



ERP system upgrades: The impact of ERP system upgrades on business changes and organisational capabilities; a view from the Thailand Business context

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Dedication

This thesis is dedicated to my mother, my aunt and
in memory of my dad.

Declaration

I certify that except where due acknowledgement has been made, the work is that of the author alone; the work has not been submitted previously, in whole or in part, to qualify for any other academic award; the content of the thesis is the result of work which has been carried out since the official commencement date of the approved research program; any editorial work, paid or unpaid, carried out by a third party is acknowledged; and, ethics procedures and guidelines have been followed.

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Table of Contents

	Page
Declaration.....	i
Acknowledgements.....	ii
Table of Contents	iv
List of Tables	ix
List of Figures.....	x
List of Abbreviations	xi
List of Publications.....	xii
Abstract.....	xiii
Chapter One: Introduction.....	1
1.1. Introduction.....	1
1.2. Research background	1
1.3. Research design.....	4
1.4. Research contribution.....	5
1.5. Outline of the thesis.....	5
Chapter Two: Literature Review	8
2.1. Introduction.....	8
2.2. ERP system upgrade.....	10
2.3. Types of ERP system upgrades.....	10
2.4. Reasons for ERP system upgrades	13
2.5. Requirements for ERP system upgrades	15
2.6. Organisational capabilities	18
2.7. Productivity improvement.....	24
2.8. Theoretical underpinning.....	26
2.9. Summary.....	31
Chapter Three: Research Methodology.....	32

3.1.	Introduction	32
3.2.	Research design.....	32
3.3.	Research methodologies	33
3.3.1.	Phase One: An online discussion panel	33
3.3.1.1.	Online discussion panel process used in this research	34
3.3.1.2.	Privacy of the participants.....	35
3.3.1.3.	Ethical considerations	36
3.3.1.4.	Pilot study	36
3.3.1.5.	Data collection for online discussion panel	37
3.3.1.6.	Data analysis of online discussion panel responses	39
3.3.2.	Phase Two: Case studies.....	40
3.3.2.1.	Research design for case study	41
3.3.2.2.	Privacy of the participant	43
3.3.2.3.	Ethical considerations	43
3.3.2.4.	Pilot case study	43
3.3.2.5.	Data collection for the Case Studies.....	43
3.3.2.6.	Data analysis for the Case Studies	45
3.4.	Summary	47
Chapter Four: Findings from the Online Discussion Panel.....		48
4.1	Introduction	48
4.2	Findings from the online discussion panel	48
4.3	Summary	71
Chapter Five: Case Study Findings		72
5.1	Introduction	72
5.2	Case Study One	72
5.2.1.	Case organisation profile.....	72
5.2.2.	Organisation One's ERP system.....	74
5.2.3.	Type of ERP system upgrade.....	79

5.2.4.	Requirements for ERP system upgrade	80
5.2.5.	Outcomes from ERP system upgrade.....	89
5.2.6.	Summary of findings from Case Study One.....	94
5.3	Case Study Two	96
5.3.1.	Case organisation profile.....	96
5.3.2.	Organisation Two's ERP system	98
5.3.3.	Type of ERP system upgrade.....	104
5.3.4.	Requirements for ERP system upgrade	106
5.3.5.	Outcomes from ERP system upgrade.....	117
5.3.6.	Summary of findings from Case Study Two	120
5.4	Case Study Three	122
5.4.1.	Case organisation profile.....	122
5.4.2.	Organisation Three's ERP system	123
5.4.3.	Type of ERP system upgrade.....	125
5.4.4.	Requirements for ERP system upgrade	126
5.4.5.	Outcomes from ERP system upgrade.....	130
5.4.6.	Summary of findings from Case Study Three.....	133
5.5	Case Study Four	135
5.5.1	Case organisation profile.....	135
5.5.2	Organisation Four's ERP system.....	136
5.5.3	Type of ERP system upgrade.....	139
5.5.4	Requirements for ERP system upgrade	140
5.5.5	Outcomes from ERP system upgrade.....	148
5.5.6	Summary of findings from Case Study Four.....	151
5.6	Case Study Five.....	153

5.6.1	Case organisation profile.....	153
5.6.2	Organisation Five’s ERP system.....	154
5.6.3	Type of ERP system upgrade.....	157
5.6.4	Requirements for ERP system upgrade	158
5.6.5	Outcomes from ERP system upgrade.....	164
5.6.6	Summary of findings from Case Study Five	166
5.7	Summary	166
Chapter Six: ERP System Upgrade Issues: A Cross-Case Analysis and Discussion of Findings.....		168
6.1.	Introduction.....	168
6.2.	Case organisations	169
6.3.	ERP system upgrades.....	170
6.4.	Types of ERP system upgrade	171
6.5.	Motivations for ERP system upgrade	173
6.6.	Requirements for ERP system upgrade.....	177
6.7.	Enhanced organisational capabilities.....	188
6.8.	Summary of Case Study findings.....	192
Chapter Seven: Conclusions		195
7.1.	Introduction.....	195
7.2.	Research contributions and implications	195
7.3.	Limitations and future research.....	198
7.4.	Conclusions.....	199
References		200
Appendices		215
	Appendix A: Invitation E-mail	215
	Appendix B: Invitation E-mail for Online Discussion Panel - Round One	216
	Appendix C: Invitation E-mail for Online Discussion Panel - Round Two	217

Appendix D: Invitation E-mail for Online Discussion Panel - Round Three	218
Appendix E: Homepage of the Online Discussion Panel	219
Appendix F: The Content of the Online Discussion Panel - Round One on Wordpress Blog.....	220
Appendix G: The Content of the Online Discussion Panel - Round Two on Wordpress Blog.....	222
Appendix H: the Content of the Online Discussion Panel - Round Three on Wordpress Blog.....	224
Appendix I: Plain Language Statement (the Proposed Participant Information Sheet and Consent Form in English Language)....	226
Appendix J: Consent Form (in English Language).....	229
Appendix K: Plain Language Statement (the Proposed Participant Information Sheet and Consent Form in Thai Language)	230
Appendix L: Consent Form (in English Language).....	235
Appendix M: Interview Tool (in English Language)	236
Appendix N: Interview Tool (in Thai Language)	241

List of Tables

	Page
Table 2.1 Types of ERP system upgrades.....	11
Table 2.2 Reasons for ERP system upgrades	13
Table 2.3 Requirements for ERP system upgrades	16
Table 2.4 IT-related capabilities achieved from new IT adoption.	20
Table 3.1 Online discussion panellists’ experiences with ERP system upgrade ..	35
Table 3.2 Interviewees’ data for five case studies	44
Table 4.1 A summary of the responses on research themes.....	50
Table 4.2 A summary of findings of the online discussion panel	69
Table 6.1 Organisation profile	169
Table 6.2 ERP system adoption and upgrades history in each organisation case	170
Table 6.3 Types of ERP system upgrade in the five cases	172
Table 6.4 Motivations for ERP system upgrade in the five cases	173
Table 6.5 Requirements for an ERP system upgrade in the five cases.....	178
Table 6.6 Enhanced organisational capabilities from the ERP system upgrade in the five cases	188

List of Figures

	Page
Figure 2.1 An ERP System Upgrade Productivity Network guided by Dynamic Capabilities (Eisenhardt & Martin 2000) and Benefits Dependency Network (Peppard, Ward & Daniel 2007).....	28
Figure 7.1 An ERP System Upgrade Productivity Network.....	196

List of Abbreviations

ABAP	Advanced Business Application Programming
ANZSIC	Australian and New Zealand Standard Industrial Classification
ASEAN	Association of Southeast Asian Nations
CIO	Chief Information Officer
CMMI	Capability Maturity Model Integration
CRM	Customer Relationship Management
ECC	ERP Central Component
ERP	Enterprise Resource Planning
ESS	Employee Self-Service
GAAP	Generally Accepted Accounting Principles
HCM	Human Capital Management
HR	Human Resources
HRM	Human Resource Management
IFRS	International Financial Reporting Standards
IS	Information Systems
IT	Information Technology
MIS	Management Information Systems
MRP	Material Requirements Planning
OS	Operating System
PCA	Profit Centre Accounting
P&L	Profit and Loss
PMO	Project Management Office
SCM	Supply Chain Management
SRM	Supplier Relationship Management
UAT	User Acceptance Test

List of Publications

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Abstract

Enterprise Resource Planning (ERP) systems are packaged suites of business application software widely deployed by organisations in all industry sectors to support both local and global business operations. ERP systems comprise a whole set of business functions including finance and accounting, procurement, production and inventory planning, and sales and marketing, as well as the distribution and return of goods and services. Since their release in the 1990s, ERP systems are now being upgraded, with improved system performance abilities, to better support new business demands for the management of increased volumes of data, enhanced multi-technology integration functions, efficient management of global operations and for improved decision making.

Although research on initial ERP systems addressing numerous technological, organisational and management issues is vast, studies on ERP upgrades are sparse. Although upgrading ERP systems is a large investment for organisations this is a necessary requirement to replace old ERP systems to manage changing business demands. Upgraded ERP systems lead to improved performance abilities in many respects, including the capacity to handle large volumes of data from multiple sources, the capacity to integrate and process data across different fixed and mobile technologies with ERP modules and the enhanced capacity to efficiently process and disseminate data in real time. The upgraded systems also have the power to more effectively support global operations, thus allowing more effective data driven decision-making. ERP systems are being upgraded at an increasing rate to meet the demands of business growth and global expansion as well as big data management. However, due to lack of extensive and comprehensive research on ERP upgrades processes, upgrade types, motivations and requirements for upgrade, and outcomes achieved from upgrading the system such as enhanced organisational capabilities, there is limited understanding of how effective organisational capabilities are achieved through ERP upgrades. Since the cost of ERP system upgrades range from two to ten million dollars, upgrading ERP systems without identifying the

requirements for, and expected outcomes from, these new and more capable systems can not only be a costly exercise for the adopting organisations, but the system may also not be fully utilised for more effective business management.

Therefore the aim of this study is to explore ERP upgrades with specific reference to the core motivations for upgrade, types of upgrade commonly adopted, the necessary requirements for effective upgrade and the outcomes, in terms of enhanced organisational capabilities.

The research is developed based on the underpinning theories of the Dynamic Capabilities and Benefits Dependency Network. A comprehensive review of existing literature is undertaken in order to appropriately frame the research aims and objectives. An ERP Upgrade Productivity Network is developed to establish the relationship between ERP upgrades (IT Enabler), business changes required for the upgraded system (Change Enablers), enhanced organisational capabilities (Capabilities) and outcomes (Benefits) achieved from the upgraded ERP systems.

Since little is known about ERP system upgrades, this is an exploratory study undertaken in two phases, which employs a qualitative mixed method approach. Phase One involves an online discussion panel with international ERP upgrade experts. The online panel discussions were developed in order to extract expert views on ERP upgrade issues. The panel comprised ERP consultants, vendor representatives and managers of organisations that recently upgraded their ERP system. After three rounds of discussion and an interpretive analysis of their responses, a set of ERP upgrade issues were identified that, alongside the literature review, helped formulate the interview tool for the second phase of the study. The second phase involved qualitative case studies developed around a selection of organisations identified to have recently upgraded their ERP systems. Five organisations were identified from vendor publications and organisational websites. Data for the case studies was collected through face-to-face interviews with a total of 24 middle and senior managers.

More data was extracted from content analysis of organisational annual reports from the five large organisations. All data was interpretively analysed, guided by Miles, Huberman and Saldaña (2013) to understand ERP upgrade issues of types and motivation for upgrades, requirements and resulting outcomes.

The findings of this study show that upgrading ERP systems is necessary to support business growth, which requires management of the increased number of subsidiaries, larger volumes of data and increased number of employees. It is also noted that, with an upgraded ERP system, organisations gain ongoing vendor support for the system which is also a necessary requirement and very costly if outsourced. This study highlights that to take advantage of new business functions supported by the upgraded system business process changes is an important requirement to align business functions with the upgraded business modules. The most notable enhanced organisational capabilities achieved from upgraded ERP systems is improved data management for business decisions. Upgraded ERP systems allow for greater data visibility and analytics for timely reporting and decisions, better sharing of knowledge and information throughout the organisation, and enhanced flexibility to meet changing business and customer demands.

This research extends the knowledge on ERP systems by highlighting issues of types of and requirements for ERP upgrades, as well as resulting outcomes achieved from ERP upgrades. Since upgraded ERP systems are a type of new technology implementation, this research also contributes to theory on new technology implementation. It expands on the theories of the Dynamic Capabilities and Benefits Dependency Network from general IT system implementations to upgrading large IT systems. Practical implications of the ERP Upgrade Productivity Network are that business leaders upgrading ERP systems can use this as a guide to manage changes required in the organisations to gain maximum benefits from upgraded ERP systems.

This research on ERP upgrades is generally from one region of the world Thailand; therefore further research on ERP upgrades is required to understand the following: if the issues from this research are similar to those faced by organisations upgrading ERP systems in other regions of the world, if there might be cultural issues to consider when upgrading ERP systems and if the requirements for achieving enhanced capabilities and productivity outcomes from new IT systems are always dependent on process changes.

Chapter One: Introduction

1.1. Introduction

This chapter presents a brief background to the research as well as explaining its theoretical and empirical significance. The research aims and objectives are also discussed alongside the key research questions. A brief outline of the research design is presented as well as a summary of the key contributions of the research and a complete thesis outline.

1.2. Research background

Enterprise Resource Planning (ERP) systems are packaged suites of business application software which organisations use to manage, integrate and share information between and across all organisational units, business functions, and geographical locations (Imtihan, Ngadiman & Haron 2008; Dorantes et al. 2013). They comprise a suite of business modules such as financial and accounting, Human Resource Management (HRM), logistics and supply chains, production planning, inventory management, sales and distribution and project management (Davenport 1998; McKendrick 2012a). The ERP systems enable organisations to integrate data from all business processes including order management, inventory management, production, accounts receivable and payable, marketing and supply chains for decision making (McGaughey & Gunasekaran 2011) and to manage customers and business.

ERP systems are used in organisations to support the management of business operations (Dorantes et al. 2013) to be able to quickly support changing business demands (Worrell 2007), to manage global operations (Rajapaksha & Singh 2009) for the convergence of data from different technologies (Franz et al. 2012), to integrate large volumes of data from new technologies used by organisations (Olson & Zhao 2007; Hamerman, Moore & Vitti 2010; SAP 2010a; McKendrick 2012a; Oracle 2013a) and to support business growth (Staehr, Shanks & Seddon

2012). Since the release of ERP systems in the early 1990s, it is mostly in the 2000s that many organisations are undertaking rigorous upgrades due to the need for greater organisational capabilities as explained above. Organisations also need greater data visibility for effective data-driven decision-making (La Valle et al, 2012a). For this reason, old ERP systems in organisations are being replaced with the ERP systems upgrade, which in turn requires changes to existing business functions and processes in the organisations (McKendrick 2012a) to improve business management and operations efficiency.

Although initial ERP implementations have been widely researched in the last 20 years, ERP upgrades are different from the initial ERP implementation and have not been adequately examined in the literature. According to Feldman et al. (2015), a key difference between these two activities is that the initial implementation is only undertaken once, while the upgrades can be done more than one time during the ERP life cycle.

Extant literature generally focuses on the processes of organisational decision-making leading to such upgrades (Khoo & Robey 2007; Claybaugh 2010; Otieno 2010; Ng 2011; Dempsey, Vance & Sheehan 2013), best practice and lessons learned (Beatty & Williams 2006; Zarotsky, Pliskin & Heart 2006; Wenrich & Ahmad 2009), critical success factors (Nah & Delgado 2006; Olson & Zhao 2007; Leyh & Muschick 2013; Scheckenbach et al. 2014) and the approaches to upgrade (Feldman et al. 2016).

ERP is the most important large IT system with integrated business modules and features used by large organisations to support their business operations (Olson & Zhao 2007; Avram 2010; Hamerman, Moore & Vitti 2010; SAP 2010a; McKendrick 2012a; Oracle 2013a). Research on initial ERP systems is wide, addressing numerous technological, organisational and management issues (Ng & Chang 2009; Hamerman, Moore & Vitti 2010; Caserio 2011; Kimberling 2012; Scanlon 2012; McKendrick 2012a). Although upgrading ERP systems is a large investment for organisations, it is a necessary requirement to replace old

systems and enhance capacity to manage changing business demands. Upgraded ERP systems lead to improved performance abilities in many respects, including capacity to handle large volumes of data from multiple sources (Olson & Zhao 2007; Hu et al. 2014) and the capacity to process and disseminate data in real across all time zones (Rajapaksha & Singh 2009). This in turn supports effective data-driven decision-making (LaValle et al. 2011; Jayawickrama, Liu & Hudson Smith 2013; Kanellou & Spathis 2013).

Although ERP system are being upgraded at an increasing rate (McKendrick 2012a), a number of areas remain less understood, including which types of upgrade systems are more beneficial to organisations; the motivations behind adopting a certain type of upgrade; the key requirements for upgrading an ERP system and the outcomes organisations achieve from upgrading the system. Since the cost of ERP system upgrades range from two to tens of million dollars (Grand View Research 2016), upgrading ERP systems without clearly identifying the requirements for, and expected outcomes from, the new systems, the exercise could end up very costly yet not achieve the desired outcomes.

Therefore the aim of this research is to explore how organisations go about making decisions on upgrading their systems, the process and requirements for upgrading and the common outcomes achieved.

The research aims to achieve the following key objectives:

- To understand the type of ERP system upgrades commonly undertaken by organisations that determines the organisations' rationale and motivations;
- To determine the requirements for upgrading ERP systems and to identify the business changes necessary for an effective upgrade; and
- To identify some of the key and common organisational improvements achieved from the upgraded ERP system.

The research is guided by the following overarching research questions:

How are organisational capabilities enhanced by upgrading ERP systems and upon what rationale and motivation are system upgrades commonly made?

In order to answer this main question and fulfil the set research objectives, the following three subsidiary questions are developed:

- What are the common ERP system upgrade types that organisations undertake and what are the common reasons for the upgrade and rationale for the choice of upgrade type?
- What business changes are necessary for successful system upgrades across different organisations?
- Which improvements do organisations commonly target and achieve as a result of the upgrade?

1.3. Research design

Since little is known about ERP system upgrades, this is an exploratory study undertaken in two phases and which employs a qualitative mixed method case study approach. Phase One involved an online discussion panel with international ERP upgrade experts. The online panel discussions were undertaken to extract expert views on ERP upgrade issues. The internet-based discussion blog, www.wordpress.com was used to facilitate participation by the expert panel involved in the online panel discussion. The different participants were coordinated by the principal researcher to post and respond to comments from across different time zones. The panel comprised of ERP consultants, vendor representatives and managers of organisations that recently upgraded their ERP systems. After three rounds of discussion and an interpretive analysis of their responses, a set of ERP upgrade themes were identified that, alongside the literature review, helped formulate the interview tool for the second phase of the study.

The second phase of this research involved qualitative case studies developed around a selection of organisations identified to have recently upgraded their ERP systems. Five organisations were identified from vendor publications and organisational websites. Data for the case studies was collected through face-to-face interviews with a total of 24 middle and senior managers. More data was extracted from the content analysis of organisational annual reports from the five organisations. All data was interpretively analysed, guided by Miles, Huberman and Saldaña (2013) to understand ERP upgrade issues of types and motivation for upgrades, requirements and resulting outcomes.

1.4. Research contribution

This research makes a useful contribution to the field of Information Systems (IS) and the theory on ERP systems and ERP system upgrade. It has several theoretical, methodological, and practical contributions (Chapter Seven). This study extends existing knowledge on ERP systems by developing findings on types of, and requirements for, ERP upgrades, as well as the outcomes achieved from ERP upgrades. It develops an ERP System Upgrade Productivity Network and suggests practical recommendations, as a guide to organisations upgrading ERP systems. The findings suggest that the alignment of business process changes with the upgraded ERP systems bring the advantage of new business functionalities, which support the management of large volumes of data, improved data analytics and more importantly, data-driven decisions making in the organisations.

1.5. Outline of the thesis

This thesis comprises of seven chapters:

Chapter One presents a brief background to the research as well as explaining its theoretical and empirical significance and contributions. The research aims and objectives are also discussed alongside the key research questions. A brief

outline of the research design is presented as well as a summary of the key of the research and a complete thesis outline.

Chapter Two presents a comprehensive review of the literature on the ERP system and ERP system upgrades, including types of, and reasons for, ERP upgrades, and requirements necessary for an effective ERP upgrade. Organisational outcomes achieved from the upgraded systems are also discussed. The research problem, aims and key research questions are also discussed in this chapter. The chapter concludes with a discussion of the theories underpinning the research.

Chapter Three describes and justifies the research design for this study. It details the research paradigm, the methodologies used, including the online discussion panel (online focus group), and multiple case studies for the collection and analysis of data. Lastly, ethical considerations are discussed, followed by a brief concluding summary.

Chapter Four describes the processes of data collection through the two methods above. Preliminary findings from this phase of this research, which were generated through interpretive analysis, are discussed and elaborated on. A discussion of the findings in relation to literature on ERP system upgrades is also included in Table 4.2.

Chapter Five presents the five individual cases studies. For each case study the chapter provides a brief organisational profile and background, followed by a discussion of the type of ERP system upgrade adopted at the organisation and the motivations and requirements for upgrading the ERP system. The upgrade outcomes, in terms of enhanced organisational capabilities resulting from the ERP system upgrade at each organisation, are also discussed, followed by a brief chapter summary.

Chapter Six provides a cross-case analysis of the findings from the five case studies, followed by an examination of the implications of the findings in relation to the underpinning theories. A summary of the research findings is also presented and discussed.

