if it was sufficient for the interviews transcription to represent a summary instead of every verbalisation; (ii) if there was any significance in transcribing any latent content observed during the interviews (such as silence, laughter, poster, pauses and signs). It was determined that the interviews transcription should only express summaries of the main contents described and explained during the interviews instead of transcribing literally every word. The reasons for opting for summaries is due to the fact that these respondents were sharing their knowledge and experience on an activity that they have been involved previously. Hence, summarising the concepts would be sufficient to collaborate the data collected from the two data collection techniques and provide a platform for understanding the commonality between data. Secondly, it was assumed that transcribing the silence, laughter, posture, and signs would not have critically swayed the research outcome, as it would not provide any additional value in identifying the decision-making processes.

4.4.2 Systematic Coding

Once the data was prepared, the next logical step was to identify the unit of analysis, a process referred to as coding. According to Miles & Huberman (1994, p.56) “coding is analysis”, therefore implying that coding is associated with tagging, separating and grouping the data into meaningful categories based on the themes or linguistic elements (such as sentences or words). Thus this research utilises descriptive, interpretative, and pattern codes based on Miles & Huberman (1994) code classification. The descriptive codes were applied to summarise and group the ideas presented within the data into segments without any interpretation. Next step was to assign interpretative codes to give meaning to the segments and systematically label all the groups occurrences between the different segments, which facilitated eliminating repetition between the interpretative codes. Next pattern codes were applied based on inferences drawn from the interpretations, to identify any significant relationships emerging from the segment groupings. Thus, reducing the data into high-level analytical content based on similarity of the meaning assigned with the intention of inductively deriving the content categories.

4.4.3 Drawing Conclusions

This was the critical stage, which involved drawing inferences and recreating the meaning resulting from the data through exploring the identified categories and their properties. In order to understand how the conclusions reflect the overall opinions of the sample population, it was important to ask relevant questions from different perspectives about the data. This involved frequent visits to the notes and transcriptions in order to justify certain arguments versus the conclusions drawn. In addition, to understand the associations of the findings it was important to explain the categories identified, so that it provides new understanding along with gathering theoretical proposition in relation to the research domain. Although, this research began by not adopting any specific theoretical lens, a further literature review was performed to identify suitable theoretical lenses that had better explain the identified categories and theoretical attributes. Hence, the study incorporates Tornatzky & Tornatzky ‘s (1990) T-O-E framework and process view of decision-making based on

Simon (1977) three phased decision-making model. Chapter 3 (sections 3.1.1 and 3.2) offer an explanation on reasons for selecting these theoretical lenses for exploring the theoretical propositions, mapping the interactions and relationships identified to formulate the Upgrade Decision Support Model (UDSM).

4.5 UDSM Evaluation

The evaluation of the model begins by comparing and contrasting the model against existing proposed upgrade decision-making models. This was an important aspect as it allowed positioning the proposed model among existing ES upgrade literature by highlighting the contributions of the proposed model. The second stage of evaluation involved presenting and discussing the upgrade decision support model with the respondents. The selection of respondents to evaluate the model utilised a purposeful sampling technique. These respondents were sourced from LinkedIn and were selected based on their experience and involvement in at least two or more ES upgrades. Another condition was these respondents should not be involved in previous data collection stages, in order to assess the interpretations and the proposed model's conformity to the processes of these organisations. Each expert was sent an email, requesting his or her participation in the evaluation session. The email explained the aim of the evaluation session, which was to gain insights on how the model reflected the decision processes and assess the usefulness of the model.

Once the respondents agreed to participate, a face-to-face discussion session was arranged; each session involved only representatives from a single organisation. The session began by explaining the research background and presenting the proposed model and explaining the stages in detail; this ensured the respondents had insights on the parameters used to conceptualise the model. Next, the respondents were requested to provide their opinions about the concepts presented in the model through a short questionnaire (see appendix B);

this was followed by an informal discussion to solicit any further recommendations. All the feedback and suggestions were analysed in order to appraise the model in context of its acceptability, significance, and applicability.

4.6 Chapter Summary

This chapter presented the research design employed to address the research objectives. In summary, this research embraces a qualitative strategy grounded on survey logic principles. As the research explores how organisations reach the decision to upgrade, this was the most suitable approach to attain a cross-sectional group of homogenous respondents to satisfy the research objectives. In addition, this chapter outlines the different approaches adopted to ensure data integrity by triangulating between two data collection approaches. It also elaborates on the steps followed to ensure trustworthiness of the result, in order to ease the alignment of the research questions to the findings and overall conclusions. The next chapter elaborates in detail the research findings that were the building block for the proposed upgrade decision support model.

CHAPTER 5

RESPONDENTS' PERSPECTIVE ON ES UPGRADE

It is reasonable to anticipate that some companies would develop their own unique approach when upgrading, while others adopt vendor defined processes. Yet, similarities on the reasons, upgrade strategies, and decision-making processes between the different organisations exists. Thus, this chapter presents the relationships between the respondents' views, ideas, and expertise on ES upgrades based on the interpretation of the collected data. This chapter starts by introducing the respondents and their field of expertise, followed by the upgrade strategies. Lastly, it presents the different stages followed during ES upgrades projects and highlights the various decisions taken during each stage. Reporting of the findings in this chapter is accomplished by balancing the descriptions and interpretations, in order to provide sufficient explanations, background, and context to the interpretations.

5.1 Respondent Demographics

The respondents represent 23 organisations (Table 5-1); which during the period of undertaking this research have upgraded their systems in the last 6 months or are currently upgrading, or were planning to upgrade their systems in the next 6-24 months. Nonetheless, the respondents representing these organisations have previously been involved in more than one upgrade, as explained in section 1.1.4 the research aimed to explore decision-making processes; hence, respondents involved in organisations that were planning to upgrade or currently upgrading were better suited to address the research questions, as they were actively involved with the decision-processes.

Table 5-1: Summary of responses

Data collection technique	**No of Organisations**	**Respondents**		
		Target	Responses received	Complete Responses
Pilot	2	5	5	5
Web-based questionnaire	16	50	38	24
Semi-structured interviews	5	15	12	12

In summary, 41 respondents participated in both data collection stages including the pilot study, of whom 24 were involved in web-based questionnaires only. While 6 were involved in both interviews and web-based questionnaires and the remaining participated in interviews only (Figure 5-1).

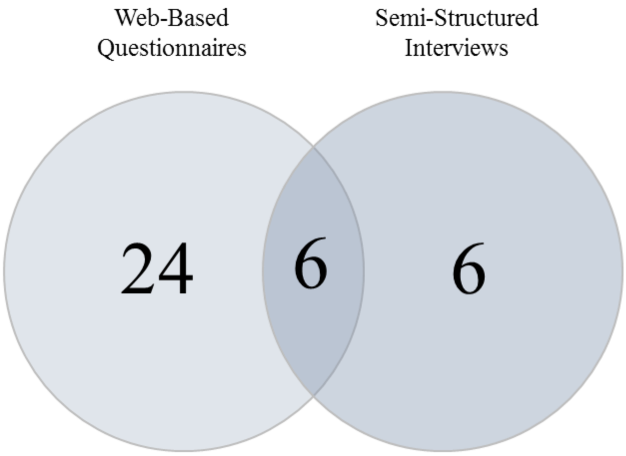

Figure 5-1: Respondents' distribution between the two data collection techniques

Based on the recommendations from Jane *et al.* (2003) it was anticipated that a maximum of 50 respondents would be sufficient to gain insightful views in relation to the research problem. Including the responses from pilot study, 43 web-based questionnaire responses were received; however, only 29 responses were complete. These respondents represented 18 different organisations offering a cross-sectional homogenous group with the majority of them having more than 8 years' experience. Table 5-2 highlights their level of experience in years.

Table 5-2: Respondents' experience

Experience	Respondents
Less than 1 year	0
1 to 2 years	1
2 to 4 years	5
4 to 6 years	2
6 to 8 years	7
More than 8 years	14

In addition, the diversified roles (Table 5-3) suggest that the group of respondents offer different perspectives and in-depth knowledge to ES upgrade phenomenon, based on their specific roles. However, it is possible that respondents had more than one role, thus, giving their opinions and experiences more value.

Table 5-3: Respondents' roles

Role	Respondents
Solution Architect	4
Project Manager	8
Systems Analyst	4
Functional Lead	7
Technical Lead	5
Database Administrator	3
Systems Administrator	2
User Representatives	1

The second category of respondents represents the interviewed respondents. Guest *et al.* (2006) recommend that during a qualitative interview a maximum of 15 participants should be sufficient to get the detailed subjective understanding of the problem investigated. Out of 15 respondents contacted, nine respondents originated from the web-based questionnaire session and the rest were selected based on their LinkedIn profiles. However, only 12 respondents agreed to participate in the interviews, resulting in an additional 5 organisations as 6 respondents had taken part in the study through responding to the web-based questionnaire.

Table 5-4 outlines the interviewee roles in their current organisations. All the interviewees had more than 6 years' experience, since this was the main selection prerequisite as explained in section 4.3.3.2.

Table 5-4: Interview respondents' role

Role	Respondents
Solution Architect	3
Project Manager	2
Technical Leads	2
Functional Leads	2
Chief financial controller	1
Database Administrator	1
Information systems manager	1

From the above explanations, it can be observed that majority of the respondents consulted in this research have more than 6 years' experience and were involved in at least two upgrade projects. Thus, they offer a distinct selection of expertise and knowledge, which supports obtaining detailed views on the upgrade process. Consequently, the findings presented in the next sections provide the necessary depth and richness required to address the research questions under investigation.

5.2 Reflection on the Data Collection Techniques

The discussion presented in this chapter reflects the responses from both data collection techniques utilised in this research. However, the web-based questionnaire responses were analysed prior to the semi-structured interviews, which allowed some constructs that required clarification and explanation to inform the design of the semi-structured interviews. This does not imply that the responses from the web-based questionnaires were not valuable, as the data offered detailed insights on some key decision processes. For example, most of the respondents suggested that there is a necessity to evaluate the existing system landscape and understanding the upgrade implication, along with mapping the new version's functionality to the requirements. The insights obtained from the analysis of the web-based questionnaires facilitated refining the proposed conceptual model (Figure 5-2).

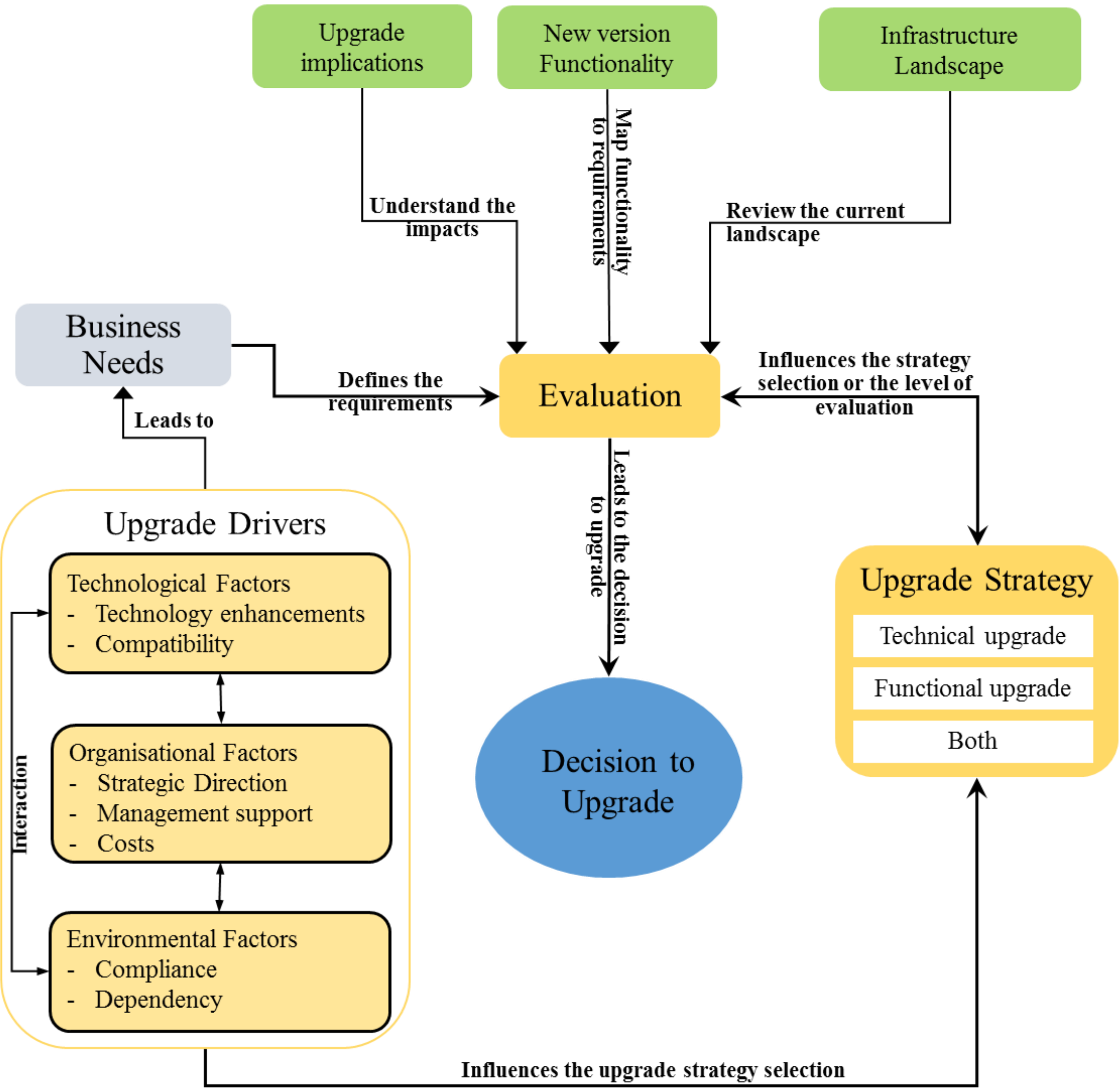

Figure 5-2: Refined conceptual ES upgrade decision-making model

However, there were limitations in terms of the depth of the explanation provided, for example, no explanation were offered on how the existing system landscape was evaluated. Therefore, in order to attain a comprehensive explanation, the following constructs (Figure 5-3) were utilised to structure the semi-structured interview questions.

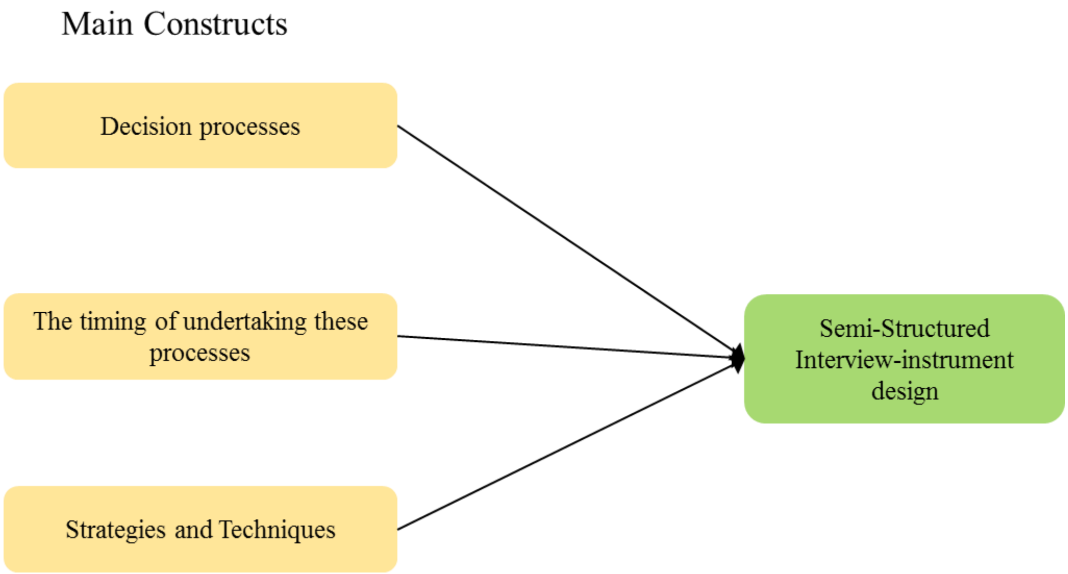

Figure 5-3: Main constructs from the web-based questionnaire

The web-based questionnaire data suggested that there are several processes undertaken during upgrade decision-making and the timing of when each process is undertaken plays an important role. For example, it is important to know when the organisation decides to review their current landscape, as this may provide details on how the outcome affects the upgrade decision. In addition, there was a need to establish the different strategies and techniques utilised by these organisations to apprehend the outcome of these processes. Obtaining a detailed explanation of these three constructs would enabled gathering comprehensions on the overall upgrade decision-making process. As a result, it would allow identifying the different processes, techniques, and strategies associated with ES upgrade decision-making. The next section discusses in detail the overall responses from both the data collection stages.

5.3 ES Upgrades

Upgrading is a complex phenomenon, which affects many different stakeholders; however, each stakeholder has a different agenda, which results in them perceiving ES upgrade differently. One of the respondent explains that this level of diversity is a common occurrence in their organisation as part of the upgrade discussions.

> *The database owners do not like to be far behind technology, but would propose an upgrade only when the necessity arises and the technology is considered reliable. While, the infrastructure team constantly encourages and proposes upgrades, as they do not prefer to support multiple versions. Whereas the business users would, provision for upgrades only when there is a need for new features to support their processes. On the other hand, the management will approve upgrades when the business case can be justified and clear continuous improvements outlined.*
>
> *Respondent21*

The essence of this explanation, illustrates that from a technical view ES upgrade implies changing the underlying system, while business users think of upgrades as a mechanism for incorporating new functionality and improving existing processes. On the other hand, management perceive upgrades as an opportunity to plan and improve the overall performance and direction of the organisation. These views facilitate broader understanding of upgrades, specifically positioning the fact that there are different reasons as to why an organisation would undertake an upgrade. Conveying the idea, that upgrade is a result of interplay between different elements that influence overall decisions. However, for an upgrade to happen, it is important to establish a common ground that ensures consensus between the different stakeholders' interests.