Chapter Seven presents the key overall conclusions from the research. It sums up the key findings and the potential contributions that the research makes to knowledge and practice. It also highlights the limitations of the research, and recommendations for further research on this topic.

Chapter Two: Literature Review

2.1. Introduction

This chapter is a review of the literature on Enterprise Resource Planning (ERP) system upgrades. Although it begins with an introduction to ERP systems, the focus is on ERP system upgrade processes and issues. It includes the literature on types of ERP upgrades, reasons for ERP system upgrades, requirements and outcomes in terms of enhanced organisational capabilities and performance outcomes achieved from the upgraded ERP system. It includes a discussion of the theories of the Dynamic Capability and Benefits Dependency Network to develop the conceptual framework guiding this research.

ERP systems are packaged suites of business application software supporting the management of organisations with integrated information shared across all organisational units, business functions and geographical locations (Imtihan, Ngadiman & Haron 2008; Schatz, Egri & Sauer 2011). ERP systems support a whole suite of business processes encompassing finance and accounting, procurement, HRM, supply chain and logistics, production planning and control, inventory management, and sales and distribution, as well as project management (Davenport 1998; McKendrick 2012a). Since ERP systems provide seamless integration and information flow from various business functions into a centralized systems in the organisation (Subramoniam, Tounsi & Krishnankutty 2009), it supports the organisations to improve business management and operational automation such as financial management, manufacturing, procurement, marketing, sales and distributions, and HRM.

According to Jacobs and Weston Jr. (2007), the original ERP systems dates back to the 1960s when the computerised reorder point (ROP) systems were introduced to support basic manufacturing planning and control requirements in manufacturing

organisations. During the 1970s, these systems further evolved to focus on Material Requirements Planning (MRP) with the aim to manage the required raw materials plans to manufacture the finished goods as well as production schedules. In the 1980s, these systems evolved to Manufacturing Resource Planning (MRP II), which increased the system capacity to optimise the whole manufacturing process by reducing overhead costs.

ERP systems were, therefore, introduced as an improved version of MRP II systems. ERP systems were introduced by J.D. Edwards, Oracle, PeopleSoft, Baan and SAP in the 1990s as IT systems with integrated business functions to support improved decision-making and reporting (Botta-Genoulaz & Millet 2006; Staehr 2010), for the management of the whole business operations (Dey, Clegg & Bennett 2010), and for better management of accounts (HassabElnaby, Hwang & Vonderembse 2012) and inventory (Dezdar & Ainin 2011). Elragala and Haddarab (2012) further explain that the ERP systems later evolved to ERP II (Extended ERP system) which included and integrated e-commerce and supply chain functions in the 2000s. Since then a growing number of companies and businesses around the globe have widely implemented the ERP systems as a computerised business backend system to manage its business.

Research on initial ERP system implementations is wide, addressing implementation and management issues (Nordheim 2009), success factors (Nah, Zuckweiler & Lau 2003; Nah & Delgado 2006), failure factors (Tsai et al. 2005; Wong et al. 2005), business process reengineering (Martin & Cheung 2005; Subramoniam, Tounsi & Krishnankutty 2009; Tsai et al. 2010) and other technological and organisational issues.

However, since the release of ERP systems in the early 1990s, these systems are now being upgraded for improvements in system performance to support the needs of changing business demands (Worrell 2007). The main aim is to more efficiently manage global business operations (Rajapaksha & Singh 2009), and to integrate large

volumes of data from numerous sources and technologies (Olson & Zhao 2007; Hamerman, Moore & Vitti 2010; McKendrick 2012a).

2.2. ERP system upgrade

An ERP system upgrade is a periodic and post-implementation activity undertaken to improve system performance to better support changing business trends (Vaucouleur 2009; Grabski, Leech & Schmidt 2011; Scheckenbach et al. 2014). Feldman et al. (2015) explain that initial ERP implementation occurs once, while an upgrade can take place a number of times. Zhao (2007) suggests that this requires a greater effort and entails more activities than the initial implementation. Although ERP system upgrades are generally initiated by organisations to meet new business demands (Ng & Gable 2010; Hecht, Wittges & Krcmar 2011; Dempsey, Vance & Sheehan 2013), they may also be initiated by vendors (SAP, ORACLE, MICROSOFT and custom providers) for continuous improvements in the systems in terms of additional business processes (Hamerman, Moore & Vitti 2010), and for enhanced technical, functional and security features (Sufi 2008). Law, Chen and Wu (2010) suggest that ERP system upgrade is warranted each time a new version of the system is released. Thus an ERP system upgrade can be the implementation of a new ERP version from the same vendor (as the current installed version), or from a different vendor (Ng 2011). Others describe an ERP upgrade as a post-implementation phase of the ERP life cycle, which is generally an 'onward and upward' phase of ERP implementation (Law, Chen & Wu 2010; Sullivan & Bozeman 2010; Grabski, Leech & Schmidt 2011; Hecht, Wittges & Krcmar 2011).

2.3. Types of ERP system upgrades

Types of ERP system upgrades vary from technical, functional and full system. The *technical* (Hamerman, Moore & Vitti 2010; Kaplan 2011; Dempsey, Vance & Sheehan 2013; Oseni et al. 2013), which are usually minor, and generally undertaken to improve the technological platform only. The *functional upgrade* (Oseni et al. 2013)

can be major, depending on the range of business applications being changed and what kinds of improvements are sought. The third type of upgrade is *full system* (SAP 2007), which involves replacing the whole system with a new system. By upgrading ERP systems, organisations increase platform capacity, add new functionalities, improve business processes and enhance system performance (Chou & Chang 2008; Feldman et al. 2015).

Technical upgrades generally lead to an improved technology platform (Oseni et al. 2013), which increases system performance (Dempsey, Vance & Sheehan 2013), resulting in business efficiencies. Although Schäumer (2007) suggests that technical upgrades are a good way to start ERP system upgrades, Zarotsky, Pliskin and Heart (2006) argue that focusing only on technical upgrades can result in cost and budget constraints as well as business disruptions (Zarotsky, Pliskin & Heart 2006).

Conversely functional upgrades involve the implementation of enhanced business functions to the existing ERP system (Oseni et al. 2013). They also provides major business improvements with new enhanced functionalities (Dempsey, Vance & Sheehan 2013) and improve business processes in regards to the organisations' needs (Feldman et al. 2015). A full system upgrade, as the name suggests, is the replacement of the existing system with a new improved system (Hamerman, Moore & Vitti 2010). Full system upgrades generally result in major business transformation (Hamerman, Moore & Vitti 2010).

Types of ERP system upgrades and their scope are summarised in Table 2.1.

Table 2.1 Types of ERP system upgrades

Type of ERP system upgrades	References	Scope
Technical - Improvements to the technology platform	Zarotsky, Pliskin and Heart (2006); Schäumer (2007); Dempsey, Vance and Sheehan (2013); Oseni et al. (2013)	Minor
Functional Upgrade - Adding new business function modules to the system	Dempsey, Vance and Sheehan (2013); Oseni et al. (2013);	Major

Type of ERP system upgrades	References	Scope
	Feldman et al. (2015)	
Full system upgrade - Replacing the whole system with a new improved version of the system	Hamerman, Moore and Vitti (2010)	Major

As shown by the information presented in Table 2.1, technical upgrades are generally minor technical improvements to an existing system; functional upgrades involve the addition of new business functions to an existing system and full system upgrades are major replacements of the system due to major transformations in the business.

Some authors (Law, Chen & Wu 2010; Ng 2013; Scheckenbach et al. 2014) have referred to ERP maintenance and modifications, which are also post-implementation processes, as upgrades. However ERP system maintenance generally occurs soon after organisations implement an ERP system (Ng & Gable 2010; Salmeron & Lopez 2010), as well as throughout the life of the system. This includes minor functional enhancements, such as the development of a patch to correct the faults in the implemented system (Law, Chen & Wu 2010), or to align the system to ongoing organisational business adjustments (Ng & Gable 2010). On the contrary, an ERP system modification refers to changing or customising modules in the ERP system to align organisational processes with ERP supported business functions (Chou & Chang 2008), to meet specific business requirements of the organisation (Dittrich & Vaucouleur 2008). ERP modifications can entail changes to user interfaces and program source codes (Law, Chen & Wu 2010), changes to ERP standard codes, software properties and functionality (Ng & Gable 2010) or add-on programs for query and reporting (Chou & Chang 2008). Oseni et al. (2013) explain that modifications are required to better exploit the ERP system to meet organisation-specific requirements.

An ERP system upgrade is generally refined to the implementation of a new version of the system (Ng & Wang 2014), with an increased platform capacity, new functionalities, improved business processes and system performance capacity

(Worrell 2007; Chou & Chang 2008). ERP system upgrades require substantial changes and are impacted by a number of factors for organisations to realise benefits from the new system (Wenrich & Ahmad 2009; Claybaugh, Ramamurthy & Haseman 2017). Reasons for upgrading ERP systems are discussed in the next section.

2.4. Reasons for ERP system upgrades

Organisations upgrade their ERP systems to support their changing business needs (Otieno 2010), to be able to meet new legal and compliance policies (Panaya 2012), to improve business performance with reduced costs (Avram 2010), support big data management (Elragal 2014), effectively manage outsourced processes (Ifinedo 2008) and have state of the art technology for business management (Hamerman, Moore & Vitti 2010; McKendrick 2012a).

Organisations upgrade ERP systems because upgraded ERP modules support better integration of data and information from different business functions (Leyh & Muschick 2013), and organisational processes are supported with customised modules (Hamerman, Moore & Vitti 2010; Riis 2012a; Dempsey, Vance & Sheehan 2013). Other reasons for upgrading ERP systems are summarised in Table 2.2.

Table 2.2 Reasons for ERP system upgrades

Reasons for ERP system upgrade	References	Category
Support changing business needs	Otieno (2010)	Business
Align with new legal and compliance requirements	Panaya (2012)	Business
Reduce process bottlenecks with better information management	Feldman et al. (2015)	Business
Better manage outsourced processes	Ifinedo (2008)	Business
Enable selective data sharing with	Hans (2013)	Business

Reasons for ERP system upgrade	References	Category
business partners		
Improved capacity and capability to meet changing business demands	Dempsey, Vance and Sheehan (2013)	Business
Strategic business improvement	Hamerman, Moore and Vitti (2010)	Business
Improved business performance	Greenbaum (2009)	Business
Better integration of information from different business functions	Leyh and Muschick (2013)	Technical
Support of big data management	Elragal (2014)	Technical
Replacement of customised modules with standard ERP modules for cost efficiencies and system consistency	Hamerman, Moore and Vitti (2010); Riis (2012a); Dempsey, Vance and Sheehan (2013)	Technical
State of the art technology for business function management	Hamerman, Moore and Vitti (2010); McKendrick (2012a)	Technical
Extension of vendor's maintenance support to the new version of software	Dempsey, Vance and Sheehan (2013); Scheckenbach et al. (2014); Seethamraju (2015)	Technical
Aquisition of new functional capabilities	Otieno (2010)	Technical
Centralised data management	Brege et al. (2012)	Technical
A reduction in application support services for the Operating System (OS), database management, and hardware support	CA Technologies (2012)	Technical

From Table 2.2 reasons for upgrading ERP systems are both business as well as technical. Businesses normally require ERP system upgrades to improve the

management of business operations. On the contrary, technical reasons for the upgrade are for IT infrastructure improvement, a reduction in application support, enhanced database management, and a better alignment of ERP system modules to business requirements. Akin to the adoption and implementation of all new technologies, requirements for upgrading ERP systems are an important consideration, as discussed in the next section.

2.5. Requirements for ERP system upgrades

It is important to establish the requirements for ERP upgrades upfront in order to avoid additional costs later (Olson & Zhao 2006) and to be able to complete the project in time (Scanlon 2012). Scheckenbach et al. (2014) suggest that the implementation of ERP system upgrades requires a well-documented plan with a clear upgrade goal statement, methods of coordination, communication and documentation of discussions with upgrade partners, as well as clearly defined roles and responsibilities of individuals and departments. McKendrick (2012b) emphasises that this will ensure upgrades are accomplished in a timely manner without incurring too many additional costs. Moreover, KPMG LLP (2009) highlight that for effective ERP system upgrades a strategic vision for business improvements as well as for enhancing IT and organisational capabilities is required at the planning stage. This view is confirmed by Kimberling (2012) who suggests that a strategy, a plan, Human Resources (HR) and time for the project are required. Although Scheckenbach et al. (2014) support the need for a strategic and detailed plan to control and manage the ERP System Upgrade Project, they also emphasise that an organisational understanding of why ERP needs to be upgraded needs to be clearly communicated to the organisation. The scope of the upgrade project (McKendrick 2012b), an estimation of the cost (McKendrick 2012b), the new hardware design, landscape, OSs, business downtime (Oracle 2011), database capacity (Oracle 2011), user participation (Wagner & Newell 2007), roles of ERP system upgrade consultants (Leyh & Muschick 2013) and risk management (Zarotsky, Pliskin & Heart 2006;

Scheckenbach et al. 2014) have also been identified to be requirements for ERP system upgrades. Project management (Caserio 2011) with budget and milestones (Avram 2010; McKendrick 2012b) and top management support (Leyh & Muschick 2013) are considered to be equally important.

Worrell (2007) supports the need for transformation of business processes across the enterprise for the upgraded ERP systems which entail improved capabilities to integrate and manage data, and information from all business functions (McKendrick 2012a). Organisations upgrade their ERP systems to meet new business demands (Ng & Chang 2009; Dempsey, Vance & Sheehan 2013). The upgraded ERP systems offer new functionalities for managing business for which organisations need to change their business processes to align them to new business functions in the upgraded system.

Requirements for ERP system upgrades drawn from the literature review discussed above are categorised as Management, People Management, Project Management, Financial Resources, Outsourcing Management and Technical in Table 2.3.

Table 2.3 Requirements for ERP system upgrades

Requirements for ERP system upgrades	References	Category
A well-documented strategy and plan	Scheckenbach et al. (2014)	Management
An organisational understanding and clear communication of the need for ERP system upgrades	Scheckenbach et al. (2014)	Management
Risk management	Zarotsky, Pliskin and Heart (2006); Scheckenbach et al. (2014)	Management
Top management involvement	Leyh and Muschick (2013)	Management

Requirements for ERP system upgrades	References	Category
Business Process Change	Wenrich and Ahmad (2009); Grabski, Leech and Schmidt (2011)	Management
The establishment of an ERP system upgrade activities and responsibilities	Scanlon (2012)	People Management (Human Resources (HR))
Human resources and time	Kimberling (2012)	People Management (Human Resources (HR))
A cross-functional team	Wagner and Newell (2007); Leyh and Muschick (2013)	People Management
User participation	Wagner and Newell (2007)	People Management
A well-established scope of the upgrade project	SAP (2010a); McKendrick (2012b)	Project Management
Project management	Caserio (2011)	Project Management
Financial Support (Budget)	Avram (2010); McKendrick (2012b)	Financial Resources
Services of consultants	Leyh and Muschick (2013)	Outsourcing Management
The new hardware design, landscape, Operating System (OS), and business downtime	SAP (2010a); Oracle (2011)	Technical
Database capacity and capability	Oracle (2011)	Technical

Requirements for ERP system upgrades range from strategy to technology, and also include people, management and finance. Business process changes are required to align organisational business processes with new ERP modules (Wenrich & Ahmad 2009; Grabski, Leech & Schmidt 2011). An understanding of the requirements for

ERP system upgrades supports the implementation of the upgrade project in a timely and cost-effective manner (Scanlon 2012). Technical requirements for ERP system upgrades include a well planned and designed platform for hardware, an OS, database capacity, cloud system for data storage, and the management of business downtime (SAP 2010a; Oracle 2011). From the management point of view, planning and strategy (Scheckenbach et al. 2014), finance (Avram 2010; McKendrick 2012b), risk management (Zarotsky, Pliskin & Heart 2006; Scheckenbach et al. 2014), the ability to engage consultants (Leyh & Muschick 2013) and to communicate information about the upgrade in the organisation (Scheckenbach et al. 2014) and process changes (Wenrich & Ahmad 2009; Grabski, Leech & Schmidt 2011) are important requirements. Project management (Caserio 2011), to ensure timely completion of the project, and a cross functional team (Wagner & Newell 2007; Leyh & Muschick 2013) with clearly defined roles and responsibilities of individuals and departments in the project is needed for understanding the organisational need for ERP system upgrades.

2.6. Organisational capabilities

From earlier research on IT systems implementation, it is known that organisational capabilities of better knowledge management and knowledge sharing (Reychav & Anand 2011), better alignment of business process and IT (Chen et al. 2008), better customer service (Grover & Kohli 2012), management of larger volumes of data (Greenbaum 2009; McKendrick 2012a; Hu et al. 2014), improved and data driven decisions (LaValle et al. 2011) , improved security of data (Hamerman, Moore & Vitti 2010; Acuña 2016) and flexibility (Tian et al. 2010) are achieved from new IT systems. Aral and Weill (2007) further explain that enhanced organisational capabilities lead to productivity and performance improvements of increased global and online market share, better relationship management with all stakeholders and a competitive advantage.

Other research on organisational capabilities achieved from IT include improved IT resources management (Lu & Ramamurthy 2011), integration data from different sources (McKendrick 2012a; Syed, Gillela & Venugopal 2013; Elragal 2014), better strategic decision making (Jayawickrama, Liu & Hudson Smith 2013; Kanellou & Spathis 2013), organisational learning (Teece 2007) and improved Supply Chain Management (SCM) (Vaidyanathan, Sabbaghi & Fu 2008). The adoption of new IT also extends the capabilities of improved security of data (Hamerman, Moore & Vitti 2010), improved ability to meet the new business demands of globalisation (Rajapaksha and Singh 2009), digitisation (Aral & Weill 2007) and improved ability to process larger volumes of data (McKendrick 2012b; Elragal 2014).

Earlier IS research underpinned by the theory of the Dynamic Capabilities are summarised in Table 2.4.

Table 2.4 IT-related capabilities achieved from new IT adoption.

References	Context	Study/ Aim(s) of research	Type of Research	Enhanced capabilities
Sher and Lee (2004)	IT supports knowledge management	To examine the use of knowledge management in enhancing Dynamic Capabilities	Quantitative	<ul style="list-style-type: none"> • Improved strategic management • Quality improvement • Business efficiency
Chen et al. (2008)	Aligning Information Technology (IT) and business strategy with a Dynamic Capabilities perspective: A longitudinal study of a Taiwanese Semiconductor Company	To examine how developing IT is important for strategic alignment. The alignment of IT to internal and external environments is a set of Dynamic Capabilities for competitive advantage.	Qualitative (Single case study)	<ul style="list-style-type: none"> • Alignment of IT strategy and business strategy • IT effectiveness
El Sawy and Pavlou (2008)	Emerging IT infrastructure for turbulent times	To examine how IT infrastructure capabilities effect business capabilities including Operational, Dynamic, and Improvisational Capabilities in turbulent environments	Literature review	<ul style="list-style-type: none"> • Organisational Dynamic Capabilities • Improvisational capabilities • Operational capabilities
Stratman (2008)	Facilitating offshoring with enterprise technologies: Reducing operational friction in the governance and production of services	To meet the challenge of offshore governance	Literature review	<ul style="list-style-type: none"> • Reduced transaction costs • Develop business process capabilities • Facilitate the transfer of process knowledge
Wu and Hisa (2008)	Developing E-Business Dynamic Capabilities: An Analysis of E-Commerce Innovation	To implement an e-commerce innovation model to analyse the differences in technological knowledge, business model and	Qualitative	<ul style="list-style-type: none"> • E-commerce innovation with technological knowledge • New business models

References	Context	Study/ Aim(s) of research	Type of Research	Enhanced capabilities
	from I-, M-, to U-Commerce	Dynamic Capability aspects of internet-commerce, mobile-commerce and ubiquitous commerce		<ul style="list-style-type: none"> • Business capabilities
Anand et al. (2009)	Dynamic Capabilities through continuous improvement infrastructure	To identify the content of continuous improvement strategies and identify infrastructure decision areas that are important for continuous improvement initiatives	Qualitative (Case study)	<ul style="list-style-type: none"> • Continuous improvement capabilities • Process improvement • New learning)
Schwarz et al. (2010)	IT-enabled organisational business process	<p>To establish a Dynamic Capabilities approach to understanding the impact of IT-enabled businesses processes and IT-business alignment on the strategic and operational performance of the firm</p> <p>To examine the IT-business alignment on the strategic and IT-enabled business process performance lead to IT-enabled performance</p>	Quantitative	<ul style="list-style-type: none"> • Alignment of business and IT strategy • Improved strategic alignment
Hwang (2011)	The Drivers of ERP Implementation and Its Impact on organisational capabilities and Performance and Customer Value	To understand the impact of IT-enabled business processes and IT-business alignment on the strategic and operational success of a firm	Quantitative	<ul style="list-style-type: none"> • Increase supplier and organisational capabilities • Enhance customer value

References	Context	Study/ Aim(s) of research	Type of Research	Enhanced capabilities
Reychav and Anand (2011)	E-learning technologies in the organisation	To explore relationships between collaborative Dynamic Capabilities, knowledge sharing and e-learning technology	Quantitative	<ul style="list-style-type: none"> • Enhance knowledge sharing and new knowledge • Improved learning process • Supported decision quality • Improved communication and coordination capabilities • Improved responsiveness to the market • New product development • Improved resource deployment capabilities
Kim et al. (2011)	IT Capabilities, process-oriented Dynamic Capabilities, and firm financial performance	To reorganising firm level - Dynamic Capabilities as key to improved firm performance	Quantitative	<ul style="list-style-type: none"> • IT personnel expertise, IT infrastructure flexibility, and IT management capabilities • Enhanced process-oriented capability • Better information sharing/communication • Reduced cost of operational processes
Niehaves, Plattfaut and Sarker (2011)	Understanding Dynamic Capabilities for effective process	To understanding of IT-enabled business process change and elements of Dynamic Capabilities	Qualitative (Case study)	<ul style="list-style-type: none"> • IT-enabled business process change capabilities • IS change success

References	Context	Study/ Aim(s) of research	Type of Research	Enhanced capabilities
	change: A Theoretical framework and an empirical application			capabilities
Anand, Wamba and Sharma (2013)	The Effects of firm IT capabilities on firm performance: The mediating effects of process improvement	To examine the direct relationship between the firm IT capabilities and firm performance	Quantitative	<ul style="list-style-type: none"> • Enhanced organisational performance improved processes at organisation levels
Bernroider, Wong and Lai (2014)	From Dynamic Capabilities to ERP enabled business improvements: The mediating effect of the implementation project	To explore if an ERP implementation project mediates the relationship between dynamic pre-adoption capabilities and ERP-enabled business improvements	Quantitative (Survey)	<ul style="list-style-type: none"> • Improved ERP enabled business capabilities • Enhanced organisational project management capabilities
Oh, Yang and Kim (2014)	Managerial capabilities of IT and firm performance: role of e-procurement system type	To examine the moderating effect of certain e-procurement system types on the relationship between IT capabilities and firm performance	Quantitative	<ul style="list-style-type: none"> • Improved collaboration capabilities • Enhanced financial performance

Table 2.4 shows that the organisational capabilities achieved from IT systems, therefore, include knowledge management, better information sharing, improved strategic management, quality improvement and business efficiency. The deployment of IT also enhances increased productivity growth, better alignment of IT to business strategy and processes, improved strategic alignment, e-commerce innovation, improved process efficiencies, effective business management, improved collaboration within organisations and better financial management.

2.7. Productivity improvement

Productivity improvement refers to better productivity by eliminating delay, idleness and waste in order to enhance organisational resource utilisation (Mohsen & Hassan 1992). By employing well-trained employees and using high-quality resources (Mohsen & Hassan 1992), organisations can enhance productivity improvement by improving their capabilities and working routines, redesigning work processes, reducing redundant operations and increasing speed of work. Yuhn and Park (2010) assert that a key factor of productivity improvement is technological change which increases technological efficiency to support business demands. Ogilvie, Pohlen and Jones (1988) state that organisations employ efficient and rapid IT and IS resources to enable improved data access, resulting in improved productivity from quick decisions.

Productivity improvement in organisations generally entails increased organisational efficiency and effectiveness (Beheshti & Beheshti 2010) and effective use of resources (Patra & Bartaki 2009). However, these improvements according to Mohsen and Hassan (1992), are outcomes of enhanced capabilities in the organisation, generally achieved from the adoption and implementation of new IT systems. This is confirmed by Yuhn and Park (2010) who explain that productivity improvements are achieved from technological change which increases organisational efficiencies. Organisational productivity improvements

achieved from ERP system upgrades include effective management of global operations (Rajapaksha & Singh 2009; Beheshti & Beheshti 2010), e-business support (Kumar & Thapliyal 2010), increased business partner satisfaction (Ince et al. 2013), increased market share (Fub et al. 2007; Law & Ngai 2007), business growth and competitive advantage (Beheshti & Beheshti 2010; Dempsey, Vance & Sheehan 2013).

The above literature discussion indicates that ERP system upgrades can be for technical or business reasons, which are either a partial or whole system upgrade. Requirements for ERP system upgrades entail management, budget, HR, project management and outsourcing management and business changes required. The literature also indicates that these required business changes lead to the achievement of improved capabilities in decision-making (Jayawickrama, Liu & Hudson Smith 2013; Kanellou & Spathis 2013), knowledge sharing (Reychav & Anand 2011) and organisational performance improvement (Schwarz et al. 2010). These capabilities are required for better meeting the new business demands of globalisation (Rajapaksha and Singh 2009), digitisation (Aral & Weill 2007) and better e-business support (Kumar & Thapliyal 2010), and for processing larger volumes of data (McKendrick 2012b; Elragal 2014).

Although types of, and reasons for, ERP system upgrades are well established, little is known on how ERP system upgrade led business changes result in improved capabilities for enhanced organisational performance.

Therefore the key research question guiding this study is:

How are organisational capabilities enhanced by upgrading ERP systems and upon what rationale and motivation are system upgrades commonly made?

To answer the main research question, several subsidiary questions have been developed as follows:

- What are the common ERP system upgrade types that organisations undertake and what are the common reasons for the upgrade and rationale for the choice of upgrade type?
- What business changes are necessary for a successful system upgrade across different organisations?
- Which improvements do organisations commonly target and achieve as a result of the upgrade?

2.8. Theoretical underpinning

Since this research explores ERP system upgrades for enhanced organisational capabilities and productivity improvement, it is guided by the theories of Dynamic Capability (Teece & Pisano 1994; Teece, Pisano & Shuen 1997; Eisenhardt & Martin 2000; Teece 2000) and the Benefits Dependency Network (Peppard, Ward & Daniel 2007). Dynamic Capabilities Theory, according to Teece, Pisano and Shuen (1997), refers to a firm's ability to integrate, build and reconfigure internal and external competences to address the rapidly changing environment. They describe capability as a set of learned processes and activities that enable an organisation to produce a particular outcome. Eisenhardt and Martin (2000) extend this theory by explaining that Dynamic Capabilities are organisational and strategic routines by which firms achieve new resource configurations in turbulent markets. These include capabilities of strategic decision-making, reconfiguration of resources within firms, changed processes, knowledge creation for effective strategy and improved performance, new alliance and acquisition for new resources from external sources.

Beatty and Williams (2006) and Leyh and Muschick (2013) suggest that ERP systems are an important IS resource that organisations depend on to operate and manage business in a rapidly changing environment. ERP system upgrades, whether partial or whole, result in business process changes (Wenrich & Ahmad 2009; Grabski, Leech & Schmidt 2011) that enhance IT resources management

(Lu & Ramamurthy 2011), integration data from different sources (McKendrick 2012a; Syed, Gillela & Venugopal 2013; Elragal 2014), strategic decision-making (Jayawickrama, Liu & Hudson Smith 2013; Kanellou & Spathis 2013), Supply Chain Management (SCM) (Vaidyanathan & Sabbaghi 2007), knowledge management and knowledge sharing (Reychav & Anand 2011), better security management of information (Hamerman, Moore & Vitti 2010).

The Benefits Dependency Network *'provides a framework for explicitly linking the overall investment objectives and the requisite benefits with the business changes which are necessary to deliver those benefits and the essential IT functionality to both drive and enable these changes to be made'* (Peppard, Ward & Daniel 2007, pp. 10-11). The four elements of Benefits Dependency Networks are IT enablers, enabling changes, business changes and benefits (Peppard, Ward & Daniel 2007). According to Ward and Daniel (2006, p. 136), an *IT enabler* is *'the information systems and technology required to support the realisation of identified benefits and to allow the necessary changes to be undertaken'*.

Productivity improvements achieved from IT systems include efficient management of global operations (Rajapaksha & Singh 2009; Beheshti & Beheshti 2010), effective e-business support (Kumar & Thapliyal 2010) and organisational performance improvement (Anand et al. 2009; Schwarz et al. 2010). Other productivity improvements include increased market share (Fub et al. 2007; Law & Ngai 2007), better customer and partner relationship management (Ince et al. 2013) and business growth and competitive advantage (Dempsey, Vance & Sheehan 2013).

Based on the above literature discussion an ERP System Upgrade Productivity Network guided by the theories of Dynamic Capabilities (Eisenhardt & Martin 2000) and Benefits Dependency Network (Peppard, Ward & Daniel 2007) is conceptualised in Figure 2.1 to establish the outcomes achieved from ERP system upgrades.

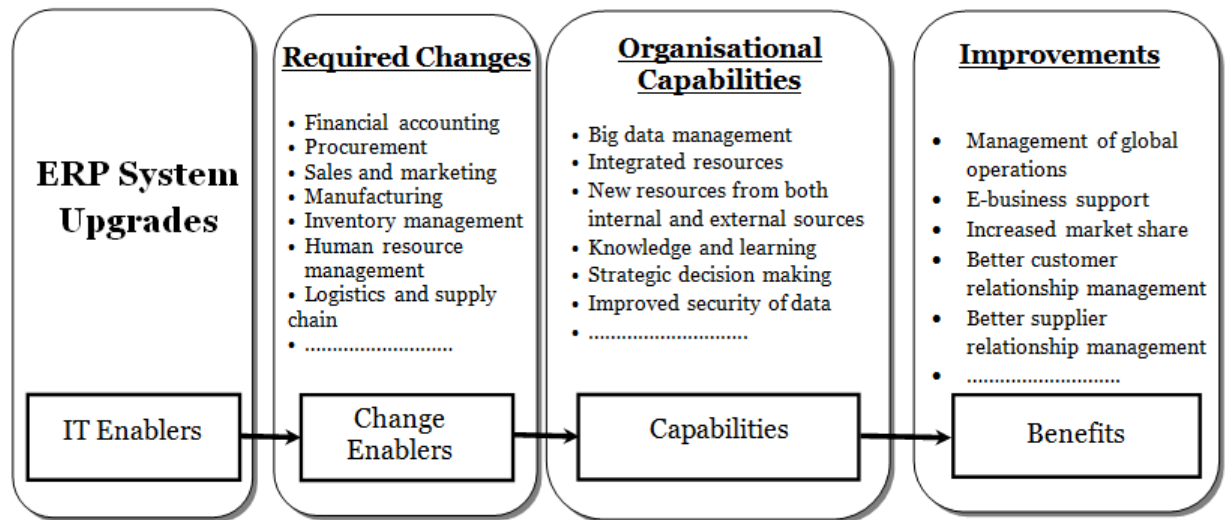


Figure 2.1 An ERP System Upgrade Productivity Network guided by Dynamic Capabilities (Eisenhardt & Martin 2000) and Benefits Dependency Network (Peppard, Ward & Daniel 2007).

Figure 2.1 is a conceptual framework showing that upgrading the ERP system is an IT enabler that leads to the achievement of enhanced organisational capabilities by incorporating a number of required business changes. The ERP System Upgrade Productivity Network aims to establish the relationship between ERP system upgrades resulting in the necessary business changes to enhance new organisational capabilities (Eisenhardt & Martin 2000) and achieve productivity improvements (Ward & Daniel 2006; Peppard, Ward & Daniel 2007).

ERP system upgrades in Figure 2.1 are referred to as an IT-enablers. In the theory of Dynamic Capabilities, new IT systems are a resource that leads to new organisational capabilities (Teece, Pisano & Shuen 1997; Eisenhardt & Martin 2000). The ERP system upgrades in Figure 2.1 therefore are a resource.

Enabling changes, according to the Benefits Dependency Networks (Peppard, Ward & Daniel 2007) are new work practices and redesigned business processes to achieve the benefits from the new IT system. Therefore, in the productivity network for ERP system upgrades (Figure 2.1), required changes are referred to as ‘*change enablers*’.

According to the theory of Dynamic Capabilities (Eisenhardt & Martin 2000), enhanced capabilities from new systems (ERP system upgrades) (Figure 2.1) entail integration of data from different sources (McKendrick 2012a; Syed, Gillela & Venugopal 2013; Elragal 2014), strategic decision-making (Jayawickrama, Liu & Hudson Smith 2013; Kanellou & Spathis 2013), SCM (Vaidyanathan, Sabbaghi & Fu 2008), knowledge management and knowledge sharing (Reychav & Anand 2011), improved security management of information (Hamerman, Moore & Vitti 2010) and the alignment of business and IT (Chen et al. 2008; El Sawy & Pavlou 2008).

According to the Benefits Dependency Networks (Peppard, Ward & Daniel 2007), beneficial outcomes of new systems (Figure 2.1) result in reduced costs, strategic planning, and diminished customer waiting times. Expected productivity improvements from ERP systems upgrade, according to the literature, include enhanced global operations (Rajapaksha & Singh 2009), e-business support (Kumar & Thapliyal 2010), increased market share (Fub et al. 2007; Law & Ngai 2007), better customer and partner relationship management (Ince et al. 2013) and a competitive advantage (Beheshti & Beheshti 2010; Dempsey, Vance & Sheehan 2013).

According to the theory of Dynamic Capabilities (Eisenhardt & Martin 2000), improved organisational capabilities result in productivity improvements. Therefore in the ERP System Upgrade Productivity Network (Figure 2.1), *benefits* from the Benefits Dependency Network are referred to as improved organisational performance and productivity outcomes.

This relationship between ERP system upgrades (*IT enablers*), required changes (*change enablers*), organisational capabilities (*capabilities*) and improvements (*benefits*) are depicted in the ERP System Upgrade Productivity Network (Figure 2.1) guided by theories of Dynamic Capabilities (Eisenhardt & Martin 2000) and the Benefits Dependency Network (Peppard, Ward & Daniel 2007).

As seen in Figure 2.1, the network illustrates that ERP system upgrades are identified as IT enablers which organisations invest in to improve their existing ERP systems for improved support to business. Change enablers are required business changes to be undertaken with the upgraded ERP system. These business changes are made to ensure the identified business benefits (for instance, organisational capabilities and productivity improvement) are realised. Enhanced new organisational capabilities are achieved from the upgraded ERP system.

The above literature analysis indicates that ERP system upgrades are improvements to the system, undertaken for technical or business reasons, either as a partial or whole system upgrade. Essential requirements for ERP system upgrades are management support, budget, HR, project management, outsourcing management and business changes. These changes lead to the achievement of enhanced capabilities of knowledge management, innovation, better alignment of business processes and the system, better customer service and improved SCM. The literature also suggests that enhanced organisational capabilities result in improved performance outcomes.

To establish the relationship between required changes for ERP system upgrades, improved capabilities and productivity improvements are guided by the Benefits Dependency Network (Peppard, Ward & Daniel 2007). The Benefits Dependency Network developed from workshops attended by sales and marketing managers show that business changes to working practices and processes and/or relationships lead to benefits. The Benefits Dependency Network is deployed to ensure that all required business changes are made, as well as improved IT capabilities being accomplished (Wilson, Clark & Smith 2007).

2.9. Summary

This chapter has provided an insightful review of the background literature relating to ERP system upgrades, the types of ERP system upgrades, reasons and requirements for ERP system upgrades, organisational capabilities, productivity improvement and theories of Dynamic Capabilities and the Benefits Dependency Network guiding this research.

Based on the extensive literature review in Chapter Two, discussions of the research approach and adopted research methods for this study are described and justified in Chapter Three.

Chapter Three: Research Methodology

3.1. Introduction

This chapter describes and justifies the research design and methodology for this study. It explains and justifies why this study is exploratory and provides the rationale for the qualitative approach. It details the two data collection methods: the online discussion panel and multiple case studies used in this research.

3.2. Research design

The aim of this research is to explore Enterprise Resource Planning (ERP) system upgrades with regard to the types of, and motivation for, upgrading existing ERP systems in organisations; the requirements and associated business changes for the upgrade; and the resulting outcomes. Since ERP system upgrades are a new post-ERP implementation activity, and research on this topic is sparse, this is an exploratory qualitative study guided by the interpretive paradigm (Collis & Hussey 2009).

Exploratory studies offer an opportunity to comprehend phenomena that is little understood; they offer a means to discover and gain information and an understanding of the subject area. They also help to identify issues and variables for further rigorous investigation (Collis & Hussey 2009; Saunders, Lewis & Thornhill 2009). The research is a qualitative study since qualitative studies are more appropriate for exploring under-researched phenomena (Yin 2014). Since this research intends to attain a deeper understanding of ERP system upgrades and resulting enhanced capabilities via business changes, the generalisation from a setting to a population is not sought; instead, a deeper understanding of the relationship between business changes for enhanced capabilities is explored with the intention to inform other settings (Orlikowski & Baroudi 1991; Johnson

& Christensen 2008). Therefore this research is an interpretive study which enables understanding of phenomena through assessing meanings that participants assign to them (Orlikowski & Baroudi 1991).

3.3. Research methodologies

This research project was undertaken in two phases:

Phase One: an online discussion panel.

Phase Two: multiple case studies.

3.3.1. Phase One: An online discussion panel

The online discussion panel is an internet-technology-based, online discussion panel similar to focus group research (Ridings & Wasko 2010). Different from focus groups though, the responses are rarely instantaneous, and participants can respond to issues at different times (Gaiser 2008). The online discussion panel technique assists in simplifying consensus with findings from geographically distributed participants (Khodyakov et al. 2011). In addition, this technique involves a group of people who are interested in the focused research area and whose views on the research topic help generate more specific research ideas (Saunders, Lewis & Thornhill 2009, p. 590).

The ERP system upgrade process normally involves pockets of upgrade knowledge and expertise from ERP vendors (Cisco 2007; Foo 2008; SAP 2008, 2010a; Oracle 2011), ERP champions in the organisations that upgraded their ERP systems (Cisco 2007; Foo 2008), consultants involved in ERP system upgrades (Olson 2009; Alsulami, Rahim & Scheepers 2013) and a few researchers around the world (Whang, Lee & Kim 2003; Zarotsky, Pliskin & Heart 2006; Olson & Zhao 2007; Ng & Chang 2011; Rauff & Hufgard 2013). Therefore it was pertinent to gather insights from a sample that was representative of these actors. The best way to capture this information from ERP system upgrade

stakeholders, who were from different parts of the world, was to conduct an online discussion panel.

The benefits of online discussion panels are that they are cost-saving and time-effective (Snyder-Halpern, Thompson & Schaffer 2000); they are able to engage more diverse panel members; allow the inclusion of experts from other countries; enable anonymity thus avoiding possible biases; and enable discussions at a time convenient to panellists (Khodyakov et al. 2011). In addition, this technique enables the involvement of a group of people who are learned in the topic area (Saunders, Lewis & Thornhill 2009). Because of these advantages, online discussion panels are being widely adopted in Information Systems (IS) research (Singh & Burgess 2007; Abu Abid 2013; Alsulami, Rahim & Scheepers 2013). Although online discussion panels can suffer from variable participation rates, information overload, difficulties in following discussion threads; and the difficulty of identifying best panellists (Khodyakov et al. 2011), it was still the most appropriate method for collecting expert and practitioner perspectives on ERP system upgrade in the first phase of this research.

3.3.1.1. Online discussion panel process used in this research

The online discussion panel was undertaken in the following:

Step One: An extensive literature review was undertaken to establish the types of ERP system upgrades, the business changes required to undertake ERP system upgrades, the organisational capabilities and productivity improvements achieved from the ERP system upgrades.

Step Two: Given that it was pertinent to gather insights from a sample that was representative of all that were involved with ERP system upgrades, this phase was devoted to seeking knowledge of ERP system upgrades from ERP vendors, ERP champions in organisations that upgraded their ERP systems, consultants involved in ERP system upgrades and a few researchers around the world. The expert panellists were chosen from the researcher's search of publications,

websites, industry reports, case studies, ERP system upgrade providers such as SAP and Oracle sites, academic publications, and LinkedIn pages, and from recommendations offered by the researcher's peers.

Step Three: I invited prospective panellists to participate in this research by sending them e-mails and LinkedIn messages, briefly explaining the aim and expected outcomes of this research and outlining the importance of their input in this project for the success of this research. They were assured of anonymity, and a brief explanation of how the online discussion panel would be conducted was also included. A total of 73 invitation emails were sent to people who had experience with the ERP system upgrades to participate in the online discussion panel. This invitation is attached as Appendix A. Twelve people replied to the invitation declining to participate in the project, however twenty people accepted the invitation and agreed to participate and share their knowledge and experience in regards to ERP system upgrades. However, in the actual discussion only twelve people participated. The respective expertise of these twelve participants in the Round One discussion is listed in Table 3.1.

Table 3.1 Online discussion panellists' experiences with ERP system upgrade

Panellists	Industry
Respondent One	ERP system upgrade consultant
Respondent Two	ERP system upgrade champion in a manufacturing organisation
Respondent Three	ERP system upgrade consultant
Respondent Four	ERP system upgrade consultant
Respondent Five	ERP system upgrade consultant
Respondent Six	ERP system upgrade consultant
Respondent Seven	ERP system upgrade consultant
Respondent Eight	ERP system upgrade consultant
Respondent Nine	ERP system upgrade champion in healthcare
Respondent Ten	ERP system upgrade consultant
Respondent Eleven	ERP system upgrade specialist in IT services organisation
Respondent Twelve	ERP system upgrade champion in a service organisation

3.3.1.2. Privacy of the participants

All participants in the online panel discussion remained anonymous. All experts were assigned an identification code. This enabled them to make comments and discuss ideas without exposing themselves or their organisation to

identification. The online discussion platform was developed on the www.wordpress.com discussion blog (<https://bpcforerpupgradesresearch.wordpress.com/about/>), as shown in Appendix E.

3.3.1.3. Ethical considerations

This study followed the Ethics Guideline Procedures set by the RMIT University ethics committee. Ethics approval for this research project was obtained through RMIT's Human Research Ethics Committee, prior to data collection from the online discussion panel.

A plain language statement (Appendix I), which indicates general guidelines and contact details of the RMIT Human Research Ethics Committee, was submitted along with the email invitation in relation to the online discussion panel discussion. With regard to participants, the researcher was prepared, organised, and considerate of participants' confidentiality in this study. The confidentiality of the information provided the respondents of the online discussion issues were assured to the participants. Furthermore, the respondents' anonymity was protected by means of a code that was assigned to each participant.

3.3.1.4. Pilot study

The purpose of the pilot study was to ensure that the online discussion platform and questions were valid. It also allowed me to understand that the participants correctly understood the research questions and the issues under discussion. The pilot study was undertaken with four PhD students and two academics. Thus pilot study helped establish the validity and understanding of expert panel discussion instructions, the questions, and the technology used. As an outcome, a few changes were made to the discussion context and the questions for each round of discussion.