> *Business continuity was the main driver; however, this was more of a blanket reason to get all stakeholders on board with the upgrade.*
>
> *Respondent21*

Most of the time an upgrade would be undertaken in order to support the organisational long-term goals, such as lower maintenance costs and efficient use of support personnel time. Other benefits include; minimise systems modifications, improve security, performance, and reliability.

> *We upgraded to save cost, as well as to gain benefit out of the seamless and robust system.*
>
> *Respondent5*

5.3.1 Upgrade Philosophy

Most organisations lean towards to defining a project scope with achievable objectives, hence, indicating that when changes are applied in a measured way, it tends to reduce risks and disruptions. These can be referred to as upgrade philosophises, which either involves undertaking upgrade either as a complete system overhaul (big-bang approach) or in smaller targeted changes (phased approach) to the system.

5.3.1.1 Phased Approach

In this approach, an upgrade process is broken down into smaller manageable chunks, which ensures the scope is well defined. Some organisations define their phases based on the nature of change that is upgrading either technical or functional aspects of the system.

> *We define our project in phases in order to keep the project within a well-defined scope.*
> *Respondent6*

In addition, since most ES have the capability of modular configuration, as a result, other organisations opt to define the phases depending on the modules that will be upgraded. This would simply mean configuring different functional modules of the system; however, this is not a common practice. Therefore, there is no clear definition of what these phases constitute, however in general a phased approach will divide the project scope into established objectives, which are achievable within a specific timeframe.

> *A phased approach ensures the versions are up-to-date and the projects are more controllable with minimum risks.*
> *Respondent24*

The phased approach requires a dedicated team, planned budget, and flexible time to complete the project, as it takes a long period to complete smaller upgrade projects.

5.3.1.2 Big-Bang Approach

When the scope of upgrade involves applying all the significant changes at a single instance resembling a new implementation, this is referred to as big-bang approach. Adopting a big-bang approach is more viable for organisations that have postponed upgrading previous versions, and now need to be consistent with the latest version offered by the vendor. In many cases, the approach requires significant planning, because cost, time, and resources play a major role in such projects success. This level of planning ensures that there is a general agreement of the project plans and outcome in order to minimise the risk of failure. The plans include taking into consideration the deliverables, the timing, budget and resources and every possibility of major disruptions in order to provide a basis for formulating actions and strategies to address challenges when they occur.

> *Many reports indicate that the decision to implement or change a system resulted in failures, this can be directly associated with the outcome not agreed and debated extensively.*
>
> *Respondent23*

Obviously, the big-bang approach incorporates a large project scope, which has a significant number of achievable objectives. Resulting in increased costs and resources demand, as the project tries to deliver across many different dimensions.

> *We plan our projects well ahead and these become part of the financial year budget. However, when we choose to do both technical and functional upgrade in the same financial year, our budgets are extremely high, as we have to account for the need extra resources required.*
>
> *Respondent6*

5.3.2 Upgrade Strategies

Organisations may define their phases differently, but mainly it involves configuring either technical or functional features of the system or a combination of both. There is evidence to suggest that upgrade drivers would define the upgrade choice and in addition, it demonstrated the dependency between the upgrade choices, for example, functional upgrade relies on technical soundness of the system. Such dependency can result in a situation where both upgrade strategies are required to fulfil the organisation long-term plans. Additionally, there is a possibility of the existing system being replaced completely due to certain new version limitations that do not satisfy the organisation’s strategic direction and requirements.

As mentioned earlier, the decision was to implement a new ERP system altogether, as we felt upgrading to the new version would not be ideal.

Respondent17

Thus, it can be argued that certain upgrade factors only influence the selection of a specific upgrade strategy; the next sub-sections explain in detail this association.

5.3.2.1 Technical Upgrade

The need to keep within the vendor releases cycle and taking advantage of new technologies results in a technical upgrade. Thus, vendors generally influence the organisation to undertake technical upgrades, but this is not always the case. As in some cases, technical upgrades are undertaken to accomplish strategic decisions, for example reducing operational costs; this is achieved by attaining vendor continuous support and being within the licensing agreements.

From a technical perspective, it is mostly the vendors driving the upgrade.

Respondent24

The goal of technical upgrade is to leverage latest technology features and to align the systems within the product life cycle. This implies that a technical upgrade is independent of a functional upgrade and concentrates mostly on changes to the underlying technical core systems such as the system architecture.

Technical upgrade keeps the system within the supported product window of suppliers.

Respondent14

Undertaking a technical upgrade involves analysing the structure of data dictionary objects and evaluating the individual coding areas to confirm that the changes do not disturb the existing functionality.

Technical upgrade is required to build better integrations/interfaces.

Respondent22

In rare cases, typically occurring in situations where the technical aspects of the system are up to date, there would be no reason to upgrade the technical platform of the system.

Technical upgrades are not undertaken frequently.

Respondent10

Such an explanation provides alternative reasons as to why organisations do not frequently upgrade their systems. However, this reference is applicable only to technical upgrades, implying that organisations could still opt to undertake a functional upgrade when the systems are technically stable.

5.3.2.2 Functional Upgrade

The need for new functionality, improved user support, and reduced modifications would normally result in a functional upgrade. Functional upgrade is required to fill gaps in the processes that the current systems do not support and ensure the organisation is compliant with legal requirements changes.

The business users identify functionality, which they would like to adopt, and normally this will result in a functional upgrade.

Respondent2

This upgrade mode involves assessing and implementing functionality improvements introduced in new versions. However, the system requires being on a consistent, compatible, and stable technical platform in order to support the new features and functionality introduced. Representing a typical scenario in which a technical upgrade may be undertaken prior to a functional upgrade, thus ensuring the technical platform is up-to-date and capable of accommodating the imposed changes. Additionally functional upgrade may necessitate changing the technical aspects of the systems, resulting in technical upgrade prior to a functional upgrade. This demonstrates the level of dependency on technical upgrade; however, this is only applicable when the existing platform is not technically stable to accommodate the changes. There are instances when the technical platform is capable of accommodating these changes, then a functional upgrade implies upgrading only the existing functionality. For example when complying with legislative requirements, the changes in systems would not affect the technical aspects of the systems.

5.4 Upgrade Stages

In order to upgrade there is a need to have exhaustive and relevant information about the new version to identify a feasible need for changing the existing systems. Upgrading introduces continuous business improvements, but the decision to implement these changes is not straightforward, as it depends on many different elements aligning together in a specific manner.

> *Sometimes is not a clear-cut decision, I mean you cannot just go from version A to B. Typically, we will identify what are the requirements, then based on these requirements we will assess the different versions.*
>
> *Respondent24*

Secondly, understanding how the new version affects existing modifications and functionality is important, since it provides the overall depth of the upgrade tasks. To achieve such detailed and accurate information, organisations adopt a systematic approach to guide their assessment and evaluation of the systems landscape, as well as implementing the new version if deemed necessary. Normally, this systematic approach comprises different stages that provide useful critical outputs to support upgrade decisions, the explanation of these stages follows next.

5.4.1 Scoping

Scoping stage is concerned with understanding the underlying reasons that drive the need to upgrade, which happens prior to upgrade project commencement. This is the first step, which highlights the limitations of the current systems and organisation's requirements. There are many different reasons that influence the need to upgrade; for example, some organisations need to reduce maintenance costs and use standardised functionality or simply to keep up with vendors' version release cycles in order to get continuous support.

Once we upgrade it will cost less to maintain and support due to greater use of standardised functionality and less customisation.

Respondent20

In other situations, the need to upgrade is driven by government agencies, through the introduction of new legislations.

My team is regularly involved with upgrade projects, for example, we upgrade our HCM system every year, as we have to comply with government legislative changes.

Respondent6

However, some organisations would not upgrade as soon as a new version is available, as they need to deliberate the stability and reliability of the new version, as well as weigh up the overall benefits of the improvements introduced by the new version.

Prior to upgrading, we network with colleagues from other organisations that have recently upgraded their systems, in order to establish the reliability, stability, and functionality of the new version.

Respondent22

Drawing from the above explanations, it becomes apparent that the drive to upgrade originates from either within the organisation or the external environment. Thus, scoping is the art of gathering significant information and linking it to known facts, which help solve problems and improve operations. This will involve collaborating and communicating with external entities (such as consultants and vendors) and internal parties (such as business users and technical leads) to gain insights of what is required. This involves exploring existing system landscape to establish new requirements, which justify the upgrade decision.

Normally we start assessing our system landscape very early on, for example, we assess functionality at least 6 months before a new financial year. This allows us to budget for the project and have a tight project scope that is achievable.

Respondent6

Scoping begins by understanding the current version licensing and support cycles, along with establishing and identifying any challenges within the system landscape. It is then followed by assessing the functional landscape, to identify any necessary improvements required, that become part of the high-level requirements. These requirements create a foundation to explore what relevant functionalities are available in the new versions to support the organisation goals. In many cases, the new versions incorporate functionalities surplus to requirements, therefore reviewing the functionality provides an understanding of the significant features and allows to prioritise features for implementation. Normally, organisations follow a two-step process when assessing new version functionality; first, they explore vendors' website to get a high-level understanding of proposed changes to be introduced in the new version. Second, they schedule meetings with vendor's representatives to get information of the new version enhancements.

We communicate with the vendors, to get details of the introduced changes. This helps us know what to expect and if the vendor will support some of our functionality.

Respondent24

The output from the scoping stage is a relatively high-level project specification incorporating changes required to be introduced as part of the business continuity strategy. This stage ensures sufficient and appropriate information is gathered to support upgrade decision makers, allowing them to make informed decisions about the upgrade.

5.4.2 Planning

Planning involves obtaining a detailed understanding of the problem and the proposed solution including its value proposition. Generally, the planning stage inherits information from scoping stage, which facilitates identifying the detailed requirements and challenges of the project.

It is about knowing how to apply and communicate what we know.

Respondent23

Planning begins by selecting the project coordinator, who will be responsible for assembling the project team and initiates the assessment of the existing system. As a result, a better understanding of existing processes usage is obtained and non-critical processes that are no longer required are identified.

> *We first explored our business process, to get a better understanding and identify improvements. This was an important step, as it helped us find a lot of waste in our processes as well as to introduce new business processes. This resulted in the production of a requirements document that contained all the functionality that we would like to see in a system.*
>
> *Respondent17*

The high-level requirements identified in the scoping stage are extended with a new set of requirements, obtained after evaluating the current system landscape. Next, these detailed requirements are compared against the new version features and functionality to obtain a detailed understanding of how these requirements will be supported. One of the methods used to get information about the new version is through reading the system documentation, which most respondents support as a good initial source of information. However, the information is subjective and limited, as it does not effectively highlight the difference in functionality offered in the new version and the significance of these changes in relation to the current version. To supplement the limitations in the documentation, some organisation opted to use consultants. Consultants were regarded as domain specialists, who can provide objective evaluations and explanations of additional features offered by the new version.

> *Documents from the software vendor are not very valuable because they do not provide objective evaluations of the changes and upgrade value proposition.*
>
> *Respondent22*

However, the planning stage is not only about reviewing functionality, as the main aim is to establish the project scope. Thus, it also necessary to justify the technical, functional, and planned deliverables, along with understanding the possible impacts in order to establish the project breadth and depth. The output from this stage is a project initiation document (PID), which is used to communicate the priorities and plan of actions. The PID includes various information, such as the team composition, the objectives of the project and deliverables. Thus, it is the core of an upgrade business case and is utilised to support upgrade decision-making, as all the relevant information are provided to guide decision makers. However, decision-making during the planning phase is a mixture of personal experiences, previous knowledge, and attaining relevant information.

> *Our decision-making mostly is based on a combination of empirical evidence and what you call gut-feeling and personal experience.*
>
> *Respondent14*

5.4.3 Design

The design stage is concerned about aligning the deliverables and outcomes to specific measurable and achievable outcomes. It begins by interrogating information presented in the PID to evaluate options presented and mapping new version functionality against requirements, in order to facilitate identification of current and future value propositions.

> *It is about constructing clear and debated objectives to achieve an agreed outcome within a specific timescale.*
>
> *Respondent23*

This stage establishes a clear vision of how well the new version satisfies the required features and what alterations are required on the existing modifications and functionality. In addition, it establishes the outdated modifications and highlights any new modifications that need to be implemented, especially in situations when the new version does not support the 'must have' requirements.

> *Normally we try to avoid bespoke solutions, but it depends on the business need and consultants' recommendations on the best way to achieve a critical functionality that is not available in the new version.*
>
> *Respondent6*

As a result, effort required for supporting the re-application of the modifications and entire upgrade process is determined. This specifies the importance of assessing all possibilities that help to achieve the project objectives and consider all alternatives in order to present the most feasible project scope. Additionally, the upgrade impact assessment is undertaken, this involves planning and performing volume testing and sizing on the existing version. These two tests are fundamental in determining the impact on hardware and supporting technologies (such as database and operating system).

> *I would not like to upgrade something, if I have not considered the impact of upgrade from multiple perspectives. As there is no point in imposing functionality without looking on how it influences the existing business process.*
>
> *Respondent21*

It is also important to measure the impact of upgrade on the business rules and customisations, in order to identify and account for the resources and costs, prior to the project commencement. In return, it allows preparing measures to overcome any risks and assuring no hidden surprises will cause rolling back the project. The impact could be measured using risk-based testing, which allows assessing the likelihood of change against the impact on the business rules, processes, and functionality. Considering these implications allows for allocation of sufficient funding and personnel to support the upgrade.

> *Most importantly estimating the impact allows incorporating any mitigation and measures to overcome risks as part of the project plan.*
>
> *Respondent17*

The output from the functionality assessment and impact measurement feeds back into the decisions to determine if it is valuable to pursue a full upgrade or not. This can be determined using a decision matrix to prioritise functionalities against requirements, which in return supports the upgrade business case, through highlighting the benefits for undertaking an upgrade.

The design stage provides a clear and detailed project definition, which includes upgrade approach and testing strategies. Additionally it will also define criteria used to determine cut-off points, which determines when the replication of these changes can be applied in the production environment. This information will be provided in the project blueprint, which aims not to leave any questions unanswered, thus it is considered as the project corner stone. The blueprint provides a solid foundation that the upgrade team can constantly refer to, in order to achieve agreed plans and follow outlined strategies. This document provides an opportunity to factor effort estimation and impact of upgrade into the decisions.

5.4.4 Realisation

Realisation resembles an upgrade implementation 'dress rehearsal'; as it is where the go-live preparation and the cut-off point planning occurs. It is regarded as the most important stage, which requires and consumes most of the time allocated for upgrade projects. This is very noticeable in large projects that are aiming to deliver across diverse scopes, as these projects become dependable on the availability of resources and time. In contrast, resources availability is not very critical when the project definition is within a narrow project scope. In general many organisations deploy a strategy of having three environments (system boxes), which are development, quality assurance and production as part of the upgrade design strategy. The sole reasons for adopting such a strategy, is to ensure that everything is functioning as required and specified, along with minimising any possibility of errors before upgrading the live production system. Normally this stage begins by replicating the existing landscape into the development box and executing different testing scenarios defined in the testing strategy to establish the 'as-is' status of the existing systems.

> *As a rule of thumb, regression testing is first executed on the pre-upgrade system, as this provides a solid case for before and after scenarios.*
>
> *Respondent6*

Next, the proposed changes are applied and similar testing scenarios are executed again to gather the 'after-changes' state of the system. There are different levels of testing involved, yet testing strategies ensure that the changes are practically correct and the impacts identified.

> *Consider a situation where you have to upgrade, but that you realise that the new version functionality will actually result in more problems such as compatibility with other*

applications and process. Therefore, you are better off with the older version, while you wait for the next version.

Respondent21

In later stages, especially when the system is stable and all problematic scenarios have been addressed, the changes are replicated to the quality assurance box, which contains meaningful data. This provides an opportunity for performing sanity tests that evaluate that everything is in line with expectations and validate the integration and information flow between the changed modules. Next, safe check tests will be undertaken based on the 'go or no go' criterias and the cut-off points defined in the project blueprint.

5.4.5 Go Live and Support

This stage is about migrating and implementing changes in the production system box, after confirming that all the checks were successful and that the project was signed-off. However, the following instructions should be given due consideration when planning to migrate to the live system. First, migrate only when the production box is not utilised, in order to minimise risks of disruptions and reduce possibility of conflicts occurring in the underlying system mechanics. Secondly, place on hold all changes to the data in existing production system, including execution of all transactions. The downside of not adhering to these instructions when upgrading, is an increase in time required to apply proposed changes and the process may result in an inconsistent system.

The next component of this stage is continuous improvement; this involves assessing whether all plans and objectives were accomplished and ensuring the changes actually provides the perceived benefits. Additionally, this stage includes support by addressing known issues and bugs and acclimatising users through continuous training. As a result, it allows identification of new changes and requirements as part of system continuous support, thus creating the groundwork for the next upgrade cycle.

5.5 Chapter Summary

This chapter has presented the data providing descriptions of the meanings attached to the views expressed by the respondents. It represented the interactions and alignment of the different stages in upgrade projects and inferring from the analysed data it is clear that a relationship between the upgrade drivers and upgrade strategy selection exists. The findings also highlighted that various stakeholders interpret the concept of upgrade differently and in order to make an effective decision to upgrade, there is a need to have a well-defined business case. This will include assessing the benefits of upgrading and correctly demonstrating the overall benefits for undertaking the upgrade.

Thus, the decision to upgrade is dependent on the interaction between different elements to balance the negative and positive influence and evaluating the benefits (technical and functional). This results in the development of the business case that includes the upgrade strategies, and the net value for undertaking the upgrade. Hence, it justifies the importance of establishing the project scope with achievable objectives and realistic timelines that can be supported with sufficient resources depending on the selected upgrade strategy. The next chapter discusses and explains the processes theorised to be part of the decision-making followed during ES upgrades.

CHAPTER 6

ES UPGRADE DECISION SUPPORT MODEL

This chapter presents the proposed upgrade decision support model, which outlines two main phases (Exploration and Evaluation) and two processes (objective assessment and strategy selection) and three sub-processes (namely technical analysis, functional gap-fit analysis and impact assessment) to represent ES upgrade decision-making. Next, it expands on the different phases and processes in the proposed model, highlighting the role of these processes and their significance. Then, it discusses the different upgrade drivers, along with the relationship between the drivers and the upgrade strategies that most organisation adopt when upgrading their systems. Lastly, it draws on existing ES upgrade literature to position the proposed model and highlight its difference to other upgrade decision-making models. Additionally it presents views from the study respondents who participated to evaluate the model applicability, significance, and acceptability in supporting ES upgrade decision-making.