An e-mail that contained the invitation letter, a link to an online discussion page, and a password were then sent individually to each participant.

3.3.1.5. Data collection for online discussion panel

A web posting technology, a Wordpress discussion blog, was employed for this research; accounts were created for expert panellists who had agreed to participate in the discussion round. Wordpress is an open source of publishing and can be used for basic content management (<http://wordpress.com>), and it allows participants to remain anonymous. The expert panellists were presented with clear instructions and guidelines on how to post their comments before the first round was conducted.

Three rounds of the online discussion panel were conducted. The first discussion round was launched on 23 September 2014. This discussion issues are listed in Appendix B.

All participants were given one week to comment on the issues for each discussion round. If the response rate during one particular week was low, each round was extended to allow a further two weeks for discussion, which brought the discussion rounds to a total of three weeks duration. I sent reminder emails to participants, asked further questions to individual participants on issues that required further explanation, and I summarised the responses for confirmation by participants in subsequent rounds of discussion.

For Round One, issues on the types of ERP system upgrades and required business changes for ERP system upgrades were discussed. I presented to the participant panellists the types of ERP system upgrades and required business and process changes that were identified from the literature so that the panellists could confirm this information, and I requested them to add more information based on their knowledge and experiences with ERP system upgrades (Appendix F). There were twelve responses for this round. At the end of the first

round, I collated and analysed all responses from the panel members and generated a summary of types of ERP system upgrades and changes required for ERP system upgrades. These summarised lists were posted on the Wordpress blog during the second round, for panel members to confirm the information and to add further comments.

The second discussion round was launched on 21 October 2014. An individual invitation email was sent to the same twelve participants of Round One. This briefly explained the duration of this discussion round, and it provided web link access to Round Two discussion issues, and provided a password (Appendix C). An individual reminder email was sent the following week to those who had not responded. An email with further questions on same issues that were not clearly explained in the discussion was sent to each participant. For Round Two discussion, 11 people participated. They were also asked to confirm a summary of Round One findings which focused on the types of ERP system upgrades and required business changes for ERP system upgrades. They were also asked to add new issues to the summary on types of ERP system upgrades, and associated changes required for ERP system upgrade. They were also asked to provide responses on organisational capabilities resulting from business and process changes as an outcome of ERP system upgrades. In this round, I also presented to the panel members a set of capabilities as an outcome of process changes identified from literature (Appendix G). The capabilities review were presented to the panel for their comments and they were allowed to add more based on their experiences. Once again the members had a week to submit their responses. However, this response time was also extended for a further two weeks because of participants' late responses.

The final round was launched on 11 November 2014. An individual invitation email was sent to the same twelve participants of the Round One discussion. This email explained the duration of the discussion round; it provided a web link to Round Three discussion issues, and it provided a password for access

and participation (Appendix D). A reminder email was sent to each participant the following week. However in this round of discussion only nine people participated. All participants were asked to confirm a summary of issues established from Round Two, which focused on the organisational capabilities achieved from business and process changes for ERP system upgrades. The purpose of this discussion round was to provide participants' comments on productivity improvement achieved from organisational capabilities that were the outcomes of business changes for ERP system upgrades.

For this round, a summary of organisational capabilities as outcomes of business and process changes was presented to all participants for validation, and further comments were sought in response to the summary. In this round, improved productivity due to ERP system upgrades identified from literature was also presented for confirmation, and more productivity improvements were sought from the panellists (Appendix H).

At this stage the panel members were informed that at the end of two months an analysis of the issues on the types of ERP system upgrades, the required process changes for ERP system upgrades, the resulting organisational capabilities, and improved productivity outcomes identified from the online discussion panel would be presented to them for confirmation.

3.3.1.6. Data analysis of online discussion panel responses

Subjective responses from the panel members were interpretively analysed guided by Miles, Huberman and Saldaña (2013). Three stages of data analysis were conducted as follows. The first step was data condensation. After data collection, the process of reading, rereading, summarising and analysing the responses was undertaken for each response. The summarised data was coded (*descriptive coding* to summarise in a word or a short phrase for indexing and categorising; as well as *In-Vivo coding* in my own words or phrases, which served as leads to particular patterns in the setting); the themes were developed,

and the categories were generated. The final step was the writing of analytic memos, which highlighted key points from the participants' comments.

The second stage of data analysis was data display. This entailed the coded data and categories being entered in matrices that aimed to examine the relationship among datasets. Data displays assist researchers in managing and condensing data, and organising information into an accessible and compressed form. In turn, researchers are able to understand the research phenomenon and can draw a justified conclusion (Miles, Huberman & Saldaña 2013). The final stage was conclusion drawing and verification (Miles, Huberman & Saldaña 2013). Then, based on Peppard, Ward and Daniel's research (2007) *Benefits dependency network*, a relationship between the process changes and the resulting organisational capabilities and improvements was determined. This was achieved by relating this relationship to Dynamic Capabilities Theory and to formulating questions for the interview tool to be used in Phase Two of this research.

3.3.2. Phase Two: Case studies

To confirm the findings from the online discussion panel and to explore ERP system upgrades in greater detail, case studies with five large organisations were undertaken. These organisations were from different industry sectors and had upgraded their ERP systems to support their business operations in the last six years.

According to Yin (2014), a case study is an empirical inquiry whereby researchers can investigate a contemporary phenomenon in depth and within its real-world context. Rowley (2002) and Saunders, Lewis and Thornhill (2009) assert that a case study enables the researchers to generate answers to 'why?', 'what?' and 'how?' questions. Furthermore, a case study entails multiple data collection techniques and approaches to data analysis (Yin 2014, p. 17), such as

interviews, observation, document analysis and questionnaires (Saunders, Lewis & Thornhill 2009). This helps develop findings from multiple sources of data.

A case study approach was also chosen for this study because, to date, little is known about the phenomenon (Eisenhardt 1989). Case studies are known to be used for the purpose of descriptive, illustrative, experimental, explanation, and exploratory studies (Collis & Hussey 2009; Yin 2014). This study is exploratory in nature since the topic of the study is relatively new and not well explored in research to date.

The multiple case study approach was chosen for this research because the findings from multiple cases are more robust than findings from a single case study (Yin 2014). Although there is no scientific method required (Yin 2014) the criteria used for choosing the case for investigation was guided by the following tenets:

- Case studies had to be organisations with a large number of business modules and functions integrated via the ERP system;
- The organisations would have upgraded their ERP system in the last six years; and
- The organisations could be from any industry sector.

3.3.2.1. Research design for case study

Research design for the multiple case studies was divided into five steps as described in the following:

Step One: An interview tool was developed using the findings from the online discussion panel and from literature with an emphasis on the different types of ERP system upgrades, the reasons and requirements for ERP system upgrades, and the outcomes achieved from the upgraded ERP system (Appendix M).

Step Two: Organisational websites and ERP system vendor announcements were investigated to source large organisations that had upgraded their ERP systems in the last six years. A random sample of 12 organisations in Australia and nearby countries were selected and contacted for their participation in this research. Of these, five organisations from Thailand agreed to participate in this study. Five detailed case studies were undertaken focusing on these five organisations to explore their processes and experiences in recent ERP system upgrades. The exploration included upgrade types, the reasons for the upgrades, the changes required for effective upgrades and the outcomes. The case study research strategy made it possible to focus on understanding the process changes, capabilities and improvements within a real-life setting (Eisenhardt 1989), with data from multiple sources (e.g. archives, reports and interviews) (Yin 2014).

According to IFS Capital (Thailand) Public Company Limited's study (The Nation 2013), 100 Thai manufacturing companies from a diverse range of industries such as food processing and the chemical, automobile, printing and electronics industry are dependent on ERP systems implemented in the period 2000 to 20005 (Aruthari & Hasan 2005). The majority of these organisations had recently upgraded their ERP system to gain a competitive advantage and to become multinational or globally focused organisations (Ganly 2006).

Step Three: A plain language statement and an invitation to participate in this research were sent to senior managers in the selected organisations via email (Appendix I). The email included a brief description of the researcher, the research topic, the research approach, and the importance of this study. All five organisations accepted the invitation and expressed their agreement to participate and share their knowledge and experience of ERP system upgrades, prior to data collection.

Step Four: The interview tool was tested as a pilot study. Necessary adjustments were made to the interview questions before the commencement of the data collection stage.

Step Five: The data collection was conducted with the participating organisations.

3.3.2.2. Privacy of the participant

The data of all interviewees was treated with high confidentiality, and the anonymity of the interviewees was protected at all times. Each interviewee agreed to and signed the consent form for the interview before starting each interview session.

3.3.2.3. Ethical considerations

This phase of the study also followed the Ethics Guideline Procedures outlined set by the RMIT ethics committee. Ethics approval for the case studies was obtained from RMIT's Human Research Ethics Committee.

3.3.2.4. Pilot case study

In early September 2015, a pilot study for the interview tool was conducted with two academics and one ERP system upgrade expert in both English and Thai languages. The pilot study helped establish the reliability of the interview tool and the clarity of the questions and instructions for the interviewees. Necessary adjustments were made to the interview questions before the field data collection for the case studies commenced (Appendix M).

3.3.2.5. Data collection for the Case Studies

At the data collection stage, interviewees were contacted via e-mail and telephone and in person with regard to scheduling interviews. Data was collected from organisational documents such as ERP system upgrade reports, organisation websites, and interviews, which were with three to five middle and

senior managers involved in the implementation and management of the ERP system upgrades in their organisations. For the interviews, a semi-structured interview tool (Appendix M) was used to ensure that the same questions were asked to all interviewees. With the permission of the respondents, responses to interviews were audio-recorded and later transcribed for analysis. The interview tool (Appendix N) was translated into the Thai language to ensure that the respondents would fully understand the questions. The translation was done by the researcher and verified by a Thai academic, thus ensuring the validity of the translation (Appendix N).

The interviews were conducted face-to-face in the Thai language, which was the first language of the interviewees. The interviews lasted from between 45 and 90 minutes, with an average of one hour. The interviews were audio-recorded and later transcribed. In regards to the Ethics Guidelines Procedures set by the RMIT Human Research Ethics Committee, each interviewee was presented with the plain language statement (Appendix I) and the consent form (Appendix J) regarding their agreement to participate in the research project. All interviewees agreed to and allowed an audio recording of the interviews. A follow-up and further questions were asked of individual participants by e-mail to clarify issues if they were not clear.

The interviews were conducted between September and November 2015. In all 24 interviews were conducted. The interviewees' information is shown in Table 3.2.

Table 3.2 Interviewees' data for five case studies

Case	Interviewee position	Managerial level
1	1. Corporate Information Technology (IT) & Business Continuity Management - Chief Information Officer (CIO)	Top level
	2. Supply Chain Process Improvement Manager	Middle level
	3. Corporate Human Resource Management (HRM) Assistant Manager	Middle level
	4. Senior Information Technology (IT) Officer	Middle level
2	1. Executive Vice President - Chief Information	Top level

Case	Interviewee position	Managerial level
	Officer (CIO) 2. Vice President of Enterprise Solution 3. Vice President – SAP ERP Financial Accounting and Management Accounting	Middle level Middle level
3	1. Deputy Director – Chief Information Officer (CIO) 2. Chief of the Material Management Division 3. Chief of the Sales and Distribution Division 4. Chief of the Internal Audit Division 5. Chief of the Accounting Division 6. Chief of the Finance Division 7. Chief of the Human Resource Management (HRM) Office 8. Chief of the Procurement Division 9. Chief of the IT Development Division	Top level Middle level Middle level Middle level Middle level Middle level Middle level Middle level Middle level
4	1. Assistant Vice President of Information Technology (IT) 2. General Manager of Software Application Development 3. Sales and Retails Manager 4. ERP Solution Manager	Middle level Middle level Middle level Middle level
5	1. Vice President of Finance and Management Information Systems (MIS) 2. Assistant Vice President of Finance and Management Information Systems (MIS) 3. Accounting Manager 4. Project Manager	Middle level Middle level Middle level Middle level
Total	24 persons	

At the end of the 24th interview, a saturation point was reached with no further new information on ERP system upgrades.

3.3.2.6. Data analysis for the Case Studies

The interviews were recorded and then transcribed in the Thai language. The transcribed version was sent by e-mail to the interviewees for them to validate the accuracy of the transcripts. Following this, the validated interview transcripts were translated from the Thai language to English by the researcher. Other sources of data such as organisation websites, ERP system upgrade reports, additional field notes, organisations' annual reports, and other relevant ERP system upgrade documents and internal confidential documents were incorporated into the analysis.

Within-case analysis

Each case-study was interpretively analysed according to the technique of Miles, Huberman and Saldaña (2013), described earlier in Section 3.3.1.6. Three stages of data analysis were conducted as follows. The first step was data condensation. After the interviews were transcribed, the process of reading, rereading, summarising and analysing interview data was undertaken for each interview. The field notes were also converted into written records referencing primary and secondary data. Following this, the summarised data was coded (*descriptive coding* to summarise in a word or a short phrase a reference for indexing and categorising; as well as *In Vivo coding* in my own words or phrases to serve as leads for finding particular patterns, from which themes were developed and categories generated. The final step was the writing of analytic memos, which highlighted key points from the interviews. The second stage of data analysis was data display, whereby the coded data and categories were entered in matrices that aimed to examine relationships among datasets. The data display helped me to organise information into an accessible and compressed form as well as assisting me to understand the research phenomenon and draw a justified conclusion (Miles, Huberman & Saldaña 2013). During the analysis stage, data from each interview was examined for similarities or differences to data from the other interviews and other sources of data. The final stage consisted of drawing a conclusion, and verification. After the analysis of data, for each case study a summary of findings was written up. This process was continued for each case study.

Cross-case analysis

After the separate analysis of each case study, cross-case analysis using the same analysis technique that was used for within-case analysis was undertaken for the data from all five cases. The researcher also analytically compared the findings of one case study with another case study for similarities and differences on each of the ERP system upgrade issues explored. The purpose of conducting the

cross-case analysis was to enhance generalisability and theory building and to further understand the issues (Miles, Huberman & Saldaña 2013). At this stage, the cross-case analysis allowed the researcher to further develop in-depth understanding from the evidence gathered through a multiple lens (Eisenhardt 1989), which successfully preserved the uniqueness and authenticity of the findings (Ayres, Kavanaugh & Knafl 2003); (Khan & VanWynsberghe 2008). Results from the cross-case analysis are presented in Chapter Six. The findings from case studies were used to corroborate the findings from the online discussion panel findings and were then related to the boarder literature of ERP system upgrades for theory building, as presented in Chapter Seven. Because of the role of the ERP system upgrades as an IT enabler, and given that the required business changes enabled changes in the organisations, it is expected that a set of new ERP (IT) based capabilities will be established, which will lead to enhanced organisational productivity resulting from ERP system upgrades.

3.4. Summary

This chapter discussed the research design used in this study for answering the research question: *How are organisational capabilities enhanced by upgrading ERP systems and upon what rationale and motivation are system upgrades commonly made?*

Chapter Four: Findings from the Online Discussion Panel

4.1 Introduction

This chapter is a qualitative analysis of data collected via the online discussion panel. The purpose of this phase of the research was to establish the types of Enterprise Resource Planning (ERP) upgrades undertaken by organisations, the business changes required for the ERP system upgrades, the enhanced organisational capabilities achieved from new business processes as an outcome of the upgrades, and improvements in organisational productivity achieved. A discussion of the issues established from the online discussion panel is presented below.

4.2 Findings from the online discussion panel

The online discussion panel addressed four key themes including types of ERP system upgrades, business changes required for ERP system upgrades, organisational capabilities achieved from ERP system upgrades, and changes in business processes and productivity improvements as a result of the upgrades. These themes were explored with respondents who had experience with ERP system upgrades and had agreed to participate in the online discussion panel. The respondents comprised of a mixed group of company executives and ERP leaders and consultants. The respondents were asked to identify and describe the different kinds of ERP system upgrades they had either implemented in their organisations or consulted on as experts. They were asked to describe the business changes required as a consequence of implementing the different types of ERP system upgrades and the impact of the upgrades on organisational capabilities and overall productivity. Table 4.1 below presents a summary of the responses on these themes. It lists the different types of upgrades, the business

changes required for the upgraded ERP systems, the organisational capability enhancements achieved and productivity improvements observed as outcomes of ERP system upgrades. The exercise entailed three rounds of discussion, and follow-up emails that clarified particular issues. The following sections address these issues that were analysed interpretively guided by Miles, Huberman & Saldaña's (2013) analysis technique described and justified in Chapter Three.

Table 4.1 A summary of the responses on research themes

Types of ERP system upgrade	Business changes required for ERP system upgrades	Enhanced organisational capabilities	Productivity improvement
<ul style="list-style-type: none"> • Full system upgrade • Functional upgrade • Technical upgrade 	<ul style="list-style-type: none"> • Business process changes <ul style="list-style-type: none"> ○ Financial accounting, controlling account and funds management ○ Procurement and order fulfilment ○ Logistics and material management ○ Human Resource Management (HRM) • No business process changes 	<ul style="list-style-type: none"> • Improved strategic decision-making • Integration and coordination of data from different sources • Larger volume of data management • Better inventory management achieved due to better logistics and supply chain • Improved funds and information management 	<ul style="list-style-type: none"> • Better customer and partnership management • A competitive advantage • Increased market share • Better e-business support • Faster response to new government regulatory requirements and compliance

Theme One: Types of ERP system upgrade

Three types of ERP system upgrades are identified in the literature: namely, full system, functional and technical upgrades (Schäumer 2007; McKendrick 2012a). A full system upgrade entails upgrading the whole existing ERP system with the implementation of a new version of the system. This is generally done with the aim of significantly changing the business processes (Wenrich & Ahmad 2009; Grabski, Leech & Schmidt 2011). It was established by seven out of the twelve participants in the online discussion panel that a full system upgrade of ERP systems was the most popular type of upgrade due to operational and cost efficiencies.

Respondent comments on the most popular upgrade:

A full system upgrade is the best return on investment. Other types of upgrades are more costly [Respondent Two].

A full system upgrade [Respondents One, Five, Six, Seven, Ten and Twelve].

The online discussion panel respondents indicated that the most popular type of ERP system upgrade implemented in the past five years was a *full system upgrade*. The literature (McKendrick 2012a) also indicates that full system upgrades are undertaken for the renewal of company processes. The responses above suggest that the reason for this is that full system upgrades are cost-effective in the long run.

The second type of upgrade established from the online discussion panel was *functional upgrade*, which means that an existing ERP system is upgraded through the adoption of new functionalities, mainly through new ERP software versions. The aim of this type of upgrade is to further integrate business functions and processes (SAP 2010a) and to reduce system complexity (Schäumer 2007). Organisations generally adopt functional upgrades to update

specific functions or to introduce new functionalities for new business needs (Schäumer 2007; McKendrick 2012a).

In total, five out of the twelve participants indicated that they had implemented a functional ERP system upgrade in the past five years. The online discussion panel established that the dominant reason for implementing a functional upgrade was to enable a rapid expansion of ERP system performance to capture new business opportunities. The functional upgrade also streamlined business processes to improve organisational efficiencies. As explained by one respondent:

A functional upgrade is the type of ERP system upgrade that I am involved with. Due to changing business demands and for organisations to expand their businesses, new business processes are required. For this reason improvements to the existing ERP systems are made by enhancing some of the ERP features [Respondent Two].

Another respondent described the functional upgrade as a 'modular upgrade' which adds a new module such as marketing to the existing ERP system [Respondent Nine].

Research findings indicated that functional ERP system upgrades were generally undertaken to support changes to business processes by quickly meeting certain specific business needs. This type of upgrade enhances only some of the ERP modules supporting the business processes required for new business demands.

The third type of ERP system upgrade established in this study was a *technical upgrade*, which is the adoption of new software release for changing the technology platform (Schäumer 2007). Organisations adopt this type of upgrade to update technical software (Oseni et al. 2015) or to change some of the hardware. A technical upgrade due to a new version of software implementation is usually a response to an ERP vendor maintenance and support issue to replace obsolete hardware (Dumitras & Narasimhan 2009d).

In this study, four out of the twelve respondents decided on a technical upgrade, implementing a new ERP version of software to improve system operations and capacity, replacing obsolete IT hardware with a new database or other hardware. This view was supported by Respondent 11 as follows:

We did a SAP upgrade from version R/3 4.7 to ECC 6 which was a technical upgrade, to replace the software implemented six years ago. Because of changing ABAP [Advanced Business Application Programming] needs and obsolete software we replaced SAP R/3 4.7 with a new version [Respondent Eleven].

This finding suggests that organisations adopt technical upgrades with the aim of replacing the old ERP software and increasing the capacity of some aspects of the existing ERP system. The technical upgrade also provided an opportunity for organisations to change or replace old or obsolete hardware.

The research findings discussed above confirm earlier theories that there are three types of ERP system upgrades: full system, functional, and technical (Schäumer 2007; McKendrick 2012a). In general, findings of seven out of the twelve participants on the online discussion panel indicated that a full system upgrade, to replace the existing ERP system with a new version of the ERP system, was the most popular type of ERP system upgrade. The online discussion panel established that an important reason for a full system upgrade was that it was cost effective to replace the whole system. Although to a lesser degree, findings of the online discussion panel also indicated that ERP system upgrades were functional (according to five out of twelve participants) and technical (according to four out of twelve participants), which confirmed the findings of earlier studies on the three types of ERP system upgrades (Schäumer 2007; McKendrick 2012a). Although the technical upgrade was the least popular type of upgrade, according to the findings of the online discussion panel this upgrade took place, which confirmed the extant literature (Oseni et al. 2015).

Theme Two: Business changes required for ERP system upgrades

According to Gullledge (2010), business processes are a set of logically related tasks that use the resources of an organisation to achieve a defined business outcome such as increased organisational performance. ERP system upgrades generally lead to change or require changes to business processes (Wenrich & Ahmad 2009; Grabski, Leech & Schmidt 2011) in order to meet changing business demands (Worrell 2007). The online discussion panel established the business changes that were required in association with the ERP system upgrades. These are discussed below.

Financial accounting, Accounting control and Funds management

Financial accounting includes processes of general ledger, accounts receivable, accounts payable, and assets accounting (Okungbowa 2015). The analysis of data from the online discussion panel showed that the most important business process changes with ERP system upgrades were financial accounting, accounting control, and funds management.

Making changes to financial accounting due to ERP system upgrades helps businesses improve the management of their financial reporting and accounting. In this study, such business changes were supported as a result of the ERP system being upgraded. As one respondent commented:

Financial accounting from the ERP system upgrade has been one of the important areas of change. A major reason for this is that data from all other changes flow through the financial accounting module [ERP system upgrades from SAP R/3 4.0 to ECC 6.0]. ERP system upgrades impact the whole Finance accounting and controlling processes [Management accounting] to enable better financial reporting, e.g. Balance sheet and P&L [Profit and Loss] report, and new business data as well implemented to existing relevant processes. Finance Accounting requires a change in data entry due to data being automatically generated from the new system

features. Some changes are due to the demands of a new tax system or of changing business needs [Respondent Three].

Another respondent indicated that changes to the financial accounting process that occurred in association with the upgraded ERP systems were required to meet the needs of new regulations and compliance:

In accounting, listed companies in Thailand have been forced to adopt IFRS [International Financial Reporting Standards], for which the functional upgrade activities to support IFRS and changes in GAAP [Generally Accepted Accounting Principles] are required. For detailed accounting from subsidiaries, branches and business units that operate externally within the same organisation, the new General Ledger [SAP] system is introduced [Respondent Five].

ERP-related changes to financial accounting processes were also necessary for multidimensional financial reporting, taking into account new legal requirements such as new taxation systems and new international financial reporting standards.

The discussion panel indicated that a changed financial accounting process associated with ERP system upgrades was required for running multidimensional financial reports (for example, balance sheets, and P&L reports), taking into account the new legal requirements.

Another business process change related to financial accounting is accounting control which aims to track and post transactions between the general ledger and the corresponding subsidiary ledger in detail (Salmon 2012). Five out of the twelve participants on the online discussion panel indicated that to effectively track transactions, changes to financial control was required with the ERP system upgrades. Support for this view is evident in the following comment:

New functions of Financial Accounting and Accounting Control from the upgraded ERP system reduce time for the profit centre report preparation. In

SAP, ECC6 records data as users post transactions which are also recorded in the Financial Accounting module. This process does not require transferring data from Financial Accounting to Profit Centre Accounting (PCA) [Respondent Three].

Such changes were required to support financial accounting by reducing operation time through recording transactions in the upgraded system:

The system users can post transaction data which the system records for both Profit Centre Accounting (PCA) and financial accounting at the same time. This also assists financial accounting users to track and examine transaction records in terms of cost accounting and financial accounting to help the streamlining of business processes and to reduce operation time [Respondent Six].

ERP system upgrades warrant changes to the process of funds management to manage and control organisational budgets, revenues and expenditure for all business activities (SAP 2015).

One participant pointed out that organisations improved on their funds management processes with ERP system upgrades. By doing this, organisations could improve budget management and monitor both revenues and expenditures for individual activities as well as ensure the budget was not exceeded. An ERP system upgrade requires that changes be made to the process of funds management to ensure the alignment of budget management in relation to other business processes.

Findings discussed above indicate that with ERP system upgrades, changes in financial accounting, accounting control and funds management are achieved in the functionality of account management and finance from upgraded ERP systems. This change enabled management of data from different processes for timely and accurate profit reports.

Procurement and Order fulfilment

Procurement is a process that organisations use for the management of inventory, suppliers, purchase requisition and order management, as well as goods received and invoicing and supplier payments (Kappauf, Lauterbach & Koch 2012). The upgraded ERP system introduces new functionalities of administering procurement contracts, decision-making on purchasing, operational procurement, centralised sourcing and contracts, supplier collaboration, and procurement analysis and reporting (SAP 2012).

Findings from six of the twelve participants indicate that the procurement process had to change to incorporate e-procurement supported by new features of the upgraded ERP system. This was required for capturing the improved data flow between processes such as financial accounting (accounts payable) and inventory management. Another reason for changing this process was to streamline and automate the procurement process for improved operations, a faster procurement cycle time and to save time and cost – all of which was supported by the upgraded ERP system. A respondent explained:

The new ERP systems support the three-way matching process (purchase order, goods receipt, and invoice receipt) with related document imaging attached to the goods receipts for accounts payable. Details of goods received, the purchase order, and invoice documents (both image and paper), are recorded and checked by the upgraded system. And, this has the capability to incorporate payment run, and automated bank reconciliation. This purchase-to-pay process saves the effort and time that was required with paper document handling in the old ERP system [Respondent Seven].

According to Respondent Twelve:

We changed the funds management process associated with procurement which helped us approve purchase requisition and process purchase orders

faster, and to ensure that procurement was within budget [Respondent Twelve].

Another respondent commented:

The order fulfilment and purchasing require changes for data entry, which is automatically generated in the latest system [Respondent Three].

The upgraded ERP system supports improved data processing for procurement in real time with purchase orders, goods received, and accounts payable. Therefore, the new capabilities of the upgraded ERP system support electronic procurement.

Order fulfilment relates to the sales inquiry, delivery of products and/or services to customers (Davis-Sramek, Mentzer & Stank 2008). It was established by four of the twelve participants that the order fulfilment was changed to take advantage of new business opportunities. As Respondent Two explained:

In our old ERP system there were only two companies: the first one was a producer and exporter of rice, and the second one was a domestic rice distributor. As the rice business is growing, this organisation decided to invest in a new production plant, the investment of which was high. However, with the new ERP system [upgraded ERP system], we added a new production line to the system. In this case, the purchasing team and the sales administration team are able to enter transaction data into the new ERP system which processes purchase and sale transactions among buyers and sellers, the exporter company and the domestic distributor [Respondent Two].

Another respondent said:

The procurement and order fulfilment process had to change for the new ERP system in order to capture the correct order fulfilment data [Respondent Eight].

Changes to the order fulfilment process had to take place to support the new e-procurement opportunities and to capture real-time sales data. The research findings discussed above indicated that changes to the procurement process associated with ERP system upgrades assisted organisations to utilise the new features of e-procurement, order fulfilment, and sales and inventory data for greater procurement effectiveness. The upgraded ERP systems automated the procurement process and assisted in timely data processing.

Logistics and Material management

Logistics is concerned with movement, storage and the tracking of finished goods and services (Rushton, Croucher & Baker 2010).

Three out of the twelve participants of the online discussion panel indicated that ERP system upgrade improvements to logistics were achieved by streamlining all associated processes of inventory, production, tracking, warehousing and distribution with real-time data processing for each of these processes. This view is supported by Respondent Five:

The latest version of ERP introduces new features and functions of Logistics modules which help businesses to streamline and improve the processes of sales, production and distribution. With new functions of logistics, businesses can better manage sales orders, integrate these with production orders, and reduce delivery time. In addition, tracking of delivery supports timely delivery [Respondent Five].

To improve and streamline sales, production, distribution and transportation and to achieve timely deliveries at reduced costs, changes to logistics process were required for the upgraded ERP systems. Two of the twelve participants also suggested that material management processes with ERP enabled improved management of the production process, offering support to logistics and inventory management. A respondent explained:

With the material management process, we easily transfer stock and manage stock in transit which helps us with an accurate account of actual stock levels in each plant [Respondent Two].

The upgraded ERP system supports material management for inventory levels and helps organisations avoid waste and inventory-associated costs. As the research findings above indicate, upgraded ERP systems supported and improved logistics and inventory management processes.

Human Resource Management (HRM)

Human Resource Management (HRM) entails organisational policies and practices of human resource design and development, employee sourcing, learning and development, performance evaluation, reward management and employee relations (Armstrong 2012). HRM is a very important asset in organisations, and Human Capital Management (HCM) is a process well supported by the upgraded ERP system.

It was established by two of the twelve participants on the online discussion panel that the upgraded ERP system supported new HCM functionalities of Employee Self-Service (ESS), incorporating new legal regulation and compliance requirements. For example, one respondent explained:

The new HCM process in upgraded ERP systems allows employees to manage their data by updating changes, applying for leave, etc. The new HCM module can also link organisations to income tax deductions, and this new module is completely electronic and eradicates all paper-based forms [Respondent Ten].

The HCM process in the upgraded ERP systems included new functions of ESS, and personnel development online was accessible on mobile devices.

As the research findings indicate (two out of twelve participants), with a technical upgrade most of the processes remained unchanged. As explained by a respondent:

I did only a technical upgrade and no business upgrade. There was no impact from a technical upgrade on the business process [Respondent Four].

Almost all business processes are unchanged because organisations need to keep their existing business processes, which are decided before the technical upgrade [Respondent One].

This research indicates that although technical upgrades are a type of ERP system upgrade, business processes for this type of upgrade generally remain unchanged. As the findings of the online discussion panel show, changes to finance, logistics, procurement, and HCM are apparent as a result of full and functional ERP system upgrades. These findings confirm earlier studies (Wenrich & Ahmad 2009; Grabski, Leech & Schmidt 2011) that in relation to ERP system upgrades, business processes need to change in order to take advantage of the improved ERP modules.

Theme Three: Enhanced organisational capabilities

With new IT systems, the enhanced organisational capabilities achieved included strategic decision-making (Jayawickrama, Liu & Hudson Smith 2013; Kanellou & Spathis 2013) as a result of the following factors: integrated, online, real-time data across business functions and the management of a larger volume of data (McKendrick 2012b; Elragal 2014), integration of data from different sources (McKendrick 2012a; Syed, Gillela & Venugopal 2013; Elragal 2014), knowledge management and knowledge sharing (Reychav & Anand 2011), improved inventory management due to better Supply Chain Management (SCM) (Vaidyanathan & Sabbaghi 2007), improvisational capabilities and operational capabilities (El Sawy & Pavlou 2008), and e-commerce innovation (Wu & Hisa 2008).

The upgraded ERP systems support organisations in attaining and enhancing new capabilities including global management, financial management, SCM, HCM, mobile solution, business intelligence and selective reporting (Šereš & Tumbas 2014). In addition, data synchronisation between enterprise and remote locations (Chang et al. 2014), management of large volumes of data by using intelligent data integration (Syed, Gillela & Venugopal 2013), the empowerment of employees by allowing them to manage their own data, and the reduction of cost in shared services (Parry & Tyson 2011) are also enhanced capabilities achieved from ERP system upgrades.

Findings from six out of the twelve participants on the online discussion panel indicated that enhanced organisational capabilities achieved from the upgraded ERP system included improved strategic decision-making, integration and coordination of data from different sources, larger volume of data management, improved inventory management – achieved from better logistics and SCM and better funds and information management. These enhanced organisational capabilities are supported by the respondents' quotes presented below.

With upgraded ERP systems, the organisations enhanced strategic decision-making capabilities in terms of effective, integrated, online, real-time data across business functions in the new system that was able to generate reports faster so as to support decision-making. Organisations also increased their ability to make timely decisions from information made available by the upgraded ERP systems. For example the upgraded ERP systems provided valuable financial and accounting information, real-time reports, and online real-time data for better decision-making:

The benefits the organisation achieves are greater data visibility and more dimensions of information management especially in terms of finance and accounting information which leads to better decision-making in all operations [Respondent Three].

The upgraded ERP system helps generate reports faster which supports decision-making [Respondent Four].

Business Warehouse/SAP Business Objects enhance real-time reports and highlight data mining which support data-oriented decision-making [Respondent Five].

Findings from the online discussion panel indicate that organisations enhanced integration and coordination of data from different data sources by employing new functions from the upgraded ERP system with the alignment of changed business processes. This enabled organisations to use their resources more efficiently and to improve coordination of all operations within the organisation. In addition, the new technology of the latest version of the ERP system also assisted organisations to utilise their resources and information more effectively, leading to improved decision-making. As the following respondents commented:

The management team and the analysis team have online, real-time data from frontend operations (sales, procurement, finance and accounting) for decision-making [Respondent Eight].

New SAP technology provides more integrated processes which supports better coordination with additional modules like SRM (Supplier Relationship Management), SCM, and CRM which enhance organisations to integrate information and work operations across the enterprise and with external stakeholders [Respondent Five].

The upgraded system provides new functions and business processes that lead to reduced work processes and people for numerous tasks [Respondent Four].

Master data synchronisation is achieved by synchronising the data, reducing duplication, checking for completeness/correctness and reducing the efforts required for separately maintaining each activity. Document approval and

workflows help make the approval process faster when using the new system
[Respondent Seven].

With greater capabilities for the management of large volumes of data, the upgraded ERP system integrates data within its system and also with data from external systems in the organisation. It supports the organisations to manage and process data more efficiently and accurately. The enhanced data management capability enabled organisations to gain an insight into all business operations, thus better management. The upgraded ERP system improved procurement leading to transparency and a reduction in costs. Because of the enhanced and larger volume of data management capabilities offered by the upgraded ERP system, organisations were able to operate faster, and to generate timely reports for quick actions. As one respondent commented:

In the case of big data management, all data [also from the external systems] are integrated and consolidated in the upgraded ERP system, for easy access and decision-making [Respondent Eight].

Organisations improved their inventory management capability with the upgraded ERP system. The upgraded ERP system enhanced the material management process in terms of effective management with online tracking of materials for production and the delivery of finished goods to the customer. This improvement entailed better logistics and SCM and reduced costs. As the following respondents commented:

Logistics and supply chain improvement is achieved from the ERP system upgrades. When using the upgraded system, we achieve online tracking of all materials used in our production plants and are able to track deliveries to our customers [Respondent Two].

Cost savings are achieved from procurement and inventory management
[Respondent Twelve].

With the upgraded ERP system, organisations improved information management for each business function and for the whole organisation. As one respondent observed:

The auditors can audit our Information Systems (IS) more effectively, efficiently and rapidly. The reports can be presented to a high level management on time [Respondent Twelve].

The findings on enhanced organisational capabilities confirmed the literature that improved strategic decision-making is achieved from an upgraded ERP system (Jayawickrama, Liu & Hudson Smith 2013; Kanellou & Spathis 2013), a larger volume of data is managed effectively (McKendrick 2012b; Elragal 2014) and an improved inventory management is achieved as well as effective management of the supply chain (Vaidyanathan & Sabbaghi 2007). Some of these findings are similar to the capabilities achieved from other IT systems as well.

As discussed in the earlier part of this chapter, capabilities enhanced by process changes initiated by ERP system upgrades are better financial management, an easier adaptation to new regulations and compliance requirements, a more detailed and timely reporting system, management of greater volumes of data, better decisions and the ability to capture new business opportunities.

Theme Four: Productivity improvement

Productivity improvements achieved from ERP system upgrades included management of global operations (Rajapaksha & Singh 2009; Beheshti & Beheshti 2010), a competitive advantage (Beheshti & Beheshti 2010; Dempsey, Vance & Sheehan 2013), e-business support (Kumar & Thapliyal 2010), increased market share (Fub et al. 2007; Law & Ngai 2007) and better CRM (Ince et al. 2013).

Productivity improvement, according to five online discussion panel members, includes better customer and partner relationship management, a competitive advantage, increased market share and improved operational efficiencies.

The upgraded ERP system provided accurate information about customers and partners. This assisted organisations in analysing and managing the information, which resulted in the provision of better services for customers and partners. In turn, the improved services led to an increase of satisfaction among customers and partners, and better relationship management. Furthermore, organisations also used this efficient and accurate information from the upgraded ERP system to forecast market demands. The organisations also increased their ability to develop strategic market plans to become more competitive in the marketplace and increase market share. These improvements are supported by the following respondents' views:

Better processes lead to better partner and customer relationships, both in terms of faster processing of shipments, billings, collections, and even empowerment by analysing the customer or partner data to provide better services to serve the customers' or partners' needs [Respondent One].

With better decision-making by using information from the upgraded ERP system, the management level can use data in the system more efficiently to determine market trends and develop business strategy for competition [Respondent One].

A competitive advantage would be the consequence of better decision-making about processes, and about processes becoming more flexible and supporting us to gain more benefits and achieve competitiveness [Respondent Seven].

Accurate information from the upgraded ERP system leads management to launch new business strategies to compete in the marketplace successfully and increase market share [Respondent One].

The upgraded ERP system associated with changes in business processes assisted organisations to better support e-business by supporting all online business operations:

With ERP system upgrades, organisations gain better e-business support. For example, electronic banking supports organisations to provide e-payment for their customers. Organisations also perform online banking reconciliation which saves time and the cost of operations and increases fraud protection [Respondent Six].

The upgraded ERP system associated with a change in the HR process enhanced the process, enabling organisations to process the data more quickly and to generate reports from the system. As one respondent maintained:

Organisations are able to provide a quick response to government regulations by using information from the upgraded ERP system [Respondent Ten].

The findings on productivity improvement established from the online discussion panel did not provide evidence of actual achievements. They revealed how the upgraded ERP system can lead to productivity improvements achieved from new and large IT systems, which are generally of a long-term nature (Beheshti & Beheshti 2010; Feldman et al. 2015), productivity improvements from upgraded ERP systems were perhaps not recorded at this stage because such outcomes are long-term in fulfilment. Another possible explanation is that many of participants of the discussion panel were consultants who might not have had details of productivity improvements achieved from ERP system upgrades in the organisations. This issue warrants further exploration.

The findings of the online discussion panel are presented in Table 4.2 with evidence from the literature on process changes, capabilities, and productivity improvements. Although some of the findings of this research are similar to

those relating to the initial ERP system integration and other IT systems in terms of the enhancement of capabilities and improvements, some of these findings refer specifically to the ERP system upgrades.

Table 4.2 A summary of findings of the online discussion panel

Types of ERP system upgrade	Types of ERP system upgrade (Literature)	Business Process Change from online panel discussion	Business change required for ERP system upgrade (Literature)	Organisational Capabilities from online panel discussion	Organisational Capabilities (Literature)	Productivity improvement from online panel discussion	Productivity improvement (Literature)
<ul style="list-style-type: none"> • Full system upgrade (7 out of 12) • Functional upgrade (5 out of 12) • Technical upgrade (4 out of 12) 	<ul style="list-style-type: none"> • Full system upgrade is increasing the capacity and competency of the whole ERP system (Schäumer 2007) • Functional upgrade is an addition of new business functions to existing modules (Schäumer 2007) • Technical upgrade is changing the technology platform (Schäumer 2007) 	<ul style="list-style-type: none"> • Financial Accounting, Accounting Control, and Funds Management (8 out of 12) • Procurement and order fulfilment (6 out of 12) • Logistics and material management (3 out of 12) • Human Resource Management (HRM) (2 out of 12) • No business process changes (2 out of 12) 	In order to manage the implementation of ERP system upgrades successfully, business process change management is a requirement (Wenrich & Ahmad 2009; Grabski, Leech & Schmidt 2011)	<ul style="list-style-type: none"> • Improved strategic decision-making (6 out of 11) • Integration and coordination of data from different sources (4 out of 11) • Larger volume of data management (3 out of 11) • Better inventory management achieved from better logistics and supply chain (1 out of 11) 	<ul style="list-style-type: none"> • Integration and coordination of data from different sources (McKendrick 2012a; Syed, Gillela & Venugopal 2013; Elragal 2014) • Strategic decision-making (Jayawickrama, Liu & Hudson Smith 2013; Kanellou & Spathis 2013) • Supply Chain Management (SCM) (Vaidyanathan & Sabbaghi 2007) • Knowledge management and Knowledge sharing (Reychav & 	Not yet established from findings of online panel discussion	<ul style="list-style-type: none"> • Management of global operations (Rajapaksha & Singh 2009; Beheshti & Beheshti 2010) • A competitive advantage (Beheshti & Beheshti 2010; Dempsey, Vance & Sheehan 2013) • E-business support (Kumar & Thapliyal 2010) • Increased market share (Fub et al. 2007; Law & Ngai 2007) • Better

Types of ERP system upgrade	Types of ERP system upgrade (Literature)	Business Process Change from online panel discussion	Business change required for ERP system upgrade (Literature)	Organisational Capabilities from online panel discussion	Organisational Capabilities (Literature)	Productivity improvement from online panel discussion	Productivity improvement (Literature)
				<ul style="list-style-type: none"> Improved funds and information management (1 out of 11) 	<p>Anand 2011)</p> <ul style="list-style-type: none"> E-commerce innovation (Wu & Hisa 2008) Better security management of information (Hamerman, Moore & Vitti 2010) Alignment of business process and IT (Chen et al. 2008) Organisational Dynamic Capabilities, improvisational capabilities and operational capabilities (El Sawy & Pavlou 2008) 		Customer Relationship Management (CRM) (Ince et al. 2013)

As McKendrick (2012a) and Schäumer (2007) have explained, the various types of ERP system upgrades comprise full system, functional, and technical upgrades. The findings above indicate that in the current study the most important type of upgrade was the full system upgrade because it was cost effective.

Business process changes associated with ERP system upgrades, as established by this research, indicate changes to financial accounting, accounting control, funds management, procurement, order fulfilment, logistics, material management, and HRM. These findings confirm the suggestion made by Wenrich and Ahmad (2009) and Grabski, Leech and Schmidt (2011) that with ERP system upgrades business process change is a requirement.