6.1 Towards the Upgrade Model

There were two main perceptions observed regarding upgrade decisions. The first perception is that the decision can be deduced using common sense and intuition depending on business nature and vendors support life cycles. While the second perception is that, the upgrade decision depends on attaining relevant information, assessing the available options and alternatives in order to support the selection of an upgrade strategy. However, upgrade decisions are not clear-cut and require a substantial amount of thinking and planning. In addition, it entails understanding how the proposed changes would disturb the existing processes internally and externally. Thus, to reach an informed decision, the decision to upgrade should result from the combination of both perceptions. Reflecting on the upgrade stages (Figure 6-1), the upgrade decision-making process can be classified as pre-upgrade and post-upgrade decisions.

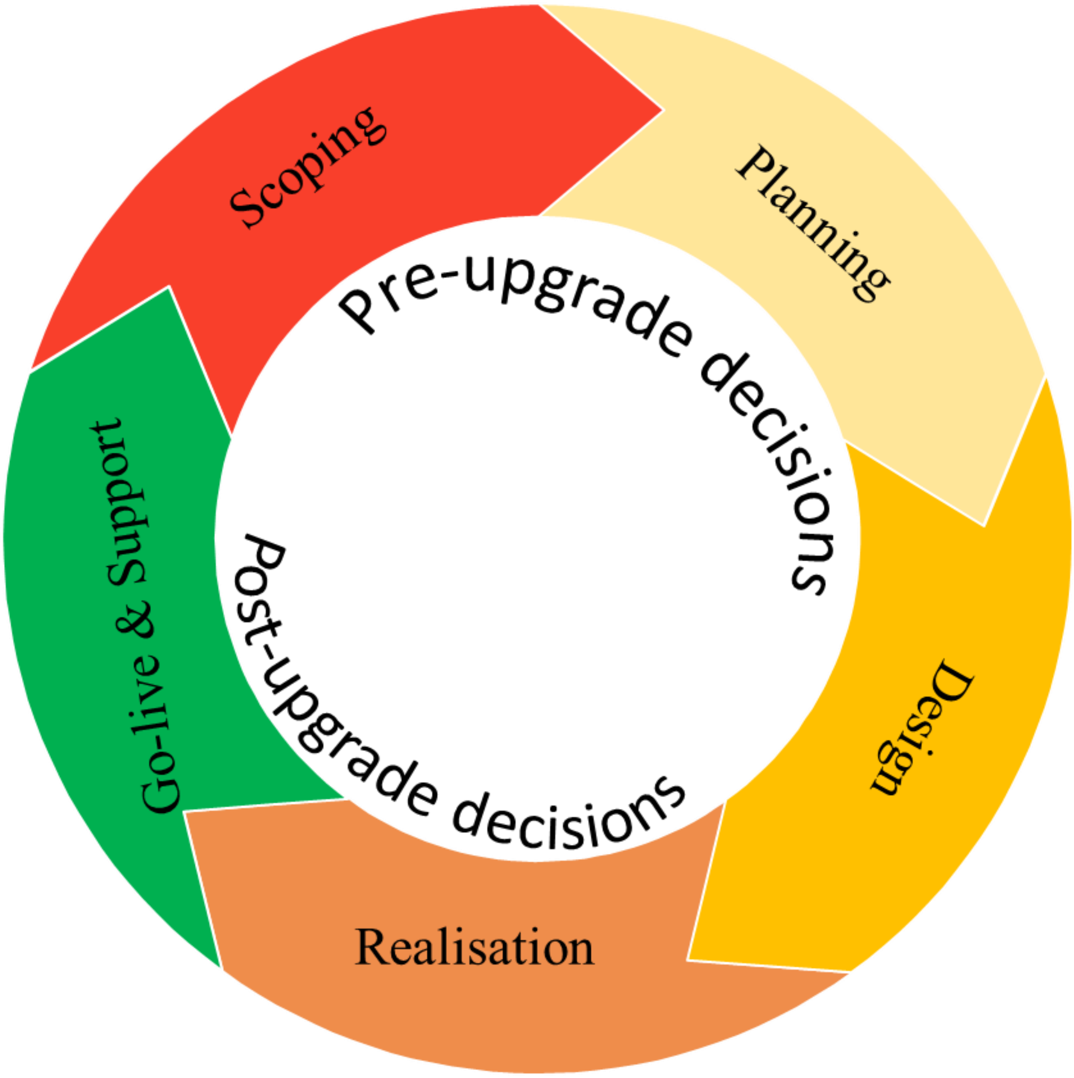

Figure 6-1: Upgrade stages

Pre-upgrade decisions includes all the decisions reached in the scoping, planning and design stages, implying that these stages occur before making the decision to upgrade. Post-upgrade decisions refer to all those decisions made after the upgrade approval, including the decisions made in realisation stage, and go-live and support stage. This demonstrates that different processes and requirements drive upgrade decisions, but the most important processes are the ones that are defined in pre-upgrade.

The next section presents the Upgrade Decision Support Model (UDSM), which focuses on pre-upgrade decisions and proposes a logical set of processes to support ES upgrade decision-making. Drawing from Simon (1977) decision-making process model and Tornatzky & Fleischer (1990) T-O-E framework, the relationship between these phases and processes are expanded to highlight their importance in upgrade decision-making process.

6.2 Enterprise Systems UDSM

The model (Figure 6-2) represents how organisations reach the decision to upgrade, which is drawn through refining the conceptual research model based on the findings. UDSM consists of two phases: EXPLORATION and EVALUATION, the output from these two phases enables ES upgrade decision makers to make informed decisions. The EXPLORATION phase focuses on identifying the need to upgrade and encompasses the upgrade drivers classified into three contexts that is technological, organisational, and environmental. These three contexts are connected with bilateral arrows to depict that there is an interaction among the different drivers and the outcome from this interaction is what defines the need to upgrade. The upgrade need determines the order in which the processes would be accomplished in the EVALUATION phase; this is depicted by the flow of the output from the interplay represented by the right brace in Figure 6-2.

The EVALUATION phase comprises of two processes that is OBJECTIVE ASSESSMENT, STRATEGY SELECTION, which support analysing and evaluating the upgrade landscape. These two processes facilitate identifying the deliverables and its associated challenges, which would then assist in the selection of an upgrade strategy that satisfies the organisation's requirements.

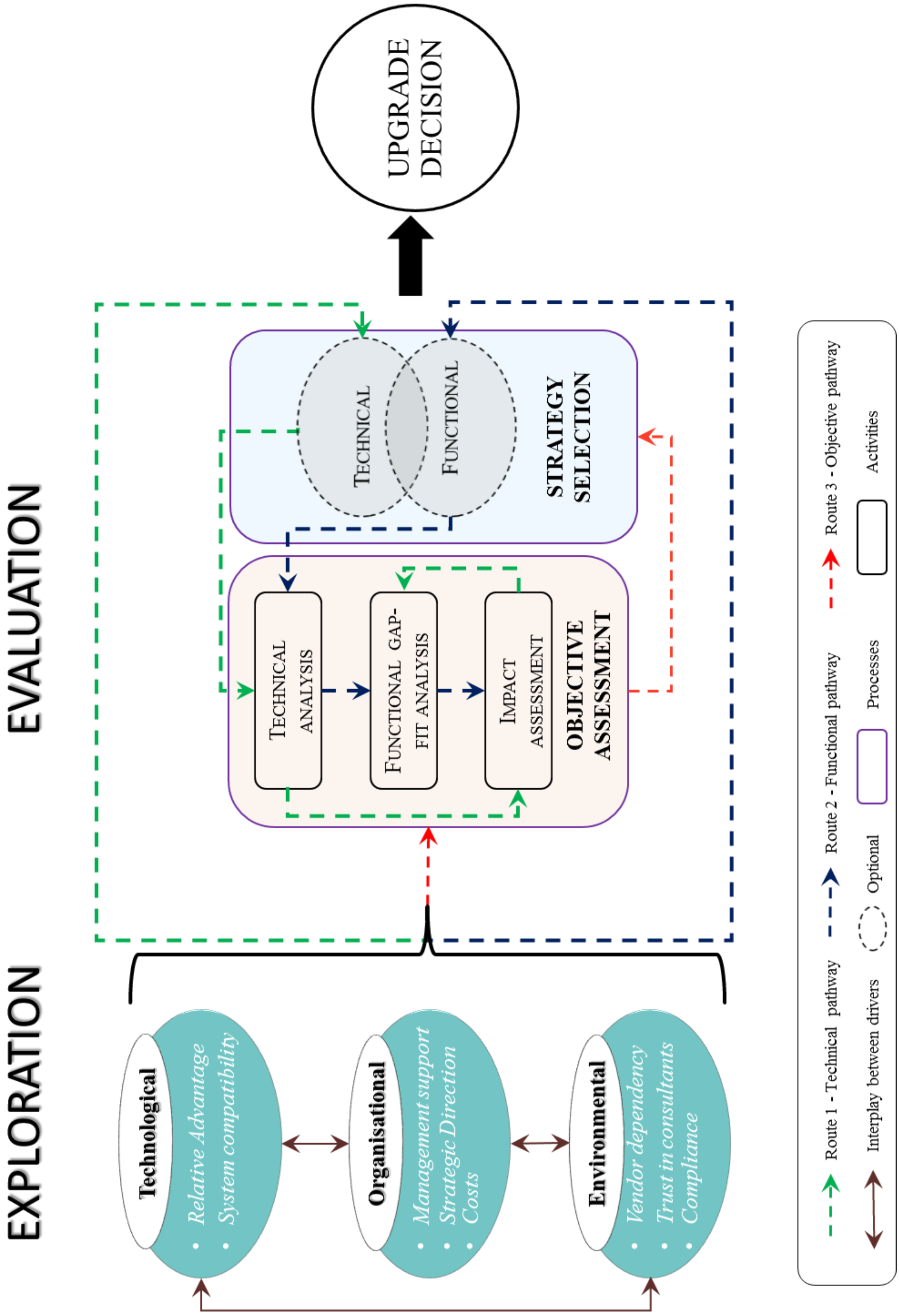

Figure 6-2: The proposed upgrade decision support model (UDSM)

The OBJECTIVE ASSESSMENT process comprises of three sub-processes these are TECHNICAL ANALYSIS, FUNCTIONAL-GAP FIT ANALYSIS, and IMPACT ASSESSMENT; these enable understanding the business need, mapping the new version's functionality against the requirements and identifying the impact that the changes will have on the existing system landscape. Thus, it enables to evaluate the different alternatives available and its consequences within the upgrade landscape. While the STRATEGY SELECTION focuses on matching the type of upgrade to the organisation requirements and deliverables, with the intention of identifying the 'best' strategy to achieve the upgrade deliverables and goals. 'Best' does not imply an optimal solution, nonetheless it indicates a choice that satisfies the problem definition based on the pre-defined criterias (Barros, 2010). The overall output from the EVALUATION PHASE is an upgrade blue print, which feeds into the decision-making process to determine the depth and breadth of the upgrade project. The blueprint outlines the agreed goals and defines the project scope, along with the upgrade implementation strategy, thus supporting decision makers to make informed decisions.

While the previous section presented an overview of UDSM, the next sections provides a detailed explanation of the phases and processes including their associations. In addition, it demonstrates the possible pathways that can be travelled when making the decision to upgrade.

6.2.1 Exploration

The exploration phase is concerned with identifying the need to upgrade by gathering significant internal and external information of the current system landscape. This involves exploring, collaborating, and communicating with all the stakeholders to gain insights into the requirements that will support the organisation's operating needs. In addition, it includes researching the proposed new version's capabilities either through using external consultants or vendors information outlets for example their website or information from companies that have recently upgraded. The information gathered requires interrogating and interpreting relevant aspects to address that specific problem, which assures achievement of meaningful outcome. Interrogation involves extracting relevant information from stakeholders, industrial white papers, documentation, vendors' websites, and systems historical data, based on experience and intuition. Such information can be directly or indirectly associated to that specific problem and will facilitate a better understanding of issues surrounding the problem. However, it is important to sift through the information in order to identify what is relevant or irrelevant to the problem, a process known as interpretation. Interpretation makes use of expertise accrued over the years, to steer identification of actions that eventually will result in meaningful and objective decisions. During the exploration stage, the focus is on identifying information that initiates the need to upgrade; the observed findings suggest there are multiple drivers and the interplay between these drivers define the need to upgrade.

Understandably, each organisation reaches the decision to upgrade differently, yet commonality between the processes exists, especially on the timing, execution, and overall generic outputs. These findings about the drivers that influence upgrade decisions bear similarity to those explained in previous studies (Kremers & van Dissel, 2000; Ng, 2001; 2006; Seibel *et al.*, 2006; Khoo & Robey, 2007; Roberts, 2009; Claybaugh, 2010; Otieno, 2010; Dempsey *et al.*, 2013). However, this research proposes a different dimension, by using T-O-E framework as a comprehensive analytical lens for studying and categorising these drivers. Although the design between this research and that conducted by Claybaugh (2010) differs, the theoretical lens bear similarity, hence this research extends Claybaugh's (2010) findings by suggesting additional drivers that influence ES upgrade decisions, especially since this research covers multiple systems from more than one vendor.

Drawing from T-O-E framework, the upgrade drivers were classified into three contexts, namely technological, organisational, and environmental (Figure 6-3).

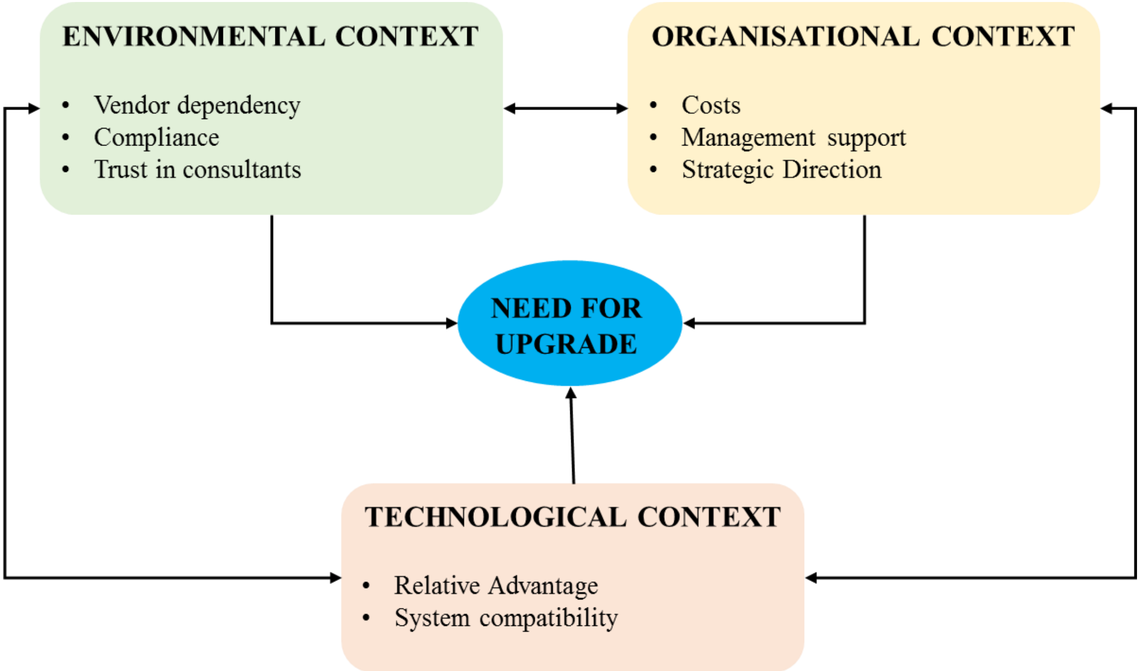

Figure 6-3: ES upgrade motivation based on T-O-E framework

From an upgrading perspective, the technology context represents relevant existing and new technologies within or external to the organisation, though the focus is on the relative advantage and compatibility to existing systems. Organisational context describes internal measures such as costs, management support, and organisation objectives. Environmental context refers to the field in which an organisation operates; this includes elements such as government legislation, vendors, and consultants' support. However, according to Tornatzky & Fleischer (1990) specific drivers identified within these categorisations may vary across different studies, since the characteristics are subjective and dependent on the adopters perception. Table 6-1 summarises the multiple factors influencing the decision to upgrade based on the three categories.

Table 6-1: Summary of upgrade drivers

Context	Categorises	Drivers
Environmental	Vendor dependency	Attain continuous vendor support
		Leverage latest technology
	Trust in consultants	Consultants' knowledge
		Consultants experience
	Compliance	Comply with legislative guidelines
		Implement national standards
		Acceptable structure and mode of operating
Organisational	Cost considerations	Reduce maintenance Costs
		Licensing fees
		Infrastructure costs
		Testing and reapplication of modifications
	Management strategy	Merge systems across the organisation
		Management philosophy
		Continuous improvement
		Standardise functionality
		Business continuity
	Strategic direction	Automate existing business processes
		Restructure business processes
		Consolidate business processes
		Consistent system architecture
		Integration of different systems
Technological	Relative advantage	Reduce maintenance costs
		Improve usability
		New functionality
	Compatibility issues	Stability
		Reliability

6.2.1.1 Environmental Context

This context represents those factors initiated by entities outside the organisation such as vendors, consultants, collaborators, and government agencies. Usually, environmental drivers are time sensitive, requiring organisations to undertake an upgrade within a specific timeframe. The findings of this research suggest that the environmental factors influences upgrade decisions and explain that organisations actively seek information about new releases from the vendors and consultants. Though there are several environmental factors, the three main drivers are vendor dependency, compliance, and trust in consultants, were identified to have significant influences on the upgrade decision; these are explained next to elaborate on their influence.