As the findings in Phase One of this study indicated, ERP systems are an important form of Information Technology (IT) in organisations that are undergoing rigorous upgrades for improvements in capacity, capability and performance. The upgraded ERP system enable the organisations to support changing business demands (Worrell 2007). Wenrich and Ahmad (2009) suggest that business process changes are a requirement in order for ERP system upgrades to be able to accommodate business growth and new production lines, to consolidate business operations and to meet new regulatory and compliance requirements (Greenbaum 2009) that help the organisation achieve new business demands.

4.3 Summary

This chapter reveals the findings from the online discussion panel which established the types of ERP system upgrades undertaken by organisations, the business changes required for ERP system upgrades, the enhanced organisational capabilities achieved from new business process as the outcome of ERP system upgrades, and the improvements in organisational productivity. The following chapter discusses the findings from the case studies.

Chapter Five: Case Study Findings

5.1 Introduction

This chapter presents the five case studies undertaken for this study. The main purpose of conducting the case studies was to investigate and develop an in-depth understanding of the motivations, processes and outcomes of Enterprise Resource Planning (ERP) system upgrades across a range of organisations. Each Case Study begins with a description of the organisation's background, followed by an analysis of ERP system upgrade history, motivations, types and requirements for ERP system upgrades. The business process changes for ERP system upgrades and enhanced organisational capabilities achieved are discussed, with a summary of findings for each Case Study.

5.2 Case Study One

5.2.1. Case organisation profile

Case One is a large multinational manufacturing organisation in South East Asia, which was established in 1913. It produces a wide range of products including cement, construction material, petrochemicals and packaging products. The company operates factories in Thailand, Vietnam, the Philippines, Singapore and Malaysia. It also has 295 subsidiaries, associated joint ventures and other trading partners in Thailand, across the Association of Southeast Asian Nations (ASEAN), and other parts of the world. These subsidiaries and associated joint ventures include distributors, manufacturers, retailers, and legal and management service consulting firms. The main products this organisation manufactures are cement, construction materials, petrochemicals and packaging products from its three core business units, which are *Cement-Building Materials*, *Chemicals* and *Paper*.

The *Cement-Building Materials* unit is responsible for the manufacture of cement, as well as a wide range of cement-related construction, decorative, sanitary and faucet materials. This unit operates mainly in Thailand, Indonesia, Laos, Vietnam, Cambodia, the Philippines, Singapore, and Myanmar. Products manufactured by the Cement-Building Materials unit are exported to an equally wide range of international destinations in Asia and other parts of the world. Since 2014, the unit has expanded its business to the United States of America (USA), the United Arab Emirates (UAE), Hong Kong, Australia, China, Italy and Bangladesh.

The *Chemicals* unit is responsible for the production of an equally wide range of products. The main ones are petrochemicals such as plastic resins, polyethylene and polypropylene resins. Others include special grade resins for medical devices, high pressure pipes, electrical appliances, automotive parts and packaging films. This unit is one of the major petrochemical manufacturers in Thailand as well as a leading manufacturer in the Asia-Pacific region. As at 2014, the Chemicals unit operated 74 subsidiaries and associated joint ventures in Thailand, ASEAN, USA, Norway, Hong Kong, China and Iran.

The *Paper* production unit is the third major part of Case One's production business. It is mostly responsible for producing paper-based products such as packaging paper for food and consumer products, corrugated containers and printing and writing paper made from dissolved pulp. Like the other units, the paper unit is a leader in the paper business in Thailand and the Asian region.

Across all its business units, the company's main vision is to become a regional market leader, contributing to the sustainable progress of ASEAN and Thailand. It is one of the 2000 largest companies in the world (Forbes 2016) with a revenue of USD 12.8 billion in 2016. Its total number of employees is 51,000, with 34,000 based in Thailand.

Due to the size and complexity of Case One's operations – its number of international subsidiaries and partners, the large number of products and scope

of its supply chain, and its large workforce – a comprehensive and sophisticated Operating System (OS) is essential to ensure efficient and productive operations. It is for this reason that the company installed an ERP system in 1998. At this point, the ERP system adopted was SAP R/3 version 3.0D. This replaced its legacy manufacturing system. This was a fairly basic system and as the business grew in size and complexity, the system was upgraded several times in order to maintain an efficient level of operations. The following sections will examine the types of ERP system upgrades, the motivations for such upgrades, the processes of upgrades and the outcomes for the company.

5.2.2. Organisation One's ERP system

As stated above, a comprehensive ERP system is critical for the efficient management of complex organisations. An ERP (Enterprise Resource Planning) system is a large IT system that integrates information shared across business functions in an organisation. Case One implemented its first ERP system (SAP R/3 version 3.0D) in 1998 and upgraded it to SAP R/3 version 4.0B in 2001. The later version was upgraded twice to SAP R/3 version 4.7 to take advantage of some business module improvements in 2004. In 2013, the organisation further upgraded its ERP system to SAP ECC version 6.0.

Initially the organisation used the Human Resource Management (HRM) module from SAP R/3 version 4.0B. However, in 2004, it adopted Oracle's PeopleSoft HRM module to leverage the advanced people management features provided by this module. In 2013, the company replaced this system with SAP's HR module, version ECC 6.0. This module offered improved HRM functions of Employee Self-Service (ESS), and the ability to manage people mobility across the organisation and business units throughout the countries in which the company operated. This helped the organisation better manage the demands of skill specialisation required from different business units.

SAP version ECC 6.0 also enabled the organisation to integrate various other functions including sales and distribution, material management, procurement,

financial, accounting control and treasury (cash and liquidity, debt and investment and financial risk) management. The system also enabled the organisation to manage production planning and control, business intelligence, plant maintenance and warehouse management across all business units and subsidiaries, and the organisation's other partners.

In order to properly understand the business changes and outcomes of ERP system upgrades, it is important to first examine the motivations behind the upgrade. Different organisations are motivated by unique considerations based on their organisational objectives and strategies. Interview data collected from various senior managers in the company highlighted that management was motivated by a number of major considerations.

When the organisation upgraded to SAP version ECC 6.0 in 2013, it wanted a system with improved performance power and greater flexibility for handling business changes. The Chief Information Officer (CIO) explained that:

Although we have many branches in the ASEAN region, we have expanded business to Europe and the USA. In 2015, our domestic sales were 60%, 20% more from the sales in the ASEAN region and another 20% increase from global exports to the USA and Europe. As I said earlier, we needed to operate our core businesses more flexibly, and to have an ERP system to manage from one instance server to three to four core business units (Cement-Building Materials, Chemicals, Paper and People) with one server for each business unit [CIO].

Furthermore the Senior IT Officer at Cement-Building Materials added that effective data analytics was required to manage the complexity of large volumes of data from the large number of business units that were now part of the main business:

The business environment has changed for which business and data analytics from numerous sources is a crucial requirement for business decisions. Hence, we need a system to support these changes to take advantage of data

analytics for business decisions. Due to these demands we had to upgrade our SAP system to ECC 6.0 [Senior IT Officer at Cement-Building Materials].

He went on to explain that:

In the past, only 30% of our subsidiary companies in the ceramics business used SAP, with the remaining 70% using their own IT systems. With data from different IT systems, managing information at our organisation was not easy. Therefore a single standard Operating System (OS) for all subsidiaries required an upgraded ERP system [Senior IT Officer at Cement-Building Materials].

Due to business expansion and growth, an upgraded ERP system (SAP version ECC 6.0) became a necessity to support the management of all three units within the organisation. It provided a separate server for each unit to handle the large volume of information, enabling the efficient management of data and reporting from the organisation's international subsidiaries. Efficient information access facilitated quick decision-making to meet new demands and associated changes. The CIO emphasised the need to better manage business growth which entails a larger volume of data from all of its subsidiaries and partners. Information collected from the ERP system upgrade meeting reports also highlighted the need to manage the increased number of employees from each of the three business units of the organisation. Volumes of data for the business had grown due to business expansion, for which efficient data analytics were required. As the organisation expanded its business units to different regions of Asia and the world, it was important to access and use relevant data from the various subsidiaries operating in different time zones. This required standardised business processes, for all business units, both local and global. This supported data-driven decisions for the management of all business operations. Upgrading the ERP system to SAP ECC 6.0 was therefore considered to be a necessary step to provide end-to-end standard processes from all business partners, both

nationally and globally for data access, analytics and storage for better decision-making.

As mentioned earlier, in the last ten years the organisation expanded its business across Thailand as well as other parts of the world. Accordingly, there was a considerable increase in the size of the workforce. The existing HRM system, Oracle's PeopleSoft, was therefore unable to cope with the growing pressure and complexity. Thus there was need to upgrade the HRM system to incorporate functions such as time management, personnel administration and ESS. Management considered that the more advanced SAP ECC 6.0 had the ability to track and manage employee working times across the enterprise and to maintain HR planning and progress, as well as monitor HR costs. The *personnel administration functionality* in SAP ECC 6.0 also supported efficient management of employee payroll and other employee benefits. It helped in assessing employee eligibility for professional development and promotions and in tracking costs and compensation. The ESS functionality in SAP ECC 6.0 would allow each employee to access and maintain other authorised information such as leave applications, claims for additional payments and company provided benefits via multiple channels such as computer, mobile device and web browser from other devices. It was understood that the SAP-HR features helped the organisation to reduce costs and to better manage and monitor HR activities across the organisation. This consideration was explained by the Corporate HRM Assistant Manager as follows:

For HRM, we required the upgraded HRM module from SAP ECC 6.0. Once the organisation had sales and operation cost data, they needed to know the labour cost in the organisation. For ten years we managed HR with PeopleSoft from Oracle which was suitable for managing 20,000 employees mostly in Thailand. Since our organisation now has grown to 30,000 employees within the three business units and works with people from 130 subsidiaries located in countries outside Thailand, upgrading HRM function

with advanced features enabled by SAP ECC 6.0 was useful for the organisation [Corporate HRM Assistant Manager].

To manage the increased member of people working for the organisation, the HRM module from PeopleSoft was replaced by the HRM module from SAP ECC 6.0 to better manage and monitor HR activities across the organisation.

Another reason managers gave for the system upgrade was to obtain continuous technology support from the ERP vendor. This was an important consideration, since support for the earlier version of the ERP system was due to elapse at the end of March 2013. The organisation was therefore concerned about operating business with an obsolete system and with no technical support from the vendor. This motivation was explained by the CIO:

There are several reasons to upgrade ERP system. One obvious reason is that the earlier ERP system would be out-of-service [laughs] from the ERP vendor. Well, I think this is a commercial term of selling IT systems, as the vendor was to discontinue technical support for SAP R/3 version, although the organisation could continue using the system. This was going to be a risk for the organisation [CIO].

In summary, the motivations for the ERP system upgrade in the organisation included the need to have a single, standardised ERP system with greater ability for data analytics and management and to have standardised processes for all business activities from all partners. Business growth required centralised data management, standardised work practices, data-driven decision-making, effective business, effective HRM and flexibility in responding to changing customer and partner demands. These drivers, together with the ongoing technical support from the vendor were the motivating factors that led to the decision to upgrade to SAP ECC 6.0.

After the decision was made to upgrade the ERP system, management needed to make yet another important decision: what type of upgrade to go for. The next

section examines how company management went about deciding on what kinds of ERP system upgrade to adopt.

5.2.3. Type of ERP system upgrade

There are a number of reasons why management has to seriously consider the type of ERP system upgrade to adopt. These include consideration of the purpose of the upgrade, the cost of the upgrade and the long-term implications. Ultimately, the company must choose an upgrade that is going to enhance its ability to operate efficiently, cost effectively and competitively. As discussed in the literature review chapter, there are three types of ERP system upgrades comprising technical, functional and full system upgrades (Schäumer 2007; McKendrick 2012a). In this case, as explained by the CIO, the organisation's management adopted a full system upgrade, replacing SAP R/3 version 4.7 with SAP version ECC 6.0:

We conducted a full system upgrade. Our previous version was SAP R/3 4.7, a single instance system for our three core business units. This had limitations in terms of rigid business processes for each unit. By replacing the old system with SAP version 6.0, we now have a separate server for each unit that is fully integrated for data and Information Management [CIO].

As suggested by the CIO in the quote above, a full system upgrade was deemed appropriate because of the intention to achieve a holistic improvement of operations in all aspects of the business, including all the production units and HR functions. This was further emphasised in the discussion with the CIO below. He also highlighted the cost versus value consideration in the decision, pointing out that a partial upgrade, e.g. technical, would cost a lot but would not have much value in terms of achieving comprehensive improvement of the business:

In my opinion, if we needed to change or deploy new functions of the new ERP version, a technical upgrade was not worth our investment. Our business has changed so much. Therefore, a full system upgrade to support

the changing business environment and customer demands was a necessity
[CIO].

From the CIO's responses above it is clear that a full system upgrade was cost effective for the organisation. A full system upgrade would also support the demands of growing and changing business needs and provide data access on a single platform – a necessary requirement for efficient business management and decisions making.

In summary, a full system upgrade would provide the organisation with a platform that enhances capabilities to manage business growth, assist with new management requirements for renewed business processes, facilitate new ways to manage people and provide better access to data for analytics and decision-making. The next section explains requirements that the organisation needs to prepare for the ERP system upgrade.

5.2.4. Requirements for ERP system upgrade

In order for any upgrade to be effective, certain key requirements must be met. That is, the organisation must make certain adjustments to enable a successful system upgrade and effective application of the new functions to business operations and management. Some of the requirements necessary to achieve a successful ERP system upgrade include a good project team with sufficient skills and technical know-how, a sufficient budget, comprehensive planning, effective communication mechanisms within the organisation and among project team members, and strong top management support. Other requirements are basic infrastructure, effective change management strategies, transition management and an ongoing ERP technical support. The CIO captured the key requirements as follows:

For our ERP System Upgrade Project, we were concerned about key users of the system who were asked to become members of our project team to get their views on the new ERP modules, as well as to use them for communication of ERP system upgrade issues to their departments. Our

ERP system upgrade was a huge project and it required extra effort from all the team members to work on this project. In addition, in my opinion, the workplace and basic infrastructure were equally important. Top management support for decisions and for solving problems throughout the implementation of the new system was required [CIO].

A key requirement, which the company paid much attention to, were the *people* required for the ERP system upgrade. To this end, teams were assembled to oversee and implement the various aspects of the upgrade. A number of teams were established, including a team of ERP consultants and implementers, and a team representing the organisation's key users and process owners from sales, marketing, finance and accounting, the supply chain, HR and manufacturing. The final team comprised the organisation's Information Technology (IT) staff, who were responsible for the ERP system infrastructure. A Project Management Office (PMO) was set up for each of the modules in ERP system to ensure that the business functions and processes were adequately modified to make them suitable for the business form the upgraded ERP system version ECC 6.0.

Each PMO comprised an ERP system upgrade consultant, a financial accounting staff member and key process owners for each business function. A financial accounting staff member was included in each PMO team to ensure that transactions from all business functions could be monitored by finance and accounting. Consultants play an important role in the ERP system upgrade process due to their experience with system implementations. The ERP System Upgrade Project also included a steering committee made up of high level management for critical decisions on ERP system upgrade issues and solutions. The ERP system upgrade steering committee held monthly meetings to discuss all matters relating to the upgrade, whereas the PMO met daily. In total, the ERP System Upgrade Project team at this organisation consisted of approximately 400 members, which was necessary for project planning, management and communication from all sections of the organisation.

Clearly, setting up a PMO was seen as highly useful for user experience, for user buy-in and for communication to all users via their representatives on each PMO. Therefore, a cross-functional team was important for the composition of the project team. This was true for the upgrade of the HRM module as well. A Corporate HRM Assistant Manager explained that:

For HR system, we asked HR representatives from each business unit, approximately 30 people, to be members of our ERP System Upgrade Project team. Each representative shared their operating process and gave business requirements for their units which helped us to cover all HR operations in terms of overall corporate tasks and practices [Corporate HRM Assistant Manager].

According to the quote above, although the HRM module does not entail business-related data as other business functions do, it is important to include users and to have a PMO for this module as well.

There were other requirements for the upgraded ERP system that were equally important: for example, budget and time management. The CIO explained that the ERP System Upgrade Project aimed to improve their ERP system performance across all business units. It required well-managed time for each task, as well as budget management to control overspend for the upgrade. The CIO explained that:

... budget and time management were essential requirements for the ERP system upgrade. While upgrading the system, we encountered numerous complications which required top management approval for the required budget. Time management was important to ensure timely completion of the project [CIO].

The above comment implies that time and budget control are very important requirements for ERP system upgrades, especially when unforeseen circumstances require more time and budget. For ongoing management of the

system post-upgrade, an ERP system support team was required to assist all ERP users in the organisation. This is explained by the CIO:

After Go-Live, we also prepared for transition management and system support team which would help us get back to normal with our operation as planned [CIO].

In the ERP system upgrade reports, the need for a system support team based within the organisation to manage a smooth transition to the upgraded system was noted. This team would support users as well as provide solutions to any hiccups in relation to the operation of the upgraded ERP system.

It was established by the ERP System Upgrade Project that important requirements include people, budget, well-planned and managed activities, communication of the project milestones within the organisation, top management support, change and transition management and an ERP support team.

It was also noted that, for the ERP system upgrade, it was useful to establish the requirements for upgrading each business module and business processes supporting the modules. The organisation therefore established the requirements for upgraded business processes as well as change processes simultaneously. This saved time and money while aligning business functions and processes in the upgraded ERP system. The CIO further explained that:

Establishing the business process changes with the requirements for upgrading each module helped us in terms of controlling change management. These requirements also highlighted the changes to processes required for the upgraded modules [CIO].

Another important requirement for an effective system upgrade is appropriate business process change, i.e., business changes and the re-engineering of processes to align the new systems with existing business functions. The following quote taken from an interview with the Senior IT Officer at the

Cement-Building Materials business unit shows the importance of this requirement:

Business process change was a requirement for ERP system upgrades. We needed to standardise processes in our organisation to ensure that our processes for the upgraded system were based on a standard data entry method that is followed by all departments and business units in the organisation [Senior IT Officer, Cement-Building Materials].

This view was supported by another respondent:

Business processes had to be changed for standardised process and practices for all subsidiary companies in our core business unit [Supply Chain Process Improvement Manager, Chemicals Business].

Business process changes for ERP system upgrades are typically conducted in two ways. Firstly, the organisation changes the business process to align with the upgrade system during, and alongside, the ERP system upgrade process (Subramoniam, Tounsi & Krishnankutty 2009). Secondly, the organisation finishes upgrading its ERP system and then changes its business processes in order to align with the upgraded ERP system.

At Case One, the former option was adopted whereby business process change was undertaken alongside the upgrade process. The CIO explained that it was the most appropriate time to change business processes in order to align with new functionalities for each business module supported by the upgraded system:

I think it was the most appropriate timing for business process changes to be made for the ERP system upgrade. In my opinion, SAP ECC6 provides new functions and features which gave us the opportunity to change processes simultaneously [CIO].

Although capturing the changes made to all the processes is not a possibility here, a few examples of process changes are noted. These include changing the

accounts to a standardised system for capturing data and reporting between the organisation and its various subsidiaries and units. To illustrate, the Senior IT Officer at Cement-Building Materials explained that:

We changed financial and accounting process to the new corporate chart of accounts. This changed the way of posting all accounting and financial transactions to the general ledger. We also changed product costing process to ensure that all subsidiaries trading with our organisation employed the same standard costing process [Senior IT Officer, Cement-Building Materials].

This description was also offered by another manager within the company:

Yes, the chart of accounts was changed for the ERP system upgrade and this affected all work processes in relation to accounting [Supply Chain Process Improvement Manager, Chemicals].

The responses above indicated that changing the accounting processes helped monitor the accounts chart from all business partners and business functions for all transactions, product costing and procurement. Furthermore, in order to achieve greater integration of data from different processes, the procurement process was changed to support the data and transaction requirements for accounts. The CIO said that:

We changed the procurement process to better manage the procurement data. We also consolidated procurement data with accounts and finance for new businesses requirements of financial accounting. The new chart of accounts supported by the upgraded ERP system helped us manage transactions with and from all business units in our organisation [CIO].

Additionally, with the upgraded ERP system, procurement was digitised to enable the creation of purchase requisition and approval, the placement of purchase orders, the management of goods received, vendor payment and the changing of the whole purchase-to-pay process. The end-to-end procurement

process is now automated in the upgraded ERP system, as explained by the Senior IT Officer at Cement-Building Materials:

At Cement-Building Materials, the change was minor. We digitised purchase approvals which helped us to check purchasing value and level of approval authority. The changing of these processes reduced purchasing operation time as in the past we had to match data in the system with purchasing paper documents but now it is automated [Cement-Building Materials, Senior IT Officer].

With the ERP system upgrades, the organisation also took the opportunity to improve the procurement process, automating and digitising each aspect of procurement. The improved procurement process reduced time, provided greater transparency and was monitored by the accountants and finance to avoid overspend.

At the Chemicals unit, the changed procurement process assisted the business to better manage raw materials purchasing and to reduce redundant purchasing operations. As one manager explained:

Well, we also changed the purchasing process by designing new purchasing workflow for Chemicals. Since we upgraded our ERP system, we took the opportunity to change our purchasing process by discussing with our subsidiary companies the partners who we buy most raw materials from and selecting them as strategic sourcing partners. With the automated procurement system supported by the upgraded ERP system we have achieved transparency and purchasing efficiencies [Supply Chain Process Improvement Manager, Chemicals].

The findings discussed above indicate that an upgraded ERP system better supports the procurement process and the management of raw materials, and it provides transparency and purchasing efficiencies.

Due to the upgraded ERP system, change to the production process was also undertaken. This involved the automation of production planning and the costing of materials with online, real-time approvals. It helped determine the level of finished product for inventory management for reduced inventory and associated costs. The Senior IT Officer at Cement-Building Materials explained that:

Our production process was changed to automated ERP-based production planning and costing. Management of work in processes in production, creating bill-of-materials, goods issued for production planning and MRP were automated to align with the upgraded ERP system [Cement-Building Materials, Senior IT Officer].