I. Vendor Dependency

This research's findings suggest that many organisations that opted not to upgrade their systems, did not receive support in a timely fashion or had to pay high premiums to get support from the vendors. This argument intensifies the findings from earlier studies (Khoo & Robey, 2007; Claybaugh, 2010; Otieno, 2010; Dempsey *et al.*, 2013) on the role of vendors in upgrade decisions. Therefore, it can be argued that vendors influence the decision to upgrade from two perspectives; first by withdrawing support for older versions, organisations are given no choice but to upgrade their systems in order to maintain continuous support. Secondly, vendors promise functionality and technology enhancements including improvement to the underlying code and system architecture with every version release. Thus, in order to leverage these new technologies and features, organisations opt to upgrade to the latest version. Yet, these frequent improvements can be viewed as a tactical move by vendors to lock-in their customers (Kremers & van Dissel, 2000). Nonetheless, it has resulted in some organisations opting to upgrade even when the new version does not offer any improvements or benefits, in order to ensure they are within the vendor's licensing and support agreement.

II. Trust in Consultants

The findings suggest that most organisations call upon consultants' knowledge and expertise during upgrade discussions to gain relevant and timely information, relating to the new version in order to support and guide their decisions. The perception is that consultants can provide detailed functionality descriptions, in a manner that organisations can comprehend easily. In order to be effective, the data indicates that many organisations utilise the same set of consultants for many different projects including upgrades. As a result, trust and good working relationships are formed, which according to Ehie & Madsen (2005) is the key to reaching effective decisions in complex project situations. Thus, the collaboration facilitates avoiding potential pitfalls, risks and minimise business disruptions associated with upgrades. However, some organisations in this research, which were encouraged to adopt outdated tools, such an ordeal resulted in the organisations losing trust in their consultant's abilities and experience. Though this research draws similar conclusion to those observed by Claybaugh (2010) and suggests that consultants play a critical role in influencing upgrade decisions. It argues that the level of influence depends on how much confidence the organisation places on the consultants' advice. Thus, it suggests that when using consultants it is important to exercise caution; one possible way is to determine where and when it is appropriate to use consultants during ES upgrade projects, in order not to lose control of critical upgrade decisions.

III. Compliance

Organisations upgrade their systems in order to comply with legislative mandates and constraints imposed on them, to ensure the systems are consistent and transparent. Additionally, organisations in regulated and centrally governed environments such as educational and banking institutes opt to upgrade in order to be operating within the acceptable standards and regulations. This findings concurs with the argument raised by Khoo (2006), which asserts that organisations in controlled environments upgrade their systems in order to keep up with centrally governed policies. However, not many studies have considered compliance as a contributor to upgrade decisions; one possible explanation lies in the frequency with which these legislation changes are applied to the systems (at least once a year). Thus, the implementations of these changes are considered to be routine tasks and can be accomplished by simply upgrading certain rules sets and attribute through a process known as patching. This explanation differs from the suggestions proposed by Kremers & van Dissel (2000) who mentions compliance as a technical upgrade. One explanation for this difference is that the level of planning when implementing legislative changes is minimal when compared to upgrading critical technical and functional aspects of the system. Even though compliance does not result in any changes to functional aspects or technical aspects of the system, this research regards it as an important attribute to consider during upgrade. The reason for taking this stance is that many organisations identified complying with legislative changes as a critical attribute that triggered the need to upgrade their systems.

6.2.1.2 Organisational Context

Organisational attributes are internal drivers that define the need to upgrade; these are initiated to support organisations to achieve certain business needs. This research's findings advocate a similar stance to Claybaugh (2010) that an organisation's characteristics can either facilitate or inhibit upgrade decisions, depending on the stakeholders' stance. The following costs, management support, and strategic direction were identified to have significant influence on the upgrade decisions, these drivers are discussed next.

I. Cost Considerations

Cost is considered as an important attribute when making upgrade decisions, but as explained by Tornatzky & Klein (1982) it is a relative characteristic that differs from one organisation to another. For example, high initial upgrade costs can lead to postponing the upgrade, however the consequences of such action is an increase in operational costs, which Glass & Vessey (1999) estimate it to be 25% of initial implementation costs. While opting to undertake an upgrade could cause the organisation to incur an initial upgrading costs ranging from 20% to 35% of the initial implementation costs (Swanton, 2004; Otieno, 2010). Cost has been a consistent theme and considered as a core factor when considering upgrade decisions. The main arguments raised by the respondents who participated in this study implied that upgrades will facilitate reduction of maintenance costs, such findings are in line with suggestions that upgrades are undertaken to minimise maintenance costs (Davenport, 1998; Dempsey *et al.*, 2013). The upgrade costs includes licensing fees, infrastructure, consultants, testing, and reapplication of modifications (Swanton, 2004; Zhao, 2007). In this research, there were instances in which organisations opted not to take full advantage of the new version, because the return on investment could not be justified.

Therefore, it can be argued that organisations become more content with the older version when initial upgrading costs become reasonably high. Alternatively, when net effect of the proposed changes outweighs investment costs, organisations tend to take advantage of the new version features and functionality. In other words, opting to upgrade reduces the overall operational, management and maintenance costs. While Dempsey *et al.* (2013) explain how annual operating costs reductions could be achieved when utilising the corporate licenses when upgrading the system. This research's findings portrayed that operating cost reductions could be achieved through aligning the systems to a consistent architecture and replacing modifications with standard system functionality when upgrading. Even though, the findings did not highlight if any costs reduction actually occurred after upgrading and neither identified a mechanism to establish cost reduction. The study's finding in respect to costs differs with suggestions from Dempsey *et al.* (2013) as they advocate that initial upgrade costs act as an inhibitor to upgrade decisions. Whereas in this research, it is suggested that costs can either influence or obstruct the decision to upgrade, depending on the different perspectives when considering upgrades.

II. Management Strategy

When contemplating ES upgrades, management focuses on understanding limitations of the existing systems in respect to the organisation's goals. Beatty & Williams (2006) and Olson & Zhao (2007) stress the importance of management in influencing upgrade projects, by mentioning top management support as one of the success factors for upgrade projects. However, they argue that the level of support is different when compared to implementation projects. The findings support these arguments and suggest that top management involvement plays a significant role during ES upgrades, though their involvement is minimal during upgrade projects. However, when the need to upgrade resulted from top management influence, these projects received full support in terms of resources and time to complete the project. In cases where management support was not attained, the scope of upgrade became limited, resulting in high level of trade-offs, and short duration assigned to the project. Hence, it became difficult to achieve the objectives, which affects the upgrade justification and possibly leads to either postponement of the upgrade or only undertaking a small portion of the upgrade.

The management support level during upgrade aligns to what Seibel *et al.* (2006) calls persuasive upgrade, which implies an upgrade would be undertaken when influenced by either an internal or external force. Hence, it can be argued that most organisations are guided by informal management strategies, which influence the decision to upgrade, for example opting not to upgrade immediately when a new version is released, as they do not want to be the 'leading edge' technology adopters. This is consistent with the suggestion by Khoo & Robey (2007) that it is not necessary to upgrade whenever a new version is available, as vendors support more than one versions. However, according Otieno (2010) it is common practice for vendors to withdraw support for older version after a certain period, thus upgrading an ES is unavoidable. Therefore, the fundamental questions most decision makers ask during upgrade decision is when to upgrade, and the study findings suggests that management involvement is critical when determining the upgrade timing. In addition, when management supports the upgrade, there would be sufficient resources and finance to make sure the project is successful and justifiable.

III. Strategic Direction

Organisations operate in an ever changing and competitive environment, which makes it necessary to adapt their ways of operating, in order to ensure improved performance. In addition, due to continual mergers and takeovers organisations turn to technology for supporting their business vision, objectives, and processes. However, over time these systems require effective management and maintenance of functionalities that ensure improved performance and efficiency. This aspect is regarded as business continuity, which also entails addressing issues within the existing infrastructure and operations such as data migration, upgrades, training, and systems integration. Due to the planned direction organisation would determine new requirements that support their medium to long-term plans, and based on these requirements assess the new version to determine how it supports improving efficiency and performance through the functionality and features offered.

Based on this research's findings, most organisations review their business processes and add new functionality as part of their upgrade plans. Consequently, filtering repetitive processes and improving existing or adding new processes to improve efficiency and performance. Thus, supporting an explanation by Ng (2006) who suggested that upgrading will provide a platform to evaluate existing business operations and system performance. Hence, upgrading assists business continuity and competiveness, yet this is only viable when upgrades occur in a timely manner. Kremers & van Dissel (2000) postulate that undertaking upgrades in timely manner provides higher gains and differentiate the organisation from competitors. Though the findings did not indicate any competitive advantage gained after upgrading, a possible explanation is that most of the projects had smaller scope, therefore it was difficult to measure the gain in competitiveness. However, having a smaller scope allows to define clear and achievable objectives, which support specified requirements and according to Loh & Koh (2004) would decrease the chances of failure. The organisation's requirements and goals with its justification, plays a critical role in upgrade decisions, specifically when the upgrade would not fulfil the requirements, this can result in the organisation postponing the upgrade. As an alternative it is also possible to abandon the existing system altogether, depending on how the new version functionalities and features fulfils the organisation's goals. Thus, agreeing with the explanation drawn from Otieno (2010) that organisations could opt to replace their existing systems instead of upgrading to a newer version, when the new versions would not fit their needs. However, this research scope was limited only to same version-to-version upgrade, hence did not concentrate on factors that led to upgrading to a different system.

6.2.1.3 Technological Context

There are several advantages gained by upgrading, such as new features and improved productivity, but it also introduces challenges due to different technological platform imposed on the system. The changes may provide better agility and flexibility but may not be compatible with existing version, hence making the system landscape unstable and increasing the chances of disruptions. The next sections address compatibility and the relative advantage, which were identified to have significant influence on defining the need to upgrade.

I. Relative Advantage

The frequent change in business structures and processes, dictate the need for newer functionality and better technology that can enable expansion and integration with other systems. These expansions lead to many other challenges, for example the need for new functionality and a common platform among the different systems. Many organisations add new functionality by modifying the existing system's underlying code. However, this approach introduces major technical challenges, which result in bugs and performance degradation (Beatty & Williams, 2006). Hence, some organisations opt to upgrade their systems as a mechanism to gain additional capabilities and features introduced by the new version. This research's findings highlighted that upgrading allowed reviewing of existing processes, in order to improve standardisation and automation. Additionally it suggested that through replacing legacy systems, the majority of the support personnel time and efforts were directed towards facilitating the discovery and refinement of business processes.

Additionally, this research's findings highlighted that as organisations acquired or merged with other entities, a new challenge of ensuring that the different systems are working in cohesion with each other was introduced. This dictated the need for redefining the processes along with consolidation and integration of the systems into a uniform system architecture, which allows for more transparency and greater accountability. Thus, organisations opt to upgrade to take advantage of the improved technologies to support the integration and consolidation of these systems. However, this requires evaluating the new version's improvements and impact prior to upgrading, these processes are represented in UDSM as the EVALUATION phase, which is explained in section 6.2.2. In addition, the business users can identify features and functionality that help streamline certain processes. However, if these requirements are not supported in the existing versions, then it presents an opportunity to consider upgrading to a new version, if it supports these requirements. Hence, the proposed requirements would be evaluated against the new version's functionality to measure if it supports business users' demands. Thus, upgrading provides a platform where organisations can merge their business processes and simplify procedures in order to leverage new version capabilities and features. However, based on the assessments and evaluations of the new version, there is a possibility that utilising the older version is more advantageous, specifically when the new version does not demonstrate any benefit to the organisation.

II. Compatibility

The different changes imposed on the system require rigorous testing to guarantee that the systems are operating with minimum interruption and performance is not affected, hence assuring the systems are stable and reliable. There is a significant difference between an existing version and the new version, especially in the system components, which can lead to disruptions particularly when not compatible with existing modifications. This result in the majority of the workload to be associated with testing and resolving compatibility issues. Beatty & Williams (2006) mention testing as one good practice that organisations' should adopt when performing upgrades. Not surprisingly, this research's findings suggest that testing is one of the main steps during upgrades and several different testing strategies are utilised to ensure systems operate as planned. This involves identifying and proposing mechanisms to address all the changes in code and the systems components, which introduces compatibility issues. Depending on the level of the modifications and effort required to address these issues, the organisation will assess if it is feasible to move ahead with the upgrade.

6.2.2 Evaluation Phase

The findings highlight the importance of evaluating the existing system, in order to establish the 'as-is' operational state of the system. This includes evaluating the pre-existing functionality to confirm that they are not disturbed or removed and establish the level of modifications applied to the existing version. Then the upgrade team can evaluate how the changes in the new version will influence the current landscape by comparing and assessing the ‘as-is’ output against the proposed changes. As part of upgrade decision-making, the different processes in the evaluation phase enable the organisations’ to identify if the new version will meet the set requirements. Additionally it will involve assessing business processes to determine which should be changed or made obsolete, and estimating the effort required to undertake the upgrade. Accordingly, the evaluation phase involves determining if there is a necessity to introduce new modifications and bolt-ons to support the required functionality, specifically when the new version does not support the business requirements. This stage reveal similarities to the strategizing category proposed by Riis & Schubert (2012) in their transition process ecosystems, which demonstrates the importance of understanding the new version benefits, functionality and fit to requirements. The output from the evaluation phase would facilitate selecting the right upgrade scope, which could be to include either a technical, functional or a combination of both upgrade strategies. The evaluation phase is further divided into two processes that enable to assess and weigh the different features and functionality, including their impacts as part of the upgrade decision process; these two processes are explained next.

6.2.2.1 Objective Assessment

This process focuses on obtaining a detailed understanding of the problem through scoping the existing landscape. This also includes measuring the value propositions of the proposed solution and communicating it across as requirements and plans of actions. The objective assessment process comprises of three sub-processes, namely technical analysis, functional analysis, and impact assessment; the next sections explain these sub-processes in detail.

I. Technical Analysis

Technical assessment makes sure that all pre-existing functionality will not be disturbed, and provides a frame of reference to measure and compare against proposed changes. This will include obtaining a present operational scenario to establish the level of modifications introduced to the system. Generally, the technical leads are responsible for performing the analysis with the support from the database and systems' administrators. Technical analysis encompasses analysing the data dictionary objects structure and evaluating individual coding areas. One of the strategies used is regression testing which aims to validate and evaluate transactions, business rules, and existing modifications. This will assess that none of the existing functionality are disturbed and determine if proposed features affect existing modifications. The output would identify which modifications are no longer required, such information feeds into the upgrade decision, since it outlines the achievable objectives.

Additionally at this stage, the underlying technology would be analysed to validate compatibility of the operational system with respect to proposed changes. Compatibility issues normally arise when existing modifications and functionality do not accomplish their intended purpose due to either introduction of new technological architecture or features. This includes modifications undertaken elsewhere in the system that can affect new functionally; as a result, there is an increased need to reapply modification. When compatibility issues exist, upgrade costs increases due to both increased testing requirements and additional effort required to reapply modifications. As such, supporting the suggestion from Beatty & Williams (2006) that in order to take full advantage of upgrades, organisations need to assess their IS infrastructure to ensure compatibility to the new version. The evidence highlighted that compatibility issues increase workload and costs, thus, it is important to perform technical analysis prior to making upgrade decisions. This will allow the determination of whether it is worth pursuing a full upgrade or not, especially when major modifications have been applied.

II. Functional Gap-Fit Analysis

As new version offers features and functionality, comparing these enhancements to existing versions expedites the identification and mapping of new features and understanding what changes will reflect the business needs. Therefore it is important to research about the required changes, processes and configurations to assess their effectiveness, and analyse how this would impact its operation with the new version (Goldstein, 2006). Mostly the functional leads and business users are in charge of the functional-gap analysis; however, the chief information officer and systems analysts support them. This research's finding suggests that conducting a functional gap-fit evaluation will facilitate taking advantage of functionality improvements. Several methods have been identified, as a means to perform gap-fit analysis, one of the methods is to consult vendor documentation. This research's findings concur with the explanation from Zarotsky *et al.* (2006) as both studies conclude that vendor documentation neither offers a subjective evaluation of the changes nor outlines the additional features. At best, it serves as a good starting point for understanding the key selling points of the new version but not an ideal tool to support a detailed explanation of how to best leverage the enhancements.

Other methods mentioned, as a means to supplement this shortcoming was to invite vendors to present their new version, this gave an opportunity to question vendors about the proposed improvements. Yet, some organisations suggested that vendors did not present a critical evaluation of all enhancements, such that the exercise became more of a marketing opportunity. As an alternative, some organisations used consultants, to provide explanation of additional features to help align organisations' perceptions against their expectations of the new version. Consultants actively educate organisations about the changes in the new versions; this includes highlighting achievable benefits when opting to adopt the new version. This enables fostering coordination between consultants and the organisations; however, the main concern was not to become overly reliant on consultants. Another method is mapping requirements against new version functionality and its impact, using a decision matrix; then scoring these attributes against each other. The scoring mechanism would depend on the organisation, for example, some have used weights for prioritising important requirements that support business continuity. The identification of benefits introduced by adopting new features highlights the usefulness of upgrading, especially by presenting easily understandable benefits to the decision makers.

The evidence posits that evaluating the existing system is an important aspect before reaching upgrade decision, as it allows strategizing for appropriate training needs and effort in advance. Ng & Gable (2009) proposed an upgrade assessment and recommendation report to perform gap-fit analysis which evaluates new functionalities with respect to organisational requirements. Utilising a similar gap analysis technique, could provide detailed explanation of functional enhancements which when incorporated in the decision-making process would allow planning for testing and user acceptance challenges. Yet, the observed trend highlighted that no formal mechanisms were utilised and most of the assessment was done using experience and knowledge acquired through networking with colleagues, or utilising the expertise of consultants or other experts and exploring formal documentation. However, most organisations combined more than one approach to analyse the functional gap effectively, hence overcoming the shortcomings in each approach.

III. Impact Assessment

In order to prepare a strong business case, it is vital to understand how these changes will disturb existing business processes. Since it will facilitate identifying challenges introduced by the proposed changes and provide a detailed view of systems' functionalities. The impact should be measured from different perspectives that is users, support team and system performance (hardware and software). Generally, the technical and functional leads, with the support from user representative, databases and systems administrators, will perform the impact assessment. Estimating the impact prior to deciding to upgrade allows identification of the effort required for supporting the process, which is dependent on the availability and allocation of resources. Thus, this research shares the view proposed by Khoo & Robey (2007) study, which suggest that resources do not dictate upgrade decision processes. Yet, the findings posit that there is a relationship between the upgrade scope, resources (financial and human), and impact on the existing system landscape as illustrated in Figure 6-4.

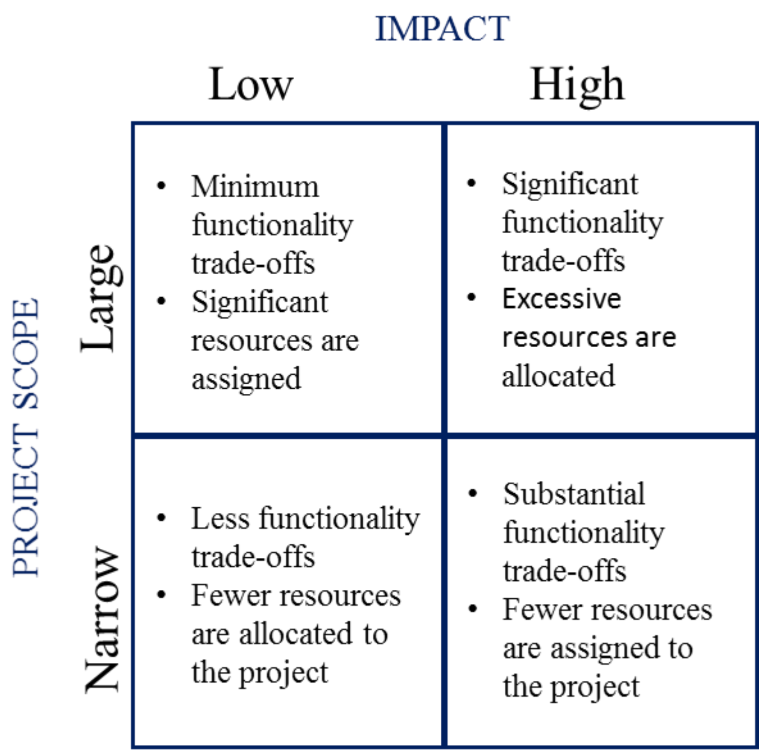

Figure 6-4: Relationship between impact, resources, and project scope

From the above figure, it can be explained that when the impact is high it is likely to cause more functionality and features trade-off. For example, consider the following scenario, when there is an external push from the vendor to upgrade, on the other hand it has been identified that the upgrade impact is high. The organisation limits the upgrade scope by significantly reducing the functionality and features that will be adopted, thus fewer resources would be allocated to the project, regardless of the high impact estimate. However if the upgrade is considered necessary, large amount of resources would be made available to the project, regardless of its scope and impact. This relationship between resources, project scope and impact supports the premise that the decision to upgrade requires contemplating trade-offs and adjustments needed at project inception, as this will define the level of effort and resources required.

Additionally impact assessment aims to minimise downtime and disruption, by identifying and incorporating strategies that would help overcome possible upgrade challenges. One of the strategies proposed by Dor *et al.* (2008) is an algorithm, which assisted non-technical experts evaluate the impact of the new version and provide an estimate of the efforts required to support the upgrade. The findings of this research reveal no evidence of organisations using any specialised tools to measure impact, apart from testing tools, which the consultants or vendors provided. One common strategy mentioned was volume testing and sizing, which helped determine the impact on the hardware and other supporting systems. Volume testing and sizing refers to testing the systems with a large load of data to measure the hardware performance and input/output capacity of the existing hardware and supporting systems. Another technique used for impact assessment is known as risk based testing; this kind of assessment measures the likelihood of changes occurring on other systems areas and identifies possible strategies that will be put in place to overcome these challenges. These arguments supports Whang *et al.* (2003) findings, which indicated that changes to the hardware and supporting systems occur during ES upgrades. Therefore, based on this proposition, impact assessment has to be carried out before the decision to upgrade is undertaken. Arguably, the cost for taking such testing strategy may not justify its application during pre-upgrade decisions. Yet, knowing the performance of the hardware and supporting systems at the earlier stages, allows catering for required changes into the business case.

Since these changes will increase the costs, efforts and duration of the upgrade, and most importantly it will be very costly to realise the need for these changes once the upgrade is underway.

6.2.2.2 Strategy Selection

Selecting the right upgrade strategy is an important aspect in the upgrade decision-making, as it helps to provide justification for the upgrade. Most organisations would decide on the scope before identifying which approach best suits the allotted project duration, the approaches either could be big-bang or phased. Zhao (2007) indicates that 67 organisations in their study opted for a big-bang approach as their upgrade implementation strategy. In contrast, this research's findings suggests that the ideal upgrade strategy was phased approach; because not only do vendors recommend it, but it also allows upgrade projects containment into a manageable size with achievable deliverables. The reason for this shift in preference is not clear, but possibly most organisations in earlier studies were several versions behind vendor's version release cycle, while during the undertaking of this research probably most organisations were either one or two versions behind. Thus, did not require to implement several versions at once, in order to catch up with the latest vendor's version.

The interaction of different upgrade drivers plays an important role on upgrade decisions specifically on selecting the upgrade strategy (Figure 6-5). The correlation between drivers and scope reveal characteristics that symbolise two kinds of influence that is direct and indirect influence. Direct influence means that one attribute openly sways the selection of a specific upgrade strategy, for example, dependency on vendor results in a technical upgrade. Generally, a technical upgrade ensures that the systems are consistent with vendor release cycles in order to assure continuous support and management of licensing agreements.

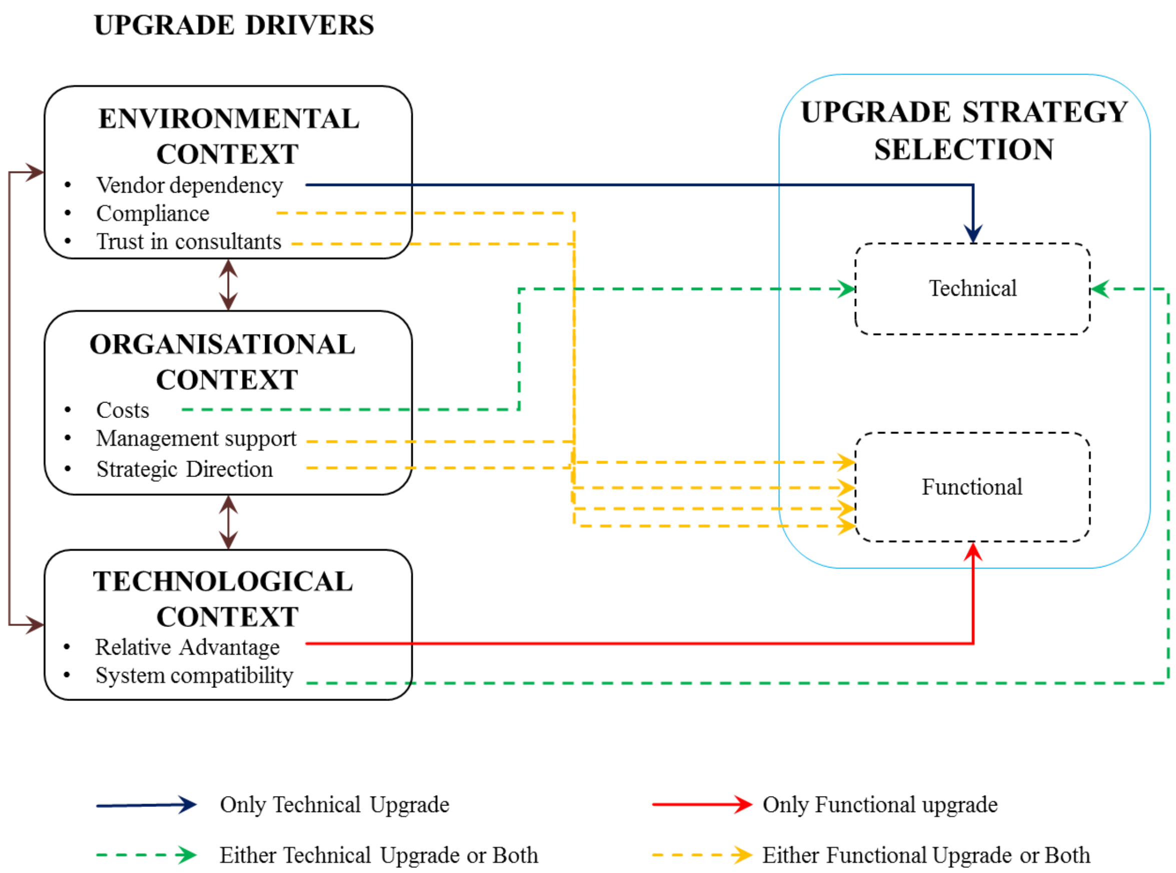

Figure 6-5: Relationship between upgrade drivers and scope

Indirect influence occurs when one upgrade driver category results in performing either a technical, functional upgrade or both upgrades. For example, if the upgrade goal is to ensure that the systems are up-to-date and take advantage of latest functionality, then a technical and functional upgrade may be commissioned. Functional upgrade, involves implementing functionality offered in the new version, normally undertaken in response to business users' demands and change in processes. In this instance, functional upgrade would have greater impact as it will introduce processes and functionality improvements. The combination of both upgrades is undertaken when there is a need to support business continuity through new features but the underlying system's technical platform cannot support these changes. Such a situation creates a necessity for undertaking the technical upgrade prior to functional upgrade, in order to ensure the system can support the functionality changes proposed. Thus, supporting the explanation from Parr & Shanks (2000) that upgrade strategy selection is determined by the interaction of several attributes and their characteristics.

6.2.3 Upgrade Decision

Upgrade decisions are complex; however, drawing from decision theories it is suggested that assigning weights to indicate the degree of influence of each attribute could reduce the level of complexity. Even though some aspects of functionality evaluation were measured by assigning weights to the requirements, there was no detailed explanation of any formal methods utilised for measuring the degree of influence. One possible reason could be associated with the fact that such analysis are regarded to as computational tasks, and is only performed when there is uncertainty (National Research Council, 2001). Yet, most organisations did not encounter any uncertainty; hence, they did not need to compute the level of influence. However, the extension of the proposed model to include mechanisms that identify the degree of influence of these multiple attributes on upgrade decision can help streamline the decision-making process.

Additionally, the gathered data suggests there are only two key ES upgrade strategies that is technical and functional upgrade. However, due to the organisation goals and direction there is a possibility to incorporate both upgrades at the same instance. This combination of technical and functional upgrade (Figure 6-6) is regarded as an alternative upgrade strategy that aims to achieve the long-term objectives and organisation needs. These findings concur with the suggestions by Dempsey *et al.* (2013) that there are two kinds of upgrades, that is technical and functional upgrade.

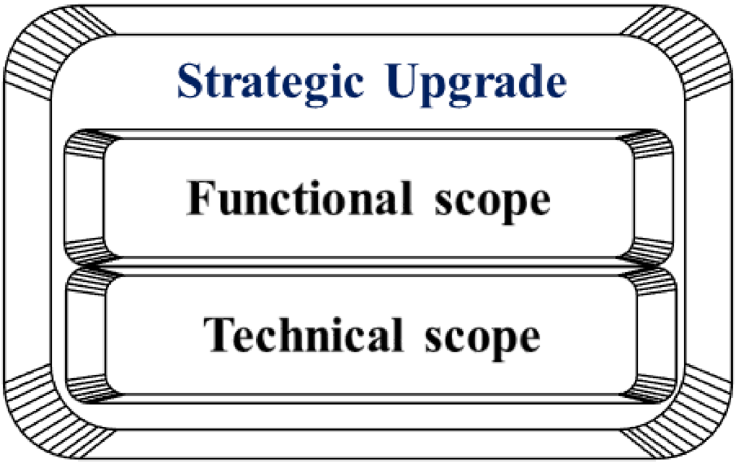

Figure 6-6: Upgrade scope super imposition

However, this does not imply that organisation strategic direction would always result in undertaking both upgrades, as sometimes undertaking of one of the options would suffice. For example, if the need were to ensure operational costs are reduced, then undertaking a technical upgrade would ensure the system is consistent with the vendor release cycle, thus lowering licensing and maintenance costs. The above explanation implies the decision would be either to undertake a technical or functional or both upgrades or possibly postpone the upgrade, depending on the factors influencing the need for upgrade. Table 6-2 provides a summary of a decision table demonstrating how the different drivers, analysis output influence the selection of upgrade strategy.

Table 6-2: Upgrade decision table

	High	Medium	Low
Modification	P	T	F
Initial upgrade costs	T	F	B
Technical stability	F	F	T
Functionality fit	F	T	P
Impact and risks estimation	P	T	F
Features trade-off	T	F	F
Resources availability	B	F	T
Business process change	P	T	F
Compatibility issues	T	F	B
External influence	T	B	P

P – Postpone
T – Technical upgrade
F – Functional upgrade
B – Both (functional and technical)

In addition, Figure 6-7 provides a visual representation that demonstrates the interaction of these different drivers and suggests why certain upgrade strategy would be preferred.

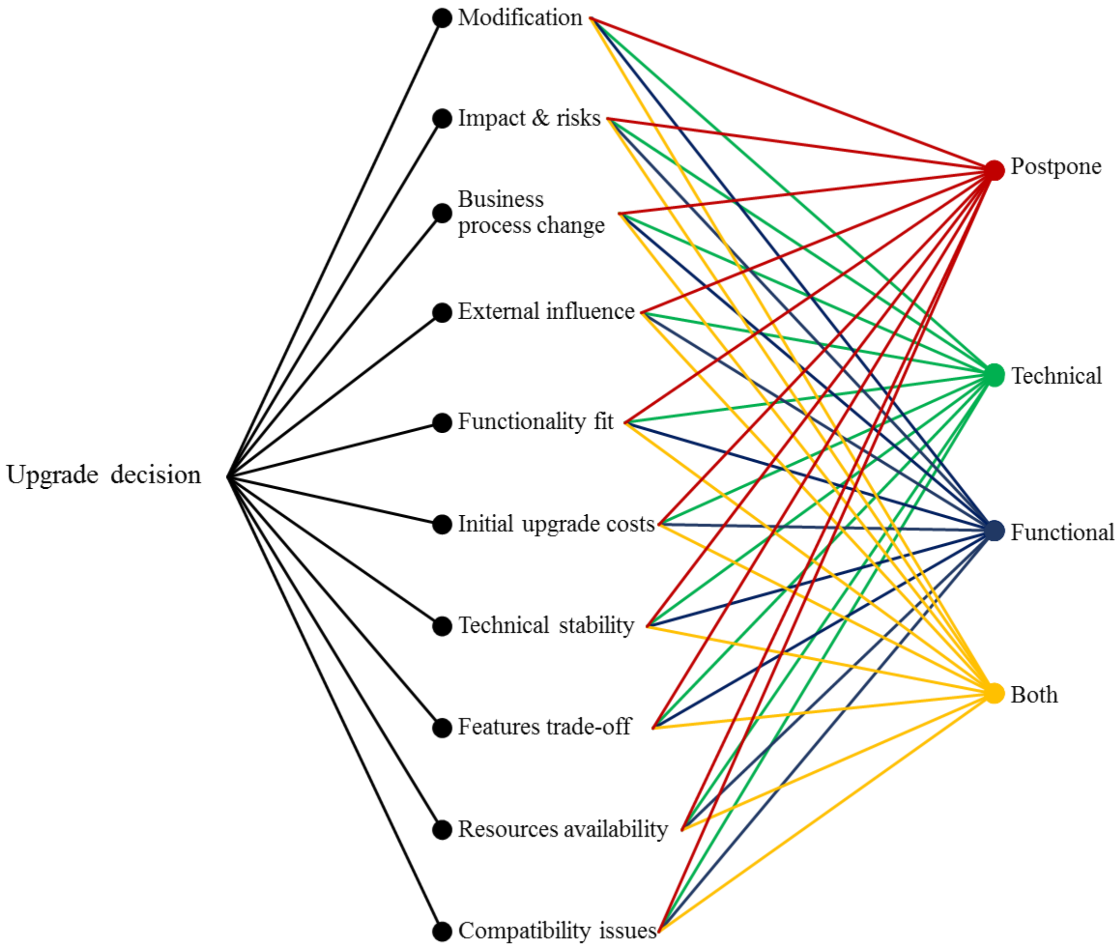

Figure 6-7: Influences on upgrade strategy selection

The decision table demonstrates that the decision to upgrade would result from balancing the upgrade need along with the impact, technical stability, and functionality fit. As a result, three possible pathways are proposed in UDSM; however, there is no particular order of executing the processes. Hence, the upgrade team can opt to start with upgrade strategy selection, followed by objective assessment or vice versa. This is described as the mechanics of the model, which outlines the three logical pathways that can be followed in the proposed decision support model (UDSM).

6.2.4 The Model Pathways

Generally, the need to upgrade can suggest a preliminary upgrade strategy to be adopted, which in return influences the choice of the logical path to be followed. When the upgrade strategy is known, then either a technical or a functional pathway would be followed. However, the number of activities that will be executed in the OBJECTIVE ASSESSMENT process would differ depending on the pathway selected. In situations where the preliminary upgrade strategy is not predetermined, then the objective pathway is followed, and the output determines the upgrade strategy to be adopted. The next section provides an explanation on the different pathways, including the processes and sub-processes performed in each pathway.

6.2.4.1 Technical Pathway

In the technical pathway, only two activities from the OBJECTIVE ASSESSMENT process are executed, these are technical analysis and impact estimation. Figure 6-8 illustrates the processes that will be performed, denoted by the green lines. Thus, in this pathway, first the initial upgrade strategy would be defined as a direct output from the interplay between the different upgrade drivers (mostly environmental and technology drivers). Thus, the preliminary upgrade would be defined as technical upgrade, which triggers the TECHNICAL ANALYSIS activity to be performed, followed by IMPACT ASSESSMENT. The output from these two sub-processes would outline the deliverables, effort, and resources required to achieve the upgrade goals. The flow of events described above between the two phases and processes in UDSM are shown as numbers 1- 4 in Figure 6-8.