ERP-based production included automated product costing for the required material as well as for the management of finished goods, reducing inventory and associated costs.

The upgraded sales and distribution module was designed as an intercompany module. It allowed each subsidiary company in the business unit to check overall product stocks and to buy and sell products, as well as manage billing and payments in one single process. The organisation changed the sales and distribution process to align it with the upgraded intercompany modules that enabled the business units to select the most applicable subsidiaries to produce cost-effective goods. The changed sales and distribution process also allowed the organisation to trade materials and finished products among the subsidiaries (retailers and manufacturers) thus reducing operational time and costs. The Senior IT Officer at Cement-Building Materials pointed out that:

In terms of product sales, our upgraded single ERP system supported us to use the system more efficiently for trading materials and products across our subsidiary companies. We were able to choose a representative company in our business unit to effectively produce goods, then transferring materials to that company for production. We gained more accurate real-time data from

the upgraded ERP system. Well, with the upgraded ERP system, we can manage intercompany stock transfer and billing payments which assist our subsidiary companies to better manage sales for us [Senior IT Officer, Cement-Building Materials].

A further point illustrated in the quote above is about improved process integration and support of all stakeholders as well as efficient management of production and sales data.

The other process change implemented was in HR and people management. Since the organisation employs approximately 35,000 employees in Thailand and over 6,000 in others countries, the upgraded HRM from SAP version ECC 6.0 needed to manage all employees through a single system. Employees and their entitlements, salaries, tax contributions, training requirements and other HR issues are all in the HR process in the SAP version ECC 6.0. The system also enables employees to manage their leave entitlements and performance-related achievements through the employee support system. This was an important change, as explained by the Corporate HRM Assistant Manager:

We changed HR by integrating HR time management data to the financial module. In the past, we used PeopleSoft for Employee Self-Service (ESS) and all employees could view their individual salary statements online, days off and absences and other leave-related information. However, for overtime management each unit had its own process. Each month, data on each employee from each unit was keyed in to PeopleSoft to calculate each employee's entitlement. With the upgraded system via the ESS, people can input their own information. This helps the HR department and the employees to monitor their entitlements online [Corporate HRM Assistant Manager].

Furthermore, all HR processes were automated and digitised with the ERP system upgrade to assist managers to make better and quicker decisions on HRM. The CIO explained this as follows:

Well, I was informed that after we upgraded the ERP system, better data quality than our previous system was achieved. In the past, the HR department gathered employee data from many sources which was used to create reports in spreadsheets and presented to our top management. Now, the upgraded ERP system is more automated. We are able to run an individual employee report which we call 'One Page'. It contains all information on each employee. This report supports our management levels to make decision on the annual promotion and also on internal job transfer in our organisation [CIO].

The above response evidenced that the upgraded ERP system greatly improved HRM.

In summary, due to the upgraded ERP system, a number of process changes were incorporated at this organisation. The analysis demonstrates that business process change is an important requirement for the successful upgrade of ERP systems. Some of the key business process changes undertaken alongside ERP system upgrade included financial and accounting, procurement, production planning, raw material and product cost control, sales and distribution and HRM.

5.2.5. Outcomes from ERP system upgrade

According to the literature, with new IT systems, organisations achieve a number of enhanced organisational capabilities (El Sawy & Pavlou 2008) including alignment of IT infrastructure, IT-enabled business capabilities, improved knowledge management and improved organisational performance. When asked about the outcomes and improvements the organisation achieved from the ERP system upgrade at Case One, the CIO explained that they now had a system that was flexible enough to meet the changing demands in each business unit. However, he explained that the most important outcome was data visibility for quick decisions and analytics for data-driven decisions:

Since we upgraded the ERP system, we have a flexible IT system which supports the business directions of each of the three business units. The upgraded system allows us to access greater volumes of data from integrated business functions and processes supporting these functions, units and partners. Greater access to data helps monitor performance against plans [CIO].

From this response, the most obvious enhanced organisational capability was big data management. Due to data analytics and visibility, better decision-making for business was achieved by being able to monitor online real-time information on all business activities. An ability to manage higher volumes of data resulted in greater flexibility to meet changes in the business.

The ERP system upgrade also led to better process integration enabling easier monitoring of production, inventory, sales, accounts payable and accounts receivable data in real-time from all business partners. The Senior IT Officer explained that:

The better data and processes integration among our subsidiaries help us to make good decision on choosing the right production plant to manufacture goods and distribute products to our subsidiary companies. Well, the intercompany stock transfer and billing payment functions with the upgraded ERP system supported our subsidiary companies to better manage and monitor inventory and sales [Senior IT Officer, Cement-Building Materials].

This demonstrates that better decision-making for business management was facilitated through improved data management. Furthermore, better data integration also increased the ability to better manage and trade materials and products among the subsidiaries, hence enhancing better products and sales management. The Senior IT Officer at Cement-Building Materials unit further explained that:

In terms of production and sales, the upgraded single ERP system supported us to operate the system more conveniently for trading materials and products across our subsidiary companies. We also gained more accurate, real-time data from these end-to-end processes in the upgraded ERP system which improved our products and sales management [Senior IT Officer, Cement-Building Materials].

As mentioned earlier, the organisation changed their chart of accounts. This enabled them to improve and standardise their financial and accounting process and procedure for use across the organisation, business units and subsidiaries as well as align with new functionalities of the upgraded ERP system. The organisation enhanced its ability to integrate larger volumes of financial data across the organisation and business partners both domestically and internationally. The online, real-time financial data supported the organisation to make decisions on business management more efficiently and maintain competitiveness. The CIO stated that:

The upgraded ERP system integrated data from all business functions in our organisation and from business partners which reflected our current business operation and financial status. For instance, the process automation from all modules of the upgraded ERP system integrated and provided useful financial data which supported our decision-making and gained us competitive advantage over the competitors. Additionally, we were able to consolidate financial data from all business units and subsidiaries as well as close our accounting period faster with the upgraded ERP system. It helped us to improve our financial management [CIO].

As the CIO explained, the ERP system upgrade improved the integration of larger volumes of data from all business aspects. This enabled the organisation to access transparent financial data and to undertake strategic decision-making as well as improved financial management in the organisation.

The organisation also gained access to HR data from the ESS due to the upgraded HR module. This module equipped top management with the tools to improve people management. The CIO stated that:

Well, I was informed that from the upgraded ERP system our HR department gained better data access on employees than our previous system. Now, the HRM system is more automated, and gathering all data which is required for reports is easier. We are able to run individual employee reports which we call 'One Page.' It contains information on each employee. This report supports our management to make better decisions on promoting employees to higher levels and internal job transfer in our organisation [CIO].

The above comment implies that improved ESS functions with the new ERP version provides valuable employee information from all business functions across the organisation. This supports management in making better decisions for their HRM.

Furthermore, the new ESS function allowed the employees to manage their own information that led to reduced HR operation time and supported employees in performing their responsibilities more efficiently. The Corporate HRM Assistant Manager explained that:

With the use of the new HRM module from the new system I noticed that we gained accurate online real-time HR information from the system. Our employees were able to manage their own information via ESS online. They did not have to prepare paper documents anymore. It also reduced HRM administrative officers' work load [Corporate HRM Assistant Manager].

The upgraded ERP system enables a single platform for developing training modules and knowledge sharing to support employees to self-learn and increase their understanding of new applications made possible by the upgraded ERP system. These learning platforms were also accessible via

mobile technologies, giving employees greater flexibility in managing their information. As explained by the Corporate HRM Assistant Manager:

I believed that everyone who participated in the upgraded ERP project had shared their knowledge and learned many new things such as learning new functions and how to use the new system [Corporate HRM Assistant Manager].

Furthermore, the Supply Chain Process Improvement Manager at Chemicals added that online learning of ERP system upgrade was available for all employees to access:

I developed a SharePoint platform as a learning web application which is like a Wiki for all partners of our company to learn about the upgraded ERP modules. We prepared training material and training video clips for our users [Supply Chain Process Improvement Manager, Chemicals].

The CIO also further described that:

We had a learning management system that provided online courses for our employees. These online courses could be accessed via mobile devices. We deployed this system over the last two years. To date, we still use this system and also perform e-ethics testing with this system. This is mandatory for our 30,000 employees to do online test via the mobile devices, the results of which are sent back to the upgraded HR system for personnel evaluation [CIO].

The upgraded ERP system enables online and mobile learning and enhanced knowledge sharing among employees via the HR learning management module. The organisation is able to develop online learning modules on any topic to train employees to train and to inform them of upgrades to the ERP system.

The findings above show that the organisation enhanced various capabilities with the ERP system upgrade. Improved organisational performance was achieved along with better integration of larger volumes of data and big data management, improved decision-making due to enhanced data visibility and

data analytics. Online real-time data from the upgraded ERP system improved finance management and enhanced communication across the organisation. Additionally, the new functionalities of the upgraded ERP system, such as intercompany procurement efficiency, ESS and HRM generally were improved.

When asked about productivity improvements achieved from the upgraded system, the respondents indicated that they did not have any hard evidence at the time of the interviews. None of the documents recorded any productivity improvements either. Therefore, since productivity improvements are usually long-term (Beheshti & Beheshti 2010), it was not possible to establish exact figures or amounts for productivity improvement achieved from the ERP system upgrade at Case One.

5.2.6. Summary of findings from Case Study One

Types of ERP system upgrade vary from technical to functional. However, at Case One a full system upgrade was undertaken due to cost effectiveness.

Case One's reasons for an ERP system upgrade include the need for an IT system with improved performance power to manage business change, growth and globalisation. Other reasons for the upgrade were the need for a single standardised IT platform to support all business functions, units, and business partners with aligned business processes. Another reason was to gain ongoing vendor support for the new system which could be very costly if outsourced.

Requirements for an ERP system upgrade determined from Case One are budget and project management, workplace and fundamental infrastructure and a cross-functional project team with representatives from different sections of the organisation. Effective communication to keep everyone in the organisation informed about the technology upgrade was identified to be an important requirement in Case One as was the role of ERP consultants. A steering committee and IT staff for change management (PMO) was also a requirement for each ERP system module. Business Changes required for the upgrade in

Case One are business processes changes to support the upgraded business module in the upgraded ERP system.

Enhanced organisational capabilities achieved from the ERP system upgrade in Case One include better management of larger volumes of data from integrated business functions, and a greater data visibility due to the improved data analytics and reporting capabilities of the new system. This led to data-driven decision-making in the organisation for quick responses to changing business demands, cost management, business partners and people management. The online real-time data from the upgraded ERP system also improved finance management, enhanced communication across the organisation, improved intercompany procurement efficiency and ESS. The new HRM module enabled effective employee relationship management and a reduction in cost for employee management.

5.3 Case Study Two

5.3.1. Case organisation profile

Case Two is a large agricultural products and food businesses operating in South East Asia, and it was established in 1978. The main products of the organisation are animal feed, fresh and processed meat and ready-to-eat food products. The organisation operates in 14 countries and exports its products to approximately 30 countries across five continents. The organisation is associated with 219 subsidiary companies, associated companies and joint ventures in Thailand, Indo-China, Europe, the United Kingdom (UK), Russia, and Africa. The organisation has extended its opportunities in other countries, such as India and the Philippines, to cater for global demands for its products. The organisation is organised into four units that are *feed business*, *farm business*, *food business* and *retail business via food outlets*.

The *feed* business unit of this organisation manufactures animal feed for sale mainly in Thailand. The main products of this unit are livestock feed, poultry feed, shrimp feed and fish feed. The marketing strategy of the feed business is to provide a full service offering quality feed and breeding stock, providing technical information for farm management and animal rearing techniques to customers. The feed business unit also supports business partners to market their products through its central purchasing unit in Thailand.

The *farm* business unit is a livestock farming business also operating mainly in Thailand. This business unit produces two major farm products which are animal breeding and products from live animals and basic processed meat. The animal breeding for farming is focused on high-quality and healthy breeds suitable for farming conditions in different destination countries which meet customers' preferences. Live animals and products from live animals include swine, duck, chicken and duck eggs which are sold domestically. The basic processed meats are chilled and frozen and distributed through the *food* business

in Thailand and exported to other countries. An important feature of the marketing strategy of the farm business unit is to ensure customer awareness of the products' quality and safety which are prudently scrutinised through the product supply chain.

The *food* business unit is a subset of the processed meats business which produces cooked, partially-cooked and ready-to-eat food products. These products of the food business are distributed to buyers through convenience stores, supermarkets, supercentres, fast food restaurants, other retail and food outlets, and other retailers and wholesalers. In addition, the food business unit also has representative offices in 14 other countries as subsidiaries. In 2015, the food business unit exported its products to approximately 30 countries globally including the European Union, the UK, Japan, the USA and some Asian countries. The food business unit's main objective is to ensure customer awareness of the products which provide a high-quality, nutritious, and tasty food. These traits are traceable throughout the whole supply chain.

The *retail and food outlet* business unit is an extension of the food business unit which provides a more convenient marketplace option for its products to customers. The distribution channels consist of a franchise kiosk, a fast food restaurant business, a fast-serve restaurant, a retail outlet, a convenience store, and a food court. The main products of the food business unit are sold through these sales channels in Thailand and in eight other Asian countries.

The organisation's main vision is to become a global kitchen leader by integrating agro-industrial and food businesses that provides high-quality, nutritious, appetising and safe products for consumers around the world. Case Two is one of the 2000 largest companies in the world (Forbes 2016) which reported a revenue of USD 13.5 billion and a profit of USD 429 million in 2016. It was selected to be a member of Dow Jones Sustainability Indices (DJIS) in the category of DJSI Emerging Markets of 2015 and ranked among the top 5 of 31 companies in the group of FAO (Food and Agriculture Organisation by the

United Nations) products. At the end of 2015, the organisation employed a total of 14,817 employees in Thailand itself.

Due to the organisation's business growth and increased diversity in terms of a growing number of international subsidiaries and partners, stakeholders, product ranges and increased workforce, powerful computing systems were required for efficient and productive operation. Therefore, the organisation implemented an ERP system as early as 2003 and considered upgrading it several times to improve the system capacity to manage its growing business and workforces. The following sections will examine the types of ERP system upgrades, the motivations for such upgrades, business changes for upgrades and the outcomes for the company.

5.3.2. Organisation Two's ERP system

The organisation needed an effective ERP system that provided agility to respond to complex business operations. It implemented the initial ERP systems SAP R/3 version 4.6C and PeopleSoft version 8.0 for HRM in 2003. The ERP system provided the functionalities required to run the business and to support end users to operate their work operations effectively. However, as the business grew, the existing ERP system was not able to meet business needs, could not support all functions and was not flexible. Due to these reasons, the SAP system was upgraded twice to SAP version ECC 5.0 in 2006 and SAP version ECC 6.0 in 2013 to support domestic and global business expansion. The upgraded ERP system was required to maintain business performance. Furthermore, in order to manage its unique business operations the organisation modified some SAP modules in its previous ERP system to align them with the business functions supporting their unique business demands. These modified programming codes were considered important and were integrated into the upgraded ERP system to support specific business requirements. The ERP modules deployed from the upgraded ERP system at Case Two include financial

accounting and control, sales and distribution, material management, production planning and plant maintenance.

It is important to comprehend the core motivations for the ERP system upgrade in order to fully understand the process and rationale for the upgrade. An improvement of the IT system in the organisation aimed to meet business objectives and strategies as well as to support the organisation and its end users. In this case, various senior managers were interviewed to understand specific motivations for the ERP system upgrades in their organisation.

The main business motivation for upgrading its ERP system to SAP version ECC 6.0 in 2013 was the need for better financial and accounting processes which would be integrated with other business functions in the organisation. Additionally, the organisation needed to improve its business operations and centralise its financial services at the headquarters while maintaining online real-time data on transactions from all business functions. The Finance Shared Service Centre required an ERP system that could support its work operation and provide better access to all financial data. Thus it would offer better financial support services in the organisation and to all business functions. Also, the organisation upgraded its ERP system in order to have a business driven by technology to support business transformation. The SAP ERP financial accounting manager explained that:

There were too many factors for ERP system upgrades but the most notable factor was to support business transformation [Vice President of ERP financial accounting management].

Furthermore, the Senior ERP Financial Accounting Manager explained that the organisation's financial service transformation aimed to centralise the financial and accounting staff to work together at the headquarters. The Finance Shared Service Centre is an internal service provider which congregates proficient financial and accounting staff and provides standardised financial services for different business functions in the organisation, business units and office

branches in Thailand. The objective of the Finance Shared Service Centre is to provide better financial service quality at a lower cost. It also needs a more powerful financial system to facilitate its work operations and support business growth. As explained by the Vice President of ERP financial accounting management:

In the past, our accountants worked across the country. When we expanded our business we had to increase the number of our accountants to support business growth. Therefore we made a decision to transform our financial and accounting work to be a 'Finance Shared Service Centre' and upgrade our existing SAP system which supported our business operations and business growth without increasing the number of accountants in the organisation [Vice President of ERP financial accounting management].

Seemingly, according to the quote above, although the transformation of the Shared Service Centre would centralise and maintain the financial and accounting staff, it was important to upgrade the existing ERP system to assist its work operation in the organisation.

According to the organisation's ERP system upgrade reports, the technical motivation for upgrading the ERP system was to have a new OS, hardware and database server and to introduce a Unicode standard for the ERP programming language. According to the Unicode Consortium (2016), the Unicode standard is an encoding system which supports unique numbers and characters of any language used in global software technology. The Unicode standard also enables a single software product or a single website to be accessed across multiple platforms, languages and countries without the need for re-engineering (Unicode Consortium 2016). It also allows data to be transferred across many different systems without being corrupted.

Another consideration in the decision to upgrade the ERP system was to improve its information system performance with the latest technology. The

organisation required efficient data analytics to boost information management capability. As explained by the CIO:

In my opinion, to upgrade the software application is to modernise the IT because it made those systems work better. If we did not upgrade the ERP system, we were not able to do any other software developments that would be used in the future. We wanted to upgrade the software to support ERP functions for financial consolidation, use data analytics with SAP HANA (High-performance Analytic Appliance) and for better treasury management [CIO].

The CIO further explained that the organisation considered using new technological advances incorporated with the new ERP version which supported data integration from more sources such as mobile technology:

In addition, if we wanted to use mobile technology for sales and distribution, we had to upgrade our core IT system because the old ERP system did not support those new technologies [CIO].

From the CIO's responses above it is obvious that the ERP system upgrade was meant to support the organisation by encouraging it use its Information Systems (IS) more efficiently as well as improve finance management with enhanced data analytics tools.

Since the technical support provided by the vendor was coming to an end, the organisation decided to upgrade the ERP system in order to maintain continued technical support and maintenance for its ERP system from the vendor. Without the support from the ERP vendor, the organisation would have to maintain its own ERP system with internal IT staff or employ external ERP experts which would not only increase the IT maintenance cost, but on top of that, the IT staff did not have the technical expertise to use ERP system. This motivation was further stated by the CIO that:

Well, it was an appropriate time to replace the old ERP system with the new version because the vendor convinced us to do this. Since we deployed the

ERP system for long period of time, we couldn't resist replacing it with the new ERP version because the support and maintenance agreement for the existing ERP system was coming to an end. To avoid additional IT maintenance costs, it was a proper time to upgrade our ERP system [CIO].

The CIO's response reveals that to have ongoing technical support from the ERP vendor was an important reason for the organisation to upgrade its ERP system.

As mentioned above, in 2003 the organisation introduced people management with the PeopleSoft HRM version 8.0. It upgraded the HRM system to version 9.0 in 2010 due to the growing size of the workforce associated with the business expansion. The organisation also needed to move from a disparate HR system to a single standard system for improved efficiency of HRM. The motivation to upgrade PeopleSoft HR version 9.0 in 2010 was to empower people management processes including employee data management, competency management, leave and absences management and personnel evaluation. The new PeopleSoft HRM version included upgraded HRM functions such as ESS, time and labour management and simplified people management. This was required for people mobility across the organisation which was necessary for the management of skill specialisation demands in the business units and branches in different parts of the country. The HRM system upgrade aimed to improve people management efficiencies and to automate and standardise HRM processes in the organisation. HR modules deployed from PeopleSoft version 9.0 included core HRM and time and labour management as well as payroll. The management considered that the more advanced PeopleSoft version 9.0 functions would support better employee management in the organisation, business units and branches across the country. It would also support better HR planning and progress as well as monitor HR costs. This consideration was explained by the Vice President of Enterprise Solution as follows:

When the ERP vendor released the new HR system version 9.0, we focused on its new and advanced functionalities which would support our HR operations, especially personnel performance evaluation. This new

functionality helped managers to better evaluate employee performance. We also decided to implement additional time management and payroll modules which support a large volume of data integration and process automation across the organisation. An aim of upgrading our HR system was to deploy a single system to automate all HR processes. In addition, the single HR system helped us to reduce error rates and risks from performing manual data integration from disparate systems [Vice President of Enterprise Solution].

The above analysis shows that the decision to upgrade the ERP system was one that was carefully considered. This is because ERP system upgrades are often costly but, at the same time, the cost of failing to upgrade when the business outgrows the current system can be enormous.

The motivations for an ERP system upgrade established from this case study, therefore, include the need to support business transformation with the Finance Shared Service Centre as well as supporting business growth and expansion. The organisation also aimed to enhance ERP system performance for the management of greater volumes of data from numerous sources including the mobile technology used across the organisation and to improve information management and data analytics. The organisation also needed a standardised HRM system for people management and evaluation of people performance process. Moreover, gaining continued system maintenance support from the ERP vendor was also a reason for the organisation to upgrade its ERP system.