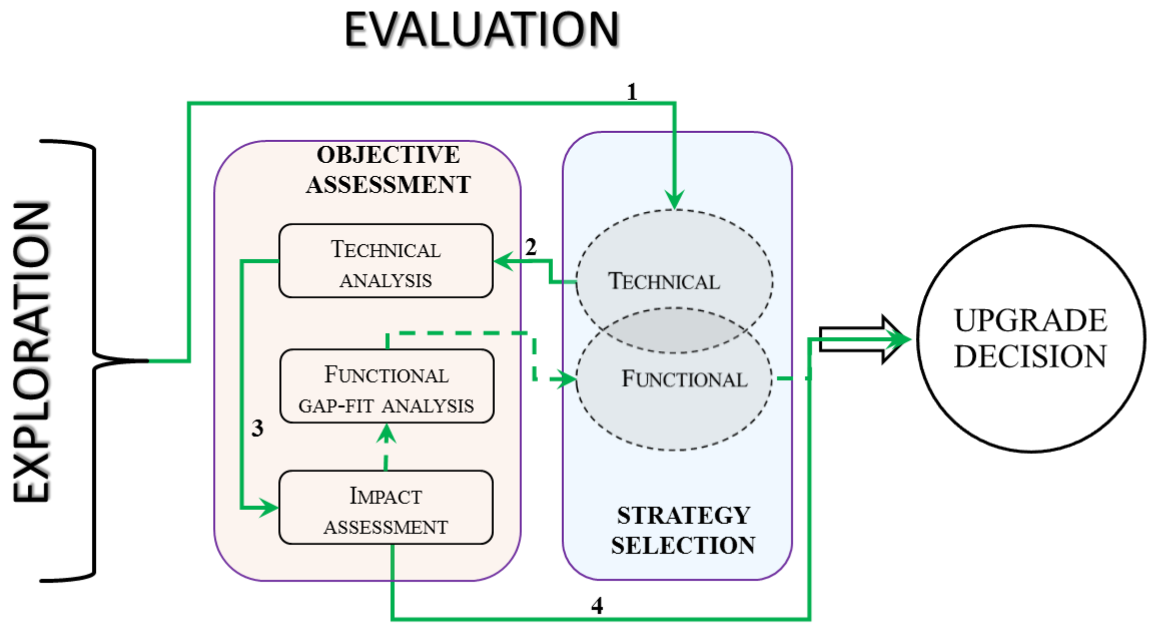

Figure 6-8: Technical pathway

However, in very few instances a technical upgrade may disturb some of the systems objects, such as user interfaces, which could introduce a necessity to upgrade the system functionality. The IMPACT ASSESSMENT will determine if the changes are significant to warrant a functional upgrade and if the output deems it necessary then the FUNCTIONAL GAP-FIT ANALYSIS will be executed. Based on the outcome from gap-fit analysis, the features and functionality that needs to be implemented would be specified. The dotted green lines denote the change in flow of events when such as situation occurs. Even though the occurrences of such instance are rare, it demonstrates the importance of undertaking an impact estimation prior to making the decision to upgrade.

6.2.4.2 Functional Pathway

Similarly, in the functional pathway, the upgrade strategy is predefined as a functional upgrade. Therefore, all the sub-processes in the OBJECTIVE ASSESSMENT will be executed in the order illustrated in Figure 6-9. The reason for undertaking all the sub-processes is to ensure that the system architecture and infrastructure are technically capable of accommodating the functional changes. In addition, it would also facilitate determining the impact that will be introduced by the new version's features and functionality to the existing system landscape.

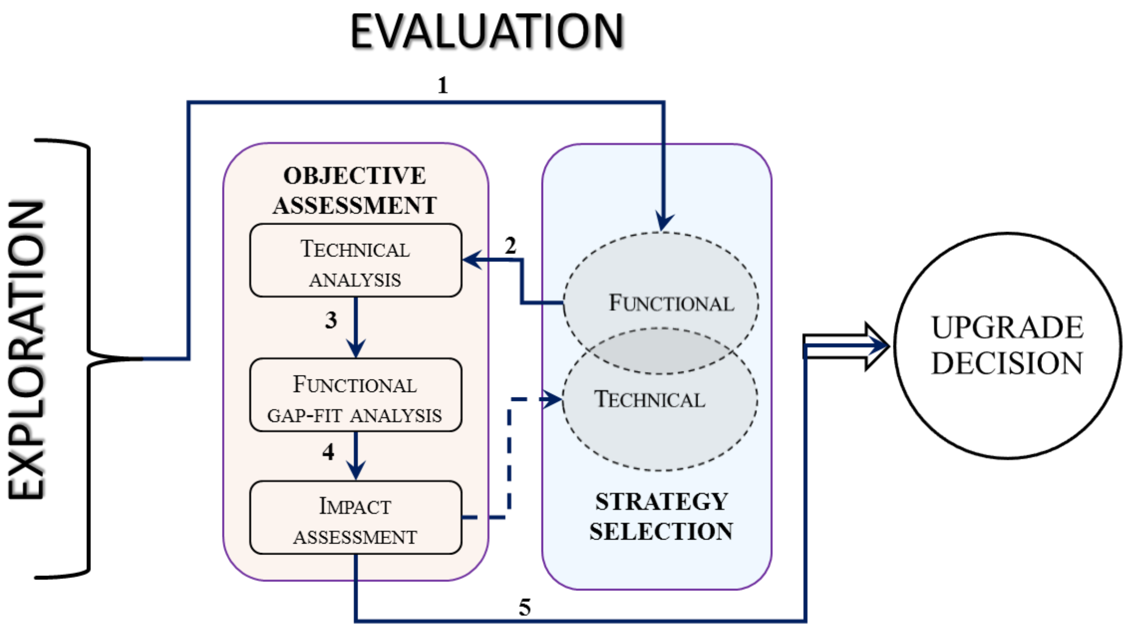

Figure 6-9: Functional pathway

There are three possible outcomes from this pathway, which is either to continue with the preliminary upgrade selection or to expand the upgrade scope to include technical and functional upgrades or to postpone the upgrade. The outcome from this pathway relies heavily on the output from the TECHNICAL ANALYSIS, for example if the underlying system is determined to be technically stable, then only a functional upgrade will be performed.

6.2.4.3 Objective Pathway

In the objective pathway, the upgrade strategy is not predetermined; hence, the OBJECTIVE ASSESSMENT process will be performed first. The flow of events would start by determining the need to upgrade, followed by conducting TECHNICAL ANALYSIS, next the FUNCTIONAL GAP-FIT ANALYSIS is executed, followed by IMPACT ASSESSMENT; based on the output from these sub-processes, the upgrade strategy will be selected as illustrated in Figure 6-10.

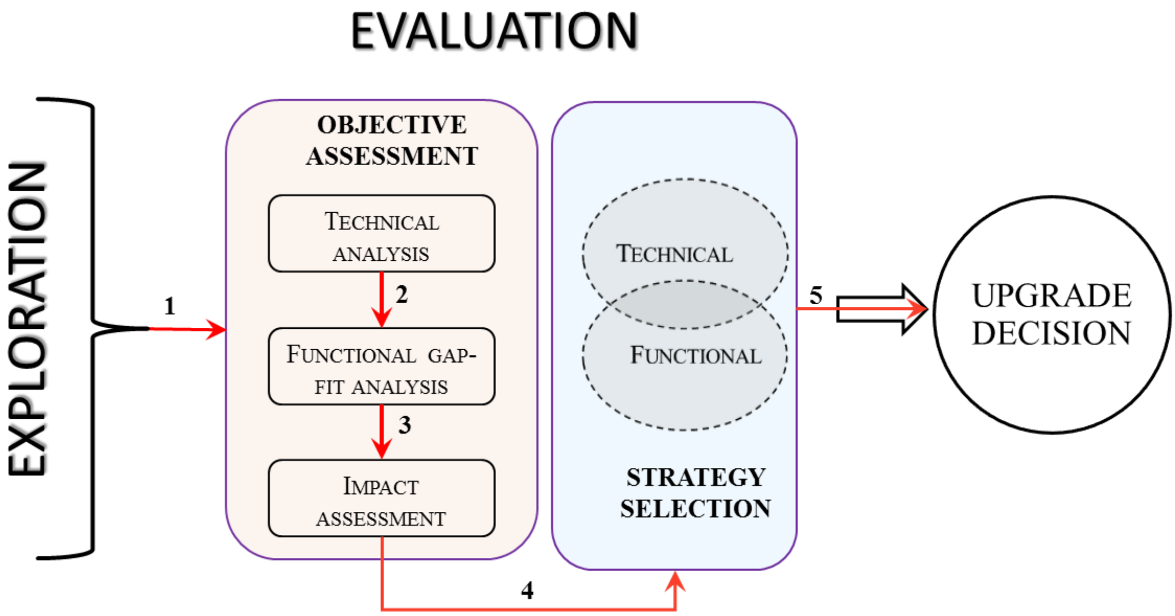

Figure 6-10: Objective pathway

There are four possible outcomes from the objective pathway that is either a technical or functional or both upgrades or deferring the upgrade. The outcome relies heavily on the output from the TECHNICAL ANALYSIS and FUNCTIONALITY GAP-FIT ANALYSIS. For example, when the underlying technology is stable and can accommodate the imposed changes, thus, the decision would be to perform a functional upgrade only; but if the underlying infrastructure cannot support the proposed changes, than both technical and functional upgrade would be required. Normally, when undertaking both upgrade strategies a phased approach is preferred; though, it is recommend that the duration between the two upgrade approaches should be significantly short, preferably before the next version release cycle. On the other hand undertaking both upgrade increases the upgrade scope and costs, hence the decision may be to adjourn the upgrade to a future date. Yet, there should be a clear agreement on how long to wait before undertaking the upgrade, since the operational costs for supporting an older version would probably increase.

6.3 UDSM Evaluation with Respondents

In order to evaluate the proposed model's acceptability, significance, and applicability as explained in section 4.3.1.1; UDSM was presented and discussed with 10 respondents from 7 different organisations. The aim of this step was to gather the respondents' opinions and perception of the proposed model based on their personal and organisation's upgrade project experience. These respondents were not selected from the initial data collection pool of respondents in order to gauge the proposed UDSM applicability, significance, and acceptability in relation to their organisations ways of approaching the upgrade decision. Therefore, it offered an alternative mechanism to evaluate the interpretation of the findings. The respondents were involved in more than two ES upgrade projects, which allowed the respondents to draw on the lessons learned from previous upgrade projects when evaluating the model. These respondents have diversified roles in their respective organisations, representing functional, technical and management aspects of the upgrade project, and all were actively involved in the upgrade decision-making process.

All the respondents strongly agreed that the concepts and the flow of processes presented in the UDSM made sense and confirmed that the model was practical. Although the respondents could easily identify with the drivers for upgrade, there were suggestions that some 'touch points' that are purely financial in nature were not given the right level of emphasis. One expert explained that, the return on investment has a significant influence on the decisions to upgrade, specifically since the initial upgrade investments are high. While another expert, suggested that the environmental factors only considered semi-static variables, as the type of ownership influences some organisations. For example, in venture capital organisations most of the decisions are influenced by the financial gain hence such organisation only define short to medium term organisational needs. These opinions confirm the findings of this research with respect to costs, as a critical driver for upgrade decisions.

In addition, it was pointed out that security issues were not reflected as one of the major drivers for upgrade. One of the respondents mentioned there are many occasions in their organisation where security threats have resulted in systems and infrastructure upgrade. Perhaps, security can be consider as a critical driver for upgrade, however many respondents that participated in this research explained that their organisations applied patches to their systems to address any security concerns; hence it was considered not to have a major impact. However, it is acknowledged that security issues can lead to upgrades especially to the technology and infrastructure that supports the systems; which in turn could lead to upgrading the functional aspect of the system.

Although, all the respondents found the model to be useful, there were multiple views on its applicability in supporting the decision-making process. On one hand, some of the respondents agreed that the model offered a systematic approach in reaching the decision to upgrade, as the processes bear similarities to those adopted by experienced managers as an empiric process. Thus, the model offers a methodical strategy, which organisations can take advantage of to reduce failures and complexity in upgrade projects. On the other hand, some of the respondents expressed that the model can be used to explain to different stakeholders the different decision processes that go into upgrade decision-making. These two views demonstrate that the UDSM can be applied to different scenarios to assist the upgrade project, such as training less experienced staff and during induction of new staff. In addition, UDSM can be utilised to foster different stakeholders understanding of ES upgrade projects and offer a systematic strategy for reaching the decision to upgrade.

As with any model, it is not possible to address all the aspects occurring in organisations; thus, the respondents offered suggestions on aspects, which could improve the model. One of the key suggestions was the role of patching, understandably patching is not regarded as an upgrade; however, some organisations opt to implement relevant patches and bolt-ons to satisfy some of the requirements, especially when it is difficult to justify a complete upgrade. Thus, it was suggested to include patching as one of the possible alternative to the upgrade selection options. In addition, it was advised to offer more flexibility in the model to addresses specific (granular level) steps required when upgrading specific systems such as ERP or CRM systems. Along with having checkpoints for each activity and process to assure that, the requirements are fulfilled and the objectives are met. What this suggestion implies is the phases and processes identified in this proposed model could assist with upgrade decision-making of different aspects such as hardware and infrastructure.

The opinions presented in respect to the model applicability, significance, and acceptability supports this research's findings. As this research suggests the importance of analysing the technical stability, matching the functionality of the new version to the requirements, and assessing the impacts that the proposed changes would have on the existing systems, processes, and people. Thus, in light of the respondents' opinions it can be argued that UDSM model represents real-life situations and is a practical model that can be used to support organisation during ES upgrade decision-making process.

6.4 Elucidation of the Research Findings

Earlier studies (discussed in section 3.1.3) suggested that upgrade decisions result from the interaction of the motivating and inhibiting forces. In addition, it was stipulated by Ng & Gable (2009) and Khoo (2006) that functionality mapping, measuring the impact and determining the effort would occur after the upgrade decision is reached. This research's findings acknowledge the importance of undertaking these processes; however, it posits that these processes are undertaken prior to reaching the upgrade decision. The reason for such suggestion is grounded on the fact that the outcome of such processes allows constructing an upgrade plan, allocating resources, providing achievable objectives, and offering a tentative timeline, which are critical facts for making informed decisions. Thus, it can be argued that the proposed model (Figure 6-2) not only extends existing upgrade decision models, but also provides a detailed outline of the processes involved in ES upgrade decision-making.

In addition, the proposed model represents three fundamental elements for making an informed decision as outlined by the National Research Council (2001), these are: relevant information, alternatives and preferences. As such, the exploration phase provides the opportunity to gather relevant information through probing, recognising, and framing the problem in order to understand the need for upgrading. The evaluation phase represents the process of researching and developing alternatives, in order to formulate decision objectives that guide the selection of an upgrade strategy, which addresses the requirements. This could mean opting to undertake either a technical or functional or both upgrade strategies or postponing the upgrade. In addition, the proposed model includes steps that addresses the trade-off terms between requirements and functionalities. Furthermore, it enables understanding and communicating the benefits of the preferred decision action, along with assessing the risks involved in adopting the proposed decision action.

The above explanation summarises the significant differences between UDSM and other upgrade decision models proposed in earlier studies. Thus, this thesis:

- Proposes an upgrade decision support model, comprising of two phases and several processes that offer a coherent and systematic approach for contemplating ES upgrade decisions.
- Recommends considering the evaluation of the new version's functionality and the upgrade implications as integral processes of ES upgrade decision-making.

- Suggest that the interaction of the different technological, organisational, and environmental drivers would result in defining the need to upgrade instead of the upgrade decision as proposed in earlier studies.
- Postulates that upgrade decisions should potentially take into account most of the stakeholders' perspectives and offer a detailed understanding of the upgrade implications and benefits.

Therefore, in order to achieve such a detailed level of explanation, the decision processes should account for the interactions of the different upgrade drivers, the assessment of the technical implications, the new version's functionality and upgrade impact, along with the selection of an appropriate upgrade strategy. Figure 6-11 offers a simplified view of the decision processes proposed in this thesis.

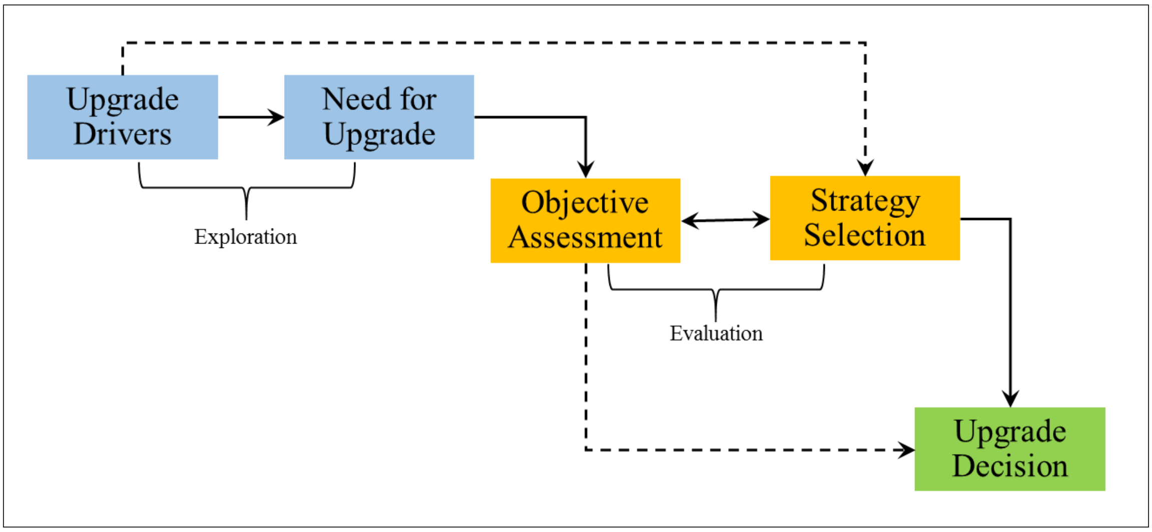

Figure 6-11: The core components of the proposed UDSM

It is argued that the decision to upgrade is initiated when the opportunities and (or) challenges within the technological, organisational, and environmental contexts are identified, as this establishes the need for upgrade. Once the need is established, an evaluation of the technical and functional aspects of the existing and new version is performed, in order to determine the upgrade implications. The output from the evaluation would suggest the appropriate upgrade strategy, which takes into account the requirements, objectives and possible impacts, hence facilitating the minimization of the disruptions. Based on the comparison of the benefits, efforts and resources, the decision to upgrade would be reached, this could include to undertake a technical or functional upgrade, or both or even to postpone the upgrade. Thus, the combination of these findings provides support for a theoretical proposition that upgrade decision-making mostly follow a coherent and methodical manner.

6.5 Chapter Summary

This chapter has given an account and categorised the reasons for upgrading enterprise systems, offering a broad understanding of the interplay between the different drivers and their role in selecting an upgrade strategy. Next, it explained the upgrade decision support model and its two phases (exploration and evaluation), two processes (objective assessment and strategy selection). Additionally the objective assessment is further divided into three sub-processes (technical analysis, functional gap-fit analysis, and impact assessment) to represent ES upgrade decision-making. As a result, it indicates that the decision to upgrade is an outcome of understanding the need, possible impact, and benefits. The outcome of this process allows making informed decisions and supports deliberation, which yields better overview of the upgrade landscape, prior to reaching an upgrade decision; thus, saving valuable time by having an effective plan about the demands and justification of the project. The chapter also offered an alternative view to ES upgrade decision-making by presenting several processes that play a critical role in upgrade decisions. In addition, it presented the opinions and views of respondents in regards to the applicability, significance, and acceptability of the proposed model in supporting ES upgrade decision-making.

CHAPTER 7

SUMMARY AND CONCLUSION

This chapter provides a summary of the key arguments that have been discussed in this thesis. In addition, it outlines the significant contributions to knowledge and practise. Lastly, it addresses the research limitations and proposes future research directions.

7.1 Summary of the Thesis

This thesis set out to explore how organisations reach the decision to upgrade. The study utilised qualitative survey design principles, and incorporated two data collection techniques, which are web-based questionnaires and semi-structured interviews. These two data collection methods allowed gathering data from multiple organisations (23 in total). The respondents' pool included solution architects, project managers, systems analysts, functional leads, technical leads, database administrators, and user representatives, with the majority of them having more than 8 years' experience. The fundamental goal of the research was to identify the upgrade decision process from an organisational perspective. Thus, this research addressed the following questions:

- How do organisations reach the decision to upgrade their systems?
- What upgrade drivers' influence organisations to select a specific upgrade strategy?

The aim of both these questions was to propose an ES upgrade decision support model that reflects on the decision-making process that organisation adopt when considering upgrading their systems. Deliberating ES upgrade based on these two research questions, presented an opportunity to attain detailed insights that can assist decision-makers to approach upgrade decisions with the right level of details in order to make informed decisions.

In order to realise these research questions, chapter 2 reviews previous studies within ES systems domain as whole, and classifies these studies into two main phases, which are implementation and post-implementation. This chapter concludes that there is a need for more research to focus on the post-implementation phase, as this is the phase in which organisation can realise the benefits of the systems.

Chapter 3 examines on ES upgrade, particularly on the factors that influences upgrade decisions and decision-making models. In addition, the chapter draws from T-O-E framework and organisational decision-making theories, specifically process view of decision-making in order to explain the emerging constructs that relate to upgrade decision-making. As a result, a conceptual upgrade decision support model was proposed, which summaries the different upgrade decision-making concepts from previous studies.

Chapter 4 discusses the methodological choices adopted in this thesis, which enabled addressing the research questions appropriately. The study design engaged with multiple organisations, which offered a multifaceted diverse view of the upgrade decision-making process, which allowed gathering, comparing, and contrasting the different upgrade experiences. Through analysing the data systematically, commonality between the experiences and views were identified. This commonality was utilised as the basic constructs to refine the conceptual model and attain a better understanding of the decision processes.

Chapter 5 conveys the organisations' upgrade experiences on how organisations approach the decision to upgrade. It also highlights the interrelationships of the different processes involved in upgrade decision-making, which were the essential components to address the research questions. Additionally, it draws on the conceptual model to guide the refinement and realisation of the proposed model.

Chapter 6 proposes the upgrade decision support model and discusses the findings of this research. The model categorises ES upgrade decision-making into two main phases; that is exploration and evaluation, and two processes as part of the evaluation phase, these are upgrade strategy selection and objective assessment. The chapter concludes that it is important to understand the implications and benefits of upgrading prior to reaching the decision to upgrade, as this allows planning for strategies that can minimise disruptions and risks associated with upgrading.

7.2 Positioning UDSM among ES Upgrade Literature

Normally, upgrades are commenced to achieve targeted benefits that support organisational long-term goals, such as lower maintenance costs, adopting new functionality improving performance and reliability, along with aligning to the version phase-out dates. In addition, the research findings suggest that ES upgrade is not avoidable and many organisations need to continuously plan and account for upgrade projects. However, the decision to upgrade is influenced by multiple factors, which relate to why the existing system version is extended.

This research finding indicates that upgrading is a complex phenomenon and suggests that the decision to upgrade is dependent on balancing multiple factors and evaluating the technical and functional benefits of the proposed changes. In addition, the stakeholders involved in the decision process have different agendas in regards to the upgrade outcome, which affects the decision to upgrade. For example, from the technical perspective an upgrade implies changing the underlying system, while business users think of upgrades as a mechanism for incorporating new functionality and improving existing processes. In contrast, management perceive upgrades as an opportunity to apply strategic plans and improve overall business performance and direction. As a result, organisations adopt various strategies, as part of the upgrade decision-making process to ensure that there is minimum disruptions to the users and the organisation as a whole. These strategies include assessing the benefits in order to justify the need to upgrade, evaluating requirements against the potential version features, and analysing the impacts. Based on this research finding, it can be argued these strategies mentioned above enables the decision maker to make informed decisions.

7.2.1 Upgrade Decision-Making

Understandably, the decision to upgrade is dependent on the business plans, system life cycle, experience, and expert judgement. On one hand, basing the decision on the system life cycle and business plans allows breaking down the problem into achievable objectives and identifying trade-offs. On the other hand, relying on experience and expert judgment ensures the decision to upgrade incorporates knowledge acquired over a long period and networking with colleagues. In addition, it is postulated that the need to upgrade is influenced by the interaction of numerous technological, organisational, and environmental drivers, irrespective of the systems or vendors providing these systems.

Though the aim of the study was not to determine which factors had more influence over the others, keeping up to date with the vendor’s release cycles plays a significant role in influencing upgrade decisions. This suggests that vendors have a stronghold in upgrade decisions, specifically on organisations that rely on vendors for continuous support and maintenance. From the organisational and technological perspective, the need for new functionality is highlighted as the most significant driver for upgrades. Despite the existing literature denoting that upgrade costs have a constraining influence, this research positions upgrade costs to have both motivating and constraining influence on upgrade decisions, depending on how the stakeholders value the proposed upgrade benefits.

Additionally, the decision to upgrade is influenced by the need to understand the functionality of the new version and the implication of upgrading. This implication includes assessment of the current infrastructure's stability to support the proposed changes, and the impact the changes would introduce. Thus, this thesis suggests that the decision to upgrade in not only about the interactions of the different drivers that either influence or inhibit the decision, but also about the need to understand the functionality, implications and added value for upgrading. This implies that the decision to upgrade is achieved in several phases and there are numerous processes undertaken during ES upgrade decision-making.

However, it can be explained that organisations would only opt to upgrade when there are tangible and intangible benefits aligned with the upgrade process, however these benefits are perceived differently from one organisation to another. The decision processes proposed in this thesis highlight to organisations, the importance of understanding the implications and benefits of upgrading prior to reaching the decision to upgrade.

7.2.2 Upgrade Drivers and Strategy Selection

This research's findings suggest that there is either a direct or an indirect relationship between the upgrade drivers and the upgrade strategy selection (discussed in section 6.2.2.2). Based on this relationship between the drivers and upgrade strategy selection, an explanation can be drawn on why organisations prefer to undertake a certain upgrade strategy. The explanation is represented by the three pathways proposed in section 6.2.4, which suggests that the different drivers either pull or push the need to upgrade.

On one hand, the environmental drivers pull for changes, which mostly results in organisation considering undertaking a technical strategy. On the other hand, the technology and organisation context push for changes, which may result in functional upgrade or both (technical and functional upgrade). Thus, suggesting the importance of consolidating the need to upgrade in such a way that the selected upgrade strategy fulfils the defined objectives. In addition, this research's findings indicated that many organisations opted to implement their upgrade in phases, in order to have more control of the upgrade project. The pathways attempt to proposition an approach to justify the reasoning for adopting a specific upgrade strategy, which could lead to undertaking the upgrade in phases.

7.3 Research Contributions

7.3.1 Contributions to Body of Knowledge

This research contributes to ES post-implementation literature and existing knowledge on ES upgrade. First, by drawing from the process view of decision-making, the thesis depicts the interrelationships between the different processes in upgrade decision-making. Additionally, it offers a detailed explanation on upgrade decision processes and drivers, along with suggesting the significance of communicating the benefits and assessing the impacts during ES upgrade decision-making. As a result, it proposes a systematic approach to ES upgrade decision-making that encourages selecting an appropriate upgrade strategy based on a careful examination of the infrastructure, mapping of the functionality to requirements, and understanding the upgrade implications.

Secondly, as the fundamentals of the model are grounded on the concept of a process view of decision-making, it is possible that the proposed UDSM is applicable to other upgrade contexts. Understandably, the model would have to be adapted to fit the context in which the upgrade decision needs to be considered. However, the use of the proposed model has not been evaluated in other contexts of upgrade decision-making, yet the suggestions from the evaluation of the model highlighted that with some adjustments, UDSM could be used to offer more granular level upgrade decisions, such as hardware upgrade.

Thirdly, this research proposes that the majority of the drivers identified in earlier studies to influence ERP upgrade decisions are also applicable to other systems upgrade decisions within the ES landscape. In addition, this research is one of the few studies that provide an explanation as to why organisations select a specific upgrade, through highlighting the association between the upgrade strategy and the upgrade drivers. These relationships are represented in the pathways, which outline the different logical flow of processes that can be followed when contemplating the decision to upgrade. These pathways highlight the significance of selecting the right upgrade strategy, in order to minimise disruptions, risks, and allocating resources appropriately.

Fourthly, this research offers a detailed understanding on the related aspects of ES upgrade decision-making, as it provides a detailed account of upgrade experiences, understandings, and perspectives from various respondents. One of the key observations is that upgrade decision-making needs support from different stakeholders; this includes technical, functional, systems personnel, and users. Though there is a clear distinction between these roles, expectations, and interests, it is the combined expertise and activities of these stakeholders, which allows reaching a decision that benefits the organisation.

Despite the relatively small group of respondents involved in this research, the two data collection approaches allowed discovery of interrelated aspects of upgrade decision-making, including the reasons organisations upgrade their systems. While this research is one of the few studies that have explored ES upgrade decision-making, similar to any qualitative research, further efforts to expand and extend these findings are required.

7.3.2 Implications for Practice

The research findings suggest the following course of actions to organisations that are considering upgrading their systems. First, as many organisation are becoming reliant on ES, this research provides detailed strategies that outline several processes that should be undertaken when upgrading. By doing so, organisations can more easily comprehend when and why there is a need to upgrade their systems, which also allows formulating an improved business case to justify the upgrade. According to the study findings, organisations need to focus on these three areas prior to making the decision; the new version features and functionality, technical assessment of the existing system, and impact of these changes to the organisation, as well as the existing system. Understanding these areas allows the organisation to adopt an appropriate upgrade strategy, in order to address the need to upgrade and plan for contingencies that address any anticipated issues.

Secondly, this research gathers and draws inferences from 23 organisations' upgrade experiences, challenges, and methodologies. Thus, the proposed UDSM provides valuable information that allows for more accountability and responsibility by suggesting the adoption of a systematic approach to upgrade decision-making. In addition, the model offers a means to demonstrate to the stakeholders involved in upgrade project, the different phases and processes that need to be followed before an upgrade decision is reached,. Therefore, some of the approaches explained in this study could prove useful to organisations when considering upgrading their systems. Additionally it allows learning from the challenges and applying similar strategies, in order to ensure that the upgrade project yields the desired outcomes.

The next section below addresses the perceived limitations of this research and cautions that these findings represent views from mostly large organisations. Thus, it can be considered that the findings are context sensitive. Hence, a reasonable approach should be considered when reviewing the findings, in order to determine its applicability to the environment in which the reader intends to apply the research findings.

7.4 Limitations

Finally, a number of important limitations need to be noted. First, it could be argued that the findings are based on insufficiently diverse data, as most of the respondents represented large organisations. However, this research gathered experiences and views from 41 respondents from multiple organisations (23 in total) and the findings were evaluated with additional 10 respondents from 7 organisations. Thus, indicating that with such a number of varied organisations, there is huge possibility of incorporating diversity into the findings. Even so, there is still the question of how representative the views of these respondents might be, for instance the views and comments addressed by the respondents could be based on their personal experiences. Thus, the strategies and approach conveyed could be specific to the organisation's environment, which the expert represents and may not be applicable to other situations.

A second limitation of the study could be associated with the data collection methods utilised in this research. The use of web-based questionnaires has its benefits but there have been many criticisms specifically when anonymity is concerned, as Buchanan (2000) suggests that there is a possibility for repeat responders. However, to improve the data quality and reduce the influence of repeat responders, partial IP (internet protocol) addresses tracking was implemented as recommended by Crawford *et al*. (2001). Additionally, to overcome a response bias the study targeted only people considered the best representatives of the study population. Despite the precautions taken to ensure the data quality, the freedom of a web-based questionnaire cannot guarantee the reliability of the responses as it depends on the respondent providing an honest and legitimate account of their experience.

Therefore, the study employs another data collection technique (semi-structured interviews) as a mechanism to improve the quality of the data. Yet, the use of interviews for data collection also has its risks, due to the dependence on the interviewee's recollection of events and willingness to share, which may result in receiving inaccurate information. Additionally the reluctance may be associated with the notion that such information is collected on behalf of their ‘own’ organisation, thus interviewees resist sharing their opinions. When such situations were experienced, the interviewees were assured that the interviews were for research purposes, and that the researcher had no affiliations to the interviewee’s organisation. As well as explaining, that participation in the study was voluntary and all information provided was anonymous unless when questions explicitly requested personal information. When personal details were requested, the study made use of pseudonyms for example respondent1 to mask the participants’ names, when using direct quotes from respondents to emphasise a point in the thesis.

A third limitation is due to the fact most of the interviewees represented different companies, crosschecking the information provided against a counterpart in the same organisation was difficult. Thus, the information gathered totally relies on the interviewee experience of the ES upgrade processes. To overcome this shortcoming, the interview transcripts were sent to the interviewees for review and verification of the contents represented. Once the review was verified, some of the details were incorporated as additional questions to the other interviewees, to get their opinions on the earlier descriptions of upgrade decision-making. Then a comparison between the answers was conducted to analyse the similarity of the different experiences. In addition, the proposed model was presented to other respondents, who did not take part in the data collection stage in order to evaluate its applicability, significance, and acceptability in supporting ES upgrade decisions.

Despite these limitations, it is arguable that the manner in which the data has been used to develop and propose the upgrade decision support model, has led to findings that are reasonably abstract to have broader application.

7.5 Future Research Directions

Notwithstanding the growing body of literature in ES post-implementation, the continuous use of ES dictates the need for further attention in this domain. This research has presented insights into ES upgrade especially on decision-making processes and thus, reducing the complexity involved in upgrade decision-making. First, based on the overall findings an upgrade decision support model was proposed outlining the different phases and processes followed during upgrade decision-making. The proposed upgrade decision support model outlines processes captured from organisations that where either planning to upgrade in the next 6-24 months or currently upgrading or had upgraded their systems in the last 6 months of undertaking this research.

However, as people learn from their experiences, the manner in which organisations approach the decision to upgrade could possibly evolve over time. Thus, in order to extend the proposed model, future research could opt to undertake a longitudinal study to provide an extensive perspective of upgrade decisions processes. As a result, it would allow similar or conflicting arguments to be established, along with offering a broader understanding of the ES upgrade decision-making process.

Second, ES upgrade is a continuous process involving different stakeholders who influence upgrade decisions. Thus, new research could apply change management concepts to explore the full upgrade cycle in order to provide a detailed understanding of the dynamic nature of ES upgrade and its interactions, from people, process, and technology aspects. In addition, as part of this research' data suggest that there is an association between upgrading and competitive advantage. Therefore, it would be interesting to understand how organisations gain competitive advantage when opting to upgrade their systems through exploring the relationship between upgrading and competitive advantage. The outcome of such study could help organisations recognise the advantage of upgrading their systems.

Third, this research utilises a descriptive process view of decision-making as the analytical lens of identifying the decision processes. Thus, the proposed model could be extended using normative decision theories, which could facilitate optimising the upgrade decision-making experience. Such an undertaking could present an extensive explanation to assist decision makers in selecting the optimal upgrade strategy. This would also allow incorporating different upgrade decision contexts, in order to compare the perceptions and experiences from different decision environments. The outcome of such studies may support organisations in adopting effective strategies that enhance ES upgrade decision-making and offer generalisation of these findings to wider-ranging upgrade phenomenon.

7.6 Conclusion

This research acknowledges that upgrade decision-making is a complex undertaking and is influenced by different technological, organisational, and environmental factors, which has led to only relatively few organisations opting to upgrade their systems. Despite increased attention to ES upgrade research, most of the recent studies have focused on best practises, success factors, decision models and factors influencing upgrade decisions. While, studies focusing on upgrade decisions have conceptualised that upgrade decisions result from the interaction of the motivating or inhibiting factors, other studies outlined the need to understand the functionality and the impact of the upgrade. Although, these studies offer a detailed understanding of upgrade decision-making, most are segmented and do not provide a holistic view on upgrade decision-making processes. This thesis addresses this shortcoming, through highlighting the interrelations between the upgrade drivers, the need to evaluate the new version's functionality, and understanding the upgrade implications. Thus, suggesting that the decision processes operate in an interconnected manner to support upgrade decision-making.