In order to make a careful and informed choice of the ERP system cost and benefits, the management was also required to determine an appropriate type of upgrade to be implemented for the organisation. The next section explores how management at the company went about deciding what kinds of ERP system upgrade to adopt.

5.3.3. Type of ERP system upgrade

Similar to Case Study One, there are a number of reasons why management has to seriously consider the type of ERP system upgrade to adopt. These include consideration of the purpose of the upgrade, the cost of the upgrade and the long-term implications. At the end of the day, the company must choose an upgrade that is going to enhance its ability to operate efficiently, cost effectively and competitively. As previously discussed in the literature review chapter, there are three types of ERP system upgrades comprising technical, functional and full system upgrades (Schäumer 2007; McKendrick 2012a). Case Two opted for a full system upgrade but implemented it in a phased form unlike Case One, which implemented its upgraded ERP system in one continuous process. The organisation began its upgrade by first focusing on technical improvement then upgraded other functions including financial, sales, distribution, procurement and inventory management. The SAP ERP Financial Accounting Manager explained that:

According to new business transformation, in my opinion, our existing ERP system version was quite old. Before we transformed our business, we had to prepare our ERP system to be the latest technology and modernised, to gain new features and functionalities and also support our future works [Vice President of SAP ERP Financial Accounting Management].

The financial accounting manager's response indicates that the organisation first made technical upgrades, then moved on to other business functions and eventually completed a whole system upgrade. The need for a full system upgrade was conceived from the functional upgrade that was achieved by investing a bit more in the system. As suggested by the CIO, since the ERP system was an integration of all business functions, the organisation had no choice but upgrade all the functions in order to achieve efficiencies from the new system. Thus the ERP system upgrade was phased, starting from technical to functional to full system. The phased approach focused on stepwise implementation by improving the technological platform first, followed by

upgrading functions of each ERP module. This reduced the potential problem associated with transforming multiple business functions. The organisation did not only upgrade every module of the ERP system but also implemented new modules to achieve improvement of the whole system performance. The CIO mentioned that the reason for the choice of the full system upgrades was so that the organisation was able to improve the performance of all SAP modules in the organisation:

The reason for selecting a full system upgrade was because we spent a large investment in our ERP system. So we couldn't do a partial upgrade of our ERP system. We had to upgrade all ERP modules which we deployed including finance, production planning, sales and distribution, material management and plant maintenance to increase the whole system performance. Furthermore, we also implemented additional treasury management modules with our ERP system upgrades to support our financial management [CIO].

As suggested by the CIO in the above interview quote, the full system upgrade was considered necessary in order to achieve an improvement of all operations in the business as well as increasing the whole ERP system performance abilities. The organisation also implemented new ERP modules to meet new business demands.

These new HRM modules included time and labour management and payroll. The Vice President of Enterprise Solution explained that:

We did a full system upgrade with our core HR system from version 8.0 to version 9.0 in 2010. We also made the decision to implement additional HR modules including time and labour management and the payroll. It was quite a big project and it took three to four years to finish this project. The new PeopleSoft HR version 9.0 provided new functionalities and features and better supported our HR operation and management across our enterprise [Vice President of Enterprise Solution].

Although the HRM system at this organisation was stand alone (PeopleSoft HR), it was also upgraded along with the SAP ERP system to take advantage of new people management functions.

The findings indicate that the organisation conducted the full system upgrade with the aim to modernise and gain the latest technology and functionalities of the ERP system in order to support business transformation, increase the whole ERP system performance and implement additional new modules to meet new business demands. However, it is important to note that the ERP system upgrade at Case Two commenced with the technical upgrade, proceeded through to functional upgrade and resulted in a full system upgrade.

5.3.4. Requirements for ERP system upgrade

An important step in the process of upgrading an IT system is to gain an understanding of the requirements for the upgrade. This will help implement the upgraded project within the timeframe, estimate the cost and meet the objectives. Such requirements would include the budget, project and activity plans, top management support, new infrastructure including software, hardware and database server, roles of the project team, training on the new system, an assessment of the existing ERP system and custom programs, an IT support team, and requirements for customising the modules of the new systems to meet the organisational business operations.

One of the most important requirements for the ERP system upgrade in the organisation was having the right people. These included representatives of different business functions in the organisation. People with ERP expertise were also included in the upgraded project. There were four groups of people involved in the ERP system upgrade at Case Two. These comprised the IT team, users, external ERP consultants and management. The first group consisted of staff from the IT department with technical skills for handling SAP functions, system administration, SAP programming and hardware. The IT staff were engaged to provide technical advice and to perform IT tasks on the ERP System

Upgrade Project. The SAP staff acted as consultants on new features and functionalities of ERP modules. The system administrator was responsible for the management of the ERP platform. The SAP programmers were in charge of customising SAP applications and programming codes to make them suitable for the organisation's needs. The hardware engineers were responsible for installing new hardware and maintaining the hardware. Some of these responsibilities were explained by the ERP financial accounting manager as follows:

An ERP System Upgrade Project team enlisted staff from different departments in the organisation including the IT department. Our IT team consisted of several groups, SAP functional staff, SAP system administrators who were responsible for technical support, and a SAP security manager. Programmers or 'ABAPers' who were responsible for re-programming our existing SAP's ABAP [Advanced Business Application Programming language] programs to use on the upgraded system and suit the organisation requirements. The final group was people with IT skills [Vice President of SAP ERP Financial Accounting Management].

The Chief Information Office also confirmed this by explaining that:

Our IT staff got involved with the SAP upgrade project such as programmers who were responsible for amending those ABAP programs from our previous SAP version to use on the upgraded SAP version ECC 6.0 [CIO].

The second group of people required consisted of the key users from all departments across the organisation for their knowledge of each function. The key users provided insightful, daily operational information regarding the ERP system. This information was useful for improving the ERP system performance as well as supporting crucial tasks in the upgraded project. The Vice President of SAP ERP Financial Accounting Management explained that:

We also invited key users who were representatives from all departments in the organisation for their knowledge of each function. These key users also

provided useful information for creating activity plans for the upgrade project [Vice President of SAP ERP Financial Accounting Management].

This was also true for the upgrade of the PeopleSoft HRM system. The staff from different business functions in the organisation were required to participate in the HR system upgrade to gain an understanding of the HRM system upgrade objectives and goals. The Vice President of Enterprise Solution further explained that:

The upgraded PeopleSoft HRM system project consisted of IT staff, HRM staff, key users from accounting and payroll, operational staff, other employees and representatives from all departments and business functions as well as IT support team [Vice President of Enterprise Solution].

In addition, the ERP System Upgrade Project required SAP consultants with experience and knowledge in SAP upgrades. The consultants defined business functions as well as implemented the ERP system upgrade efficiently and successfully. The Vice President of ERP Financial Accounting Management further pointed out that:

... experienced SAP consultants were required to counsel us on new SAP functionalities and the implementation of the upgraded system to meet our business requirements [Vice President of SAP ERP Financial accounting Management].

The CIO also confirmed this as follows:

We also required ERP consultants to provide us with their expert suggestions on upgrading our ERP system [CIO].

The Vice President of Enterprise Solution also explained that experienced ERP consultants were an important requirement for their practical knowledge, consultation and implementation advice on the system upgrade.

We also hired external HR consultants to provide business solutions for the upgraded HRM system [Vice President of Enterprise Solution].

In addition, top management was engaged to provide support and to oversee the whole ERP System Upgrade Project. Its executive support was required to ensure all upgraded activities were achieved on time and that the end goal of the ERP system upgrade was achieved. The Vice President of ERP financial accounting management pointed out that:

Importantly, our executive management was engaged as a project sponsor to the upgrade project. The project management team was required to regularly report the project's progress to the project sponsor to ensure the project was on track [Vice President of SAP ERP Financial Accounting Management].

According to the above quote, addressing the requirements for ERP system upgrades is essential to prepare people, organise resources and obtain managerial and user buy-in before starting the ERP System Upgrade Project. Therefore representatives from users, top management, experienced ERP consultants and other employees are important for the composition of the project team successfully achieve the ERP system upgrade goal.

Another key requirement the management carefully considered for improving the IT system in the organisation was setting aside sufficient funds. The cost of upgrading ERP systems can be very high and includes the cost of the software license fee, the maintenance fee, a new IT infrastructure and hardware, implementation and consultancy services. The Vice President of Enterprise Solution mentioned that the budget for HR system upgrade was prepared before making the final decision on their new HR system. Comparing the advantages of the new features and functionalities between the PeopleSoft HR Payroll module and SAP Payroll module, the organisation decided to adopt *PeopleSoft* HRM system:

For the upgraded HRM system, we prepared a budget for this project. At that time we needed to deploy new payroll module which we considered and compared between SAP-Payroll and PeopleSoft-Payroll. Finally, we decided to deploy the PeopleSoft-Payroll module rather than replaced it with the SAP Payroll module. However, the prepared budget was used for overall activities of the whole HR system upgrade [Vice President of Enterprise Solution].

To have a successful ERP system upgrade, the organisation not only needs to prepare an adequate budget but also requires an effective plan for the entire ERP System Upgrade Project. This would manage activities and resources necessary to complete the project goal within budget and time. The ERP System Upgrade Project plan therefore comprised all upgrade activities with milestones, resource planning, business requirements and the teams for supporting project management and achieving the ERP system upgrade outcomes. The Vice President of Enterprise Solution further explained that:

For the SAP upgraded project, we had prepared a good project plan which helped us to manage the project more efficiently and effectively. We also planned and required the user participation for several activities such as unit acceptance tests or 'UAT' for testing the accuracy of the upgraded system, data conversion and project cutover before go-live the upgraded system [Vice President of SAP ERP Financial Accounting Management].

The above comment implies that a good plan is important for a successful ERP system upgrade which helps the organisation to manage and control the upgrade tasks and activities.

Furthermore, new SAP version ECC 6.0 provided numerous new features and functionalities. The project team members were required to learn and gain an understanding of the new features and functionalities of each module within the upgraded ERP system. The SAP ERP Financial Accounting Manager further explained that:

Our project team members are required to learn and gain knowledge on new SAP features and functionalities to better understand its new functions. This knowledge will assist them during the upgrade implementation and to operate the upgraded SAP system after Go-Live [Vice President of SAP ERP Financial Accounting Management].

The above response indicates that the ERP system upgrade requires the users to learn new functionalities and features of the upgraded system. These would help them to understand how the system functions as well as to accomplish tasks using the new system.

The ERP system upgrade brought about several changes to the system as well as to processes. ERP system end-user training was needed to educate employees to precisely understand the new process, to teach them how to use the system and how to input data accurately into the system. As the Vice President of Enterprise Solution Management explained:

We also provided a user training course for all employees who interact with the upgraded HR system to operate their employee self-service functions. It was a hard task for us because these people had never used a computer before. Therefore our users were trained to operate the system via the computers that we provided for them to use at all factories [Vice President of Enterprise Solution management].

It is obvious that the ERP system end-user training is also essential when upgrading the ERP system which is conducted to ensure that the employees understand how to operate the new system precisely.

As mentioned above, the organisation modified software programs within its existing ERP system to assist its unique business functions. Some of these modified software programs were necessary for supporting the specific business operations. For that reason, it required the management to determine which modified programs would be transferred to the upgraded ERP system. With the new ERP versions, some program codes had to be rewritten to customise them

to the business and to be used in the new system. Hence, an assessment of the existing custom programs with SAP version ECC 5.0 was another essential requirement for the upgraded in Case Two. The CIO pointed out that:

Those business functions on our old SAP systems also needed to be assessed before upgrading the SAP system because we needed to know which customised programs were required to amend and migrate to use in the upgraded SAP system. In terms of operation, I must say after we finished the upgrades, we had to maintain our custom programs to work with the upgraded ERP system. This task took much of our effort to maintain so that the whole system worked properly to meet our specific business requirements [CIO].

Apart from the new ERP application software version, new infrastructure included an OS, hardware and a database server required for the new SAP version to harmonise with the new technology and increase the system performance and scalability. New hardware was therefore another key requirement to replace the old hardware as well as to be compatible with the new ERP software applications. The ERP Financial Accounting Manager stated that:

We also prepared two sets of new hardware. One hardware set was used as a new system testing environment and another set was used to replace the old infrastructure with our previous SAP version and use with SAP ECC 6.0 as a production system [Vice President of SAP ERP financial accounting management].

The need to change business processes to align them with the new functionalities of the latest ERP version was considered as another key requirement for the ERP system upgrade. As also explained in relation to Case Study One, the business process changes for the ERP system upgrade are typically conducted in two ways. In the first option, the organisation changes the business process to align with the system upgrade during and alongside the

ERP system upgrade process (Subramoniam, Tounsi & Krishnankutty 2009). Alternatively, the organisation finishes upgrading its ERP system and then changes its business processes in order to align with the upgraded ERP system.

At Case Two, the organisation adopted the latter option whereby business process change was undertaken after the upgraded process. The reason to take this option was that the organisation used many ERP modules and also operated numerous business processes which made it difficult to simultaneously upgrade ERP system and change business processes at the same time. To minimise complexities, upgrading the existing ERP system was accomplished, followed by changing the business process. The SAP ERP Financial Accounting Manager explained:

A major process change had been done after the SAP system was upgraded. This helps transform the old financial accounting process to the Finance Shared Service Centre. We now also have centralised accounting process owners who work at the Shared Service Centre. In the past, those accounting staff worked across the country and it's quite hard to improve data and process because everyone thought that they were an individual process owner. When these accounting staff are centralised and worked together at the Shared Service Centre, now they can differentiate the data and processes [The SAP ERP Financial Accounting Manager].

The CIO also confirmed as below:

We created a Shared Service Centre for our financial and accounting which was our big business process changes in our organisation. However, we changed this process after we finished our ERP System Upgrade Project. In addition, after upgrading the ERP system, we also adjusted and improved a large number of our processes which we planned to do as the second phase after the SAP upgrade. These process changes, for example, were financial accounting and sales and distribution [CIO].

It is noted that some possible business processes change with the ERP system upgrade at Case Two included finance, sales and distribution and HRM processes. As mentioned above, the organisation transformed its financial and accounting operations to a Shared Service Centre resulting in the financial and accounting process aligning with the new Finance Shared Services Operation and the upgrading of the financial accounting module. Hence, the transformation of the financial process to the Shared Service Centre aimed to centralise the accounting staff at the headquarters. The organisation also needed to sustain financial accounting services which supported business operation in the organisation, business branches and subsidiary companies across the country. The CIO further explained that:

We had to reduce the number of our accountants [laugh] who work at our business branches across the country. We found that by changing finance with a Shared Service Centre, we can work faster and get accurate data online real-time due to the upgraded SAP system. Our financial and accounting operation is now more controllable. With the Shared Service Centre, we are able to manage our HR more effectively and also centralise our accounting staff to provide better services for all of our business functions [CIO].

This view was also supported by the ERP Financial Manager:

The Shared Service Centre helped us to bring all accounting staff to work together at the same place. This helped improve financial work processes and made it better. Financial and accounting process changes result in better data management in the upgraded SAP system which supports the system users across the organisation. It also brings about process automation, better workflow and stored digitised documents in the upgraded SAP system [Vice President of SAP ERP Financial Accounting Management].

The point illustrated in the quotes above is about efficient management of financial and accounting operations. The upgraded ERP system would also streamline and automate work as well as transform document management with

digitalisation. Furthermore, as part of financial management, the organisation implemented a new, additional treasury management module which included cash and liquidity management and treasury and financial risk management. The treasury management module was an extension of the financial accounting module which increased its financial management capacity. The organisation also needed to improve its financial process in order to align with the new treasury management modules as well as replace old manual processes for financial process efficiency. This view was supported by CIO that:

We also implemented treasury management as an additional new module with the upgraded SAP system. In the past, we used a manual spreadsheet to keep records for treasury data management. In addition, the treasury process (cash and liquidity management) make us work easier and our financial status is also getting better [CIO].

Because of the increased use of mobile technology for a number of business processes, there was a need for effective integration of all data from mobile technology into the upgraded SAP system. The organisation also made the decision to change its sales and distribution process to align with the upgraded sales module. This supported using mobile devices to support business operations. Deploying new technology also assisted sales representatives to access information faster from the upgraded ERP system, which helped improve customer services. To illustrate this, the CIO explained that:

... after finishing SAP upgrade we have changed our sales and distribution process according to the needs of using mobile technology with the sales and distribution module. With advantages of the mobile devices, our sales people can use them to check available stock and create sales orders online which connect to our upgraded SAP system. This is another urgent task which we needed to undertake after upgrading our SAP system because it helps to operate sales orders more conveniently and quickly to service our customers [CIO].

The above quote from the CIO indicates that with the upgraded ERP system data could be integrated and processed from mobile technologies, improving the sales and distribution process much more easily.

Another process change implemented was in HR and people management. Since the organisation employed approximately 15,000 employees in Thailand, the upgraded HRM system from PeopleSoft HRM version 9.0 needed to manage all employees through a single system. The organisation aimed to standardise its HRM system as well as the people management process across the enterprise. Since they replaced their in-house HRM software with the PeopleSoft time and labour management module, the process was changed to effectively and efficiently manage people and time. This was an important change, as explained by the Vice President of Enterprise Solution Management:

The reason for changing those processes (HR and time and labour management) was that we needed all departments and business units to use the same HR work standard and practice. According to new standardised HRM system, the HRM process and work practice were changed to align with the upgraded HRM system, including employee self-service and payroll. However, time and labour management processes were dramatically changed in the PeopleSoft HRM version 9.0 [Vice President of Enterprise Solution Management].

The CIO also noted that:

We changed our employee self-service process which actually was additional tasks with the system upgrade.

Furthermore, the ESS process was therefore changed to enable employees to maintain and update their information, leave applications, claims for additional payments and company provided benefits. They could do this via organisational computers, personal laptops, ipads and other mobile devices. This change enabled the organisation to access online real-time information on timesheets as

well. The Vice President of Enterprise Solution management explained this as follows:

This new HRM standardised process and work practice help us to better control and manage people data in the upgraded HRM system. It improved our workforce management and also assisted us to gain better operational efficiency. In addition, new employee self-service also assisted and facilitated the employees to operate their HRM activities from multiple sources such as desk terminals and kiosks at all factories across the country [Vice President of Enterprise Solution Management].

In summary, due to the upgraded ERP system a number of process changes were incorporated at Case Two. The analysis demonstrates that business process change is an important requirement for the successful upgrade of ERP systems. Some of the key business process changes undertaken alongside ERP system upgrade included financial accounting, sales and distribution and HRM.

5.3.5. Outcomes from ERP system upgrade

The organisation was able to integrate business data functions on one platform. The upgraded ERP system enabled greater data visibility for improved and quicker decision-making. All transactions were recorded in digitised format in the system which could be easily retrieved for analytics as required. The CIO explained that:

Data is now more visible in the upgraded ERP system. In the past, when our business branches paid for purchase documents, we had to wait for a long time for those scanned documents or the original documents to be sent to the accounting department at our headquarters. These days, with the upgraded ERP system, our top management level is able to access online real-time data on all purchasing as it takes place [CIO].

This illustrates that the organisation can now make decisions quickly by using online data which supports effective business management.

As a result of the upgraded ERP system, the organisation is able to access transparent and accurate data which has enhanced their data analytics capability. The integration of larger volumes of online real-time data from the enterprise and from business partners helps the organisation to access and process all relevant data. It also strategically focused on business planning and provided an up-to-date financial status and reports of all aspects of the business. The CIO expressed that:

The visible data from the upgraded SAP system is used and analysed more efficiently to support business management. Since we gained access to faster visual financial data from the upgraded SAP system, we are able to make better business plans and better categorise and analyse data for all accountants. We are able to analyse treasury management data which help us make accurate financial decisions. It's an advantage that we gain from the upgraded SAP system for decision-making on business [CIO].

Apparently, transparent data from the upgraded ERP system has enhanced analytical capabilities in the organisation. The analysed data supports strategic planning and decision-making.

The ERP system upgrade also led to the integration of business processes which helped to better monitor and manage financial transactions with all business partners. Due to the creation of the Finance Shared Service Centre, the financial data from different business functions was integrated in the upgraded ERP system. This improved financial management. The ERP Financial Accounting Manager asserted that:

From changing financial accounting process with the transformation of the Shared Service Centre, the financial data is now better managed. Our accounting team at the Shared Service Centre are responsible for financial data and processes. The financial data is monitored by this team in the ERP system [Vice President of SAP ERP Financial Accounting Management].

Furthermore, the management of finance data in the upgraded ERP system has enabled the organisation to improve its cash flow status. This helps with the management of timely payments for purchase and other expenses. As expressed by the CIO:

I believe that we have gained the ability to access cash flow data more quickly and manage our business more efficiently. We are now using real-time data from the system for the amount of the actual expense. In the past, we only guessed those expense amounts because we didn't get real-time data to support our decisions. In my opinion, with visual data from the upgraded ERP system, we are better managing our cash flow [CIO].

From the responses above on improved financial management and a greater integration of data from all business functions and technologies, it can be seen that Case Two is now able to manage its cash flow a lot better.

It also appears that due to the upgraded ERP system the organisation was able to reduce operation costs as well as the cost of labour. The Vice President of ERP Financial Accounting Management expressed that:

We reduced operation costs from the transformation of the accounting operation into the Shared Service Centre. I must say we are able to lower operation costs although our business is growing and we have not increased the number of employees to support our business growth [Vice President of SAP ERP Financial Accounting Management].

The upgraded ERP system streamlined and automated end-to-end business processes which reduced duplication and manual work which happened in the past. The CIO also described that:

We gained benefits from the upgraded ERP system by reducing work redundancy and operational time. We also get more accurate data from the upgraded system [CIO].

The Vice President of Enterprise