Therefore, it can be argued that this thesis proposes a methodical approach, which encourages organisations to select an appropriate upgrade strategy. This methodical approach not only facilitates achieving the desired upgrade outcome, but also takes into consideration the needs of the different stakeholders and incorporates effective strategies to minimise disruptions. Additionally, it emphasises on the association between the upgrade drivers and upgrade strategy, in order to provide a broader explanation to why certain upgrade strategies are preferred. Understanding this association is fundamental for providing arguments that when used effectively can support the justification for commissioning an upgrade and assist with identifying the benefits of upgrading. Thus, organisations adopting such thinking are likely to reduce the complexity and risks associated with upgrade projects as a whole. It is hoped that the findings presented in this thesis provides useful contributions to motivate future research in this area and to organisations planning to upgrade their ES.

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APPENDIX A

WEB-BASED QUESTIONNAIRE

Enterprise System Upgrade: The Drivers and Decision Processes

Few organisations choose to upgrade their systems despite the benefits of new features and additional functionality offered by upgrading their Enterprise Systems. The reason for this is upgrading an ES remains a complex undertaking which requires strategies to minimise disruption to business operations.

Our survey should not take longer than 20 minutes to complete; your answers to these questions will help us understand how organisations reach the decision to upgrade and establish the reasons that influence the decision-making process. The outcome of this survey aims to present a generalised view of how organisations reach the decision to upgrade.

Confidentiality, Privacy and Consent

This research conforms to Birmingham City University's (BCU) (2010) Research Ethical Framework. The researcher ensures that the details of all participating organisations and individuals will be kept confidential; and any information which might potentially identify you will not be used in any published material unless to share the findings and outcome of the research (if requested). You have the right to withdraw "without prejudice" from the study at any time up to January 2014 and all the information you provided will no longer be used as part of this research.

By clicking the next button, you are agreeing to participate in this research and understand the purposes of the research, including the right to withdraw from the study.

General Information

1 Which classification best describes your organisation? *

○ Small enterprise (1-50 employees)

○ Medium enterprise (50 – 250 employees)

○ Large enterprise (250+ employees)

2 What is your current role in the organisation? *

☐ Solution Architect

☐ Functional Lead

☐ Technical Lead

☐ Systems Analyst

☐ Systems Administrator

☐ Database Administrator

☐ Project Manager

☐ User Representative

☐ Chief Information Officer

☐ Chief Executive Officer

☐ Other ____

3 How many years' of experience do you have? *

○ Less than 1 year

○ 1 to 2 years

○ 2 to 4 years

○ 4 to 6 years

- ○ 6 to 8 years
- ○ More than 8 years
- ○ Other ____

4 In this research, Enterprise Systems (ES) is defined as a system that is offering a range of features and functionality that simplify inter-departmental integration of business processes to support information-processing needs of the entire organisation.

Please select all the systems your organisation is currently using*

- ☐ Enterprise Resource Planning (ERP)
- ☐ Customer Relationship Management (CRM)
- ☐ Supplier Relationship Management (SRM)
- ☐ Supply Chain Management (SCM)
- ☐ Business Intelligence (BI)
- ☐ Human Resources Management (HRM)
- ☐ Enterprise Collaboration System (ESC)
- ☐ Integrated Service Management
- ☐ Other: ____

Enterprise Systems Upgrade Planning

5 ES upgrade is a process that aims to expand the core system capabilities by improving functionality and taking advantage of new business processes and features. This can be accomplished by either changing an aspect of the existing system or adopting a newer version of the same system.

When is your organisation planning to upgrade any of its systems selected in the previous question? *

- ○ Upgraded in the last 6 months
- ○ Currently upgrading
- ○ Next 6 months
- ○ Next 12 Months
- ○ Next 12-24 months
- ○ Not planning (*go to question 13)*

6 Did your organisation follow any specific process when making the decision to upgrade?*

- ○ Yes
- ○ No (*go to question 7)*

6.1 Describe the process undertaken by your organisation during the upgrade decision-making (please provide as much detail as possible)

____

____

____

7 What upgrade strategy is your organisation planning to implement? *

☐ Technical upgrade

☐ Functional upgrade

☐ Strategic upgrade

☐ Other____

7.1 Why was the selected approach (es) adopted?

____

____

____

____

8 Is it important to understand the new version's functionality improvements?

○ Yes

○ No

9 Does the new version documentation provide a detailed explanation of the functionality improvements from the current (implemented) version?

○ Yes

○ No

10 What mechanisms were used to assess the new version's functionality?

____

____

____

Reasons for Upgrading

11 How much do you agree or disagree with the following statements about the reasons that influenced the decision to upgrade? *

Please choose the appropriate response for each item:

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Ensure availability of continuous vendor support	○	○	○	○	○
Standardise functionality across the organisation	○	○	○	○	○
Reduce modification maintenance	○	○	○	○	○
Improve usability	○	○	○	○	○
Consolidate the system across the organisation	○	○	○	○	○
Integration of different systems	○	○	○	○	○
Leverage latest technology enhancements	○	○	○	○	○
Automate existing business processes	○	○	○	○	○
Adopt new functionality	○	○	○	○	○
Pressure to keep up with competitors	○	○	○	○	○
Restructure business process and procedure	○	○	○	○	○
Comply with legal requirements	○	○	○	○	○
Simplify and standardise system management	○	○	○	○	○
Functionality of the new version	○	○	○	○	○
New versions offer better scalability	○	○	○	○	○

11.1 Specify any other reasons that influenced your decision to upgrade:

____

12 Do you think the new version will add value to the organisation? *

○ Yes

○ No (*go to question 13)*

12.1 How was the added-value evaluated?

____

Upgrade Decision Support Tools

13 Will the use of decision support tools help streamline the upgrade decision-making process? *

- ○ Yes
- ○ No (*go to question 14)*

13.1 Please elaborate why it will be useful

____

____

14 How much do you agree or disagree with the following statement about the role of the decision support tool? *

Please choose the appropriate response for each item:

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Present the new version functionality in simplified format	○	○	○	○	○
Highlight the added-value for upgrading	○	○	○	○	○
Assess the impact of the upgrading to the new version	○	○	○	○	○
Evaluate the effort and resources required for the upgrade	○	○	○	○	○
Appraise the functionality between the installed versions and the new version	○	○	○	○	○

14.1 Outline any other features that the decision support tool should address

____

____

____

Contact Details

15 Do you require access to the findings and outcome of the research?

- ○ Yes
- ○ No

16 We would appreciate an opportunity to discuss further about your experiences on Enterprise Systems (ES) upgrade, would you allow us to contact you?

- ○ Yes (*go to question 17)*
- ○ No

17 Please provide us with your contact details so that we can get in touch with you (only in regards to the above two question (if you replied yes) and for the results of the draw)

Full Name: ____

Organisation Name: ______________________________________

Address: ____

City: ____

Postcode: ____

Tel: _________________________Mobile: ____________________

Email: ____

Thank you for taking time to share your views, experience, and knowledge about ES upgrade, your contribution is highly appreciated.

APPENDIX B

EVALUATION QUESTIONNAIRE

Enterprise Systems Upgrade Decision Support Model Evaluation Questionnaire

This research focuses on Enterprise System upgrade decision-making process, at this particular stage of the research; we intend to evaluate the proposed model. The proposed model is drawn from the data collected by interviewing and surveying respondents whose organisation have recently upgraded or are in the process of upgrading their Enterprise Systems.

The evaluation process offers insights of how the model depicts the activities in real world and its usefulness for supporting upgrade decisions. The outcome of this evaluation would offer more rigor to propose upgrade decision support model and the research findings as a whole.

Confidentiality, Privacy and Consent

This research conforms to Birmingham City University's (BCU) (2010) Research Ethical Framework. The researcher ensures that the details of all participating organisations and individuals will be kept confidential; the record does not contain any identifying information about you unless a specific question has asked for this information. You have the right to withdraw "without prejudice" from the study at any time up to Dec 2014 and all the information you provided will no longer be used as part of this research.

From your understanding of concepts and scope presented about the model, as well as drawing from personal experience and understanding of upgrade practises, let us know you opinion on the following:

1 The Concepts and flow of events within the model make sense to me

() Strongly Agree

() Agree

() Neither

() Disagree

() Strongly Disagree

2 How do the phases and decision processes reflect ES upgrade decision-making occurring in your organisation? (Provide as much detail as possible)

3 Do you think the model will be useful in supporting upgrade decision-making process? (Provide as much detail as possible)

4 Do you think the flow of processes is practical and workable? (Provide as much detail as possible)

5 How can the model be enhanced? (Provide as much detail as possible)

Thank you for taking time to share your views, experience, and knowledge on ES upgrade, your contribution is highly appreciated.

APPENDIX C

ES UPGRADE DRIVERS

Normally the drive to upgrade will originate from either within the organisation referred as internal demand or imposed by the external environment referred to as external drivers.

C.1 External Drivers

This group represents those factors initiated by entities outside the organisation such as vendors, consultants, collaborators, and government agencies. Usually, the external drivers are time sensitive, requiring organisations to undertaken an upgrade within a specific timeframe. This provides organisations with little choice, apart from opting to upgrade their systems; as failure to do so could lead to serious disruptions and high maintenance cost. There was clear indication that both external drivers and internal demands are equally important and in their own right can lead to an upgrade.

C.1.1 Vendor Dependency

Vendors defines the need to upgrade in different dimensions, however the most common mentioned driver in the study has been the need to keep up to date with vendors release cycles. Even though most vendors support older versions at an additional cost, there will be a point in time where the vendor ceases to provide support, hence providing no option but to upgrade. The reliance on vendor for support and maintenance creates an environment where organisations believe that by not upgrading, their systems are at a very high risk of not attaining necessary support on timely manner. Such philosophy defines a necessity to upgrade whenever the vendors release a new version and withdraw support for older versions.

Support for our system is to expire in 2015, and being a big company, we did not want to take the risk of having unsupported system.

Respondent17

On the positive side, this tendency enables us to be within the licensing agreement and not obtaining support at higher rate, especially when the product reaches its end of life.

We upgraded to ensure a continuous system support from the vendor.

Respondent20

However, some organisations would not upgrade as soon as a new version is available, as they need to deliberate the new technologies stability and reliability, as well as weigh the overall benefits of such improvements.

We will only upgrade when we feel the technology is more reliable.

Respondent21

This encourages most organisations to explore and understand the new version features and functionality extensively prior to making the decision to upgrade. One of the techniques is to network and collaborate with vendor representatives and colleagues to understand the new version implications, in order to gauge its stability.

C.1.2 Compliance

Government agencies have a significant influence on driving upgrades. In many circumstance attaining compliance is a repetitive task done yearly, specifically if the compliance involves fulfilling government regulations such as taxation.

My team is regularly involved with upgrade projects, for example, we upgrade our HCM system every year. The main reason we upgrade the HCM system is that we have to comply with the government legislative changes.

Respondent6

Another perspective of compliance involves organisations in highly regulated environment such as education institutes and banking have to follow directive and regulations set by centrally governed agencies or governmental bodies. This ensures acquire standardised mode of operating and functionality based on national requirements based certain standards and regulations. The challenges is when these regulations change or are updated it enforces the organisation to implement and comply with these changes within a fixed timelines.

When there are national requirements, it necessitate implementation of certain features, normally these come with deadlines affixed to them.

Respondent21

Complying with the legal and national requirements requires undertaking upgrade within a certain timeframe and possibly frequently. Thus, compliance not only includes government legislatives, but also changes to regulations in regulated environment would likely trigger the organisation to consider upgrading their systems.

C.1.3 Trust in Consultants

Many organisations opt to upgrade their systems based on advice from consultants, who can provide in-depth explanation of the additional features to support the upgrade. These consultants have acquired product landscape knowledge, so can provide reasonable advice, which helps to define the business case for upgrade.

Our company is upgrading based on the guidance by our consultancy 'partner'.

Respondent18

In some situations, the consultants provided advice that encouraged using outdated tools, which results in the organisation losing faith in their abilities and forcing the organisation to upgrade in order to overcome such a mistake. The downside of relying on consultants is that organisations feel they are losing control of their systems as the decisions are depending on external advice.

Consultants used outdated integration technologies during the initial implementation.

Respondent11

However, working with similar group of consultants for many years builds rapport and trust, which ensures delivery of valuable and professional advice that benefits both parties. This encourages efficient collaboration, resulting in many organisations constantly turning to consultants for guidance of when to upgrade or on mechanisms to leverage their systems.

C.2 Internal Demand

It is common practise for most organisations to change ways of operating in order to adapt with the market demands and gain a competitive edge. However, the systems have to reflect these changes in order to support the organisation daily operations. Resulting in the need that originates from within the organisation, aiming to ensure the organisation aligns its business processes with the frequent changing business needs. Permitting to take advantage of new functionality and additional capabilities made available by the newer versions, which the existing systems do not support.

C.2.1 Management Support

Management plays a critical role in either supporting or preventing ES upgrades, largely, through setting directives of when the company needs to improve its performance or competitive edge. These directives require system standardisation across the organisation, which may lead to upgrades. By actively driving the need to upgrade, management participate in the upgrade projects and support the business case. As such, the management cooperation becomes one of the main criteria for successfully completing the upgrade project.

> *The directive from the head office management was to integrate all its subsidiaries systems to simplify information sharing and reporting. Since our system was different, we opted to install a new system that was consistent with the head office system.*
>
> *Respondent26*

In such a scenario, the management are fully engaged in the project, and offer support, however the management involvement in upgrade projects are not similar in terms of level and commitment when compared with initial implementation. Nevertheless, there are scenarios where the management do not envision return on investment, but the upgrades are externally forced. This results in limited cooperation from the management to support the upgrade, which in turn results in a narrowed upgrade scope to satisfy only the necessary requirements. Indicating that the management strategy is to focus around overall costs and risks, stipulating that upgrades have to be strongly justified, providing little room to explore and evaluate all the features of the new version.

> *Management offered insufficient time and money to review the related business processes, which was far from ideal, resulting in prioritising only essential upgrade work.*
> *Respondent20*

In addition, many organisations adopt certain philosophies, such as, only upgrade when the business case can be justified. Secondly, when the improvements demonstrate that the operational costs would decrease, and thirdly there is absolute surety that the existing version is stable and reliable.

> *Prior to upgrading, we network with colleagues or peers in other organisations who have upgraded, in order to establish the reliability, stability and functionality of the new version.*
> *Respondent22*

So the management would be on the fence with upgrade projects until when there is explicit evidence that the new version is stable and reliable, which may force them to adopt a principle of upgrading every other version. In which they believe that the next version is more stable and reliable since it would be overcoming the bugs and stability issues from the previous version. This also gives sufficient time to evaluate the new versions to study if the improvements would help bring down the operational costs.

C.2.2 Strategic Direction

Over the years organisations grow, creating a necessity to incorporate new ways of operating and reporting, which indicate that the systems supporting these processes need to incorporate new functionality, normally achieved by upgrading to a new version. From the outlook, upgrading is a valuable experience, since it allows rationalising the tools and examining existing business process within the system landscape.

> *We upgraded because there are some major changes within the business, also some of this is to rationalise the tools used within the business, adding functionality that the new tools offer.*

Respondent19

In general, business users identify activities or steps that are not part of the current system, but can help to streamline certain processes. These activities turn into requirements, which defined the business needs, for the new version to incorporate such activities. Such requests present an opportunity to assess existing business processes, in order to re-define, eliminate, or add new processes into the existing landscape. This allows identifying requirements that will support the business and map them against new version functionality that can support the organisations strategic direction.

Evaluating and mapping of functionality allows trimming down wasteful processes.
Respondent17

In order to achieve maximum potential from the assessment, user involvement is important as it enables easier understanding of existing processes and communicating the proposed changes. As such, it allows receiving feedback on the impact and usefulness of the proposed changes.

C.2.3 Technological Driven

The underlying ES platform supports adding new functionality through modifications; however, modification results in high maintenance costs and extensive efforts to support. The cost for maintaining modification over long period is one of the main technical drivers that influence organisations to upgrade their systems.

The new releases would not support modifications introduced by the organisations, thus upgrading modified systems can result in some of the modifications being made obsolete. This can impede the existing functionality and stability of the system, demanding extra effort for testing the imposed changes and evaluating existing modification impact on the new version.

Major modifications result in high costs, which include cost of re-implementing the changes and testing the components and ensuring none of the existing functionality is disturbed.

Respondent24

When there is no significant business justification for undertaking an upgrade, it increases the possibility of postponing the upgrade; the downside is increased workload to support outdated systems. This creates circumstances where the majority consumption of the support personnel's time and effort is in mundane tasks of supporting older versions. Whereas replacing such systems would free up the resources and allow them to engage in more creative and productive tasks, which could facilitate discovery and refinement of business processes.

Upgrading allows us to retire legacy systems that are not supportable.

Respondent19

Refining business processes or acquisition and mergers with other organisations create a new challenge from the systems perspectives that is the need for different systems to be able to work in cohesion with each other. This necessitates the need to consolidate and integrate systems into uniform system architecture. Integration allows different systems to support the organisation business processes, allowing for more transparency and easier access to information. Thus, offering consistent and consolidated processes that improves collaboration and provides greater accountability that assures efficient administration and support across the organisation.

Recently we went through a merger and to some extent, this influenced us to upgrade, as we felt that we should have a similar ERP system with the other company.

Respondent17

C.2.4 Costs

On one hand operational costs reduction can be the driving force for upgrades while on the other hand the initial upgrade cost can inhibit upgrades. A stance resonated by many respondents, suggesting that costs should be given detailed attention, otherwise it can cause delays or rescheduling of the upgrade especially when the net value is not justified. The initial costs not only include the implementation costs but also the licensing fees and resources (person-hours) required to support the upgrade. In such situations, organisations compromise on the upgrade benefits and decide not take full advantage of the new enhancements.

> *For example when we were upgrading one of our systems, we decided to skip the version because the net effect of the improvements offered didn't justify the investment cost, and I don't mean only the software cost, but the overall cost.*
>
> *Respondent25*

There was no explanation on means or techniques to measure these operational costs reduction, but it a generally understanding that minimizing customisation and overall maintenance costs, as well as decreasing licensing and support fees, would result in reduction to the overall operational costs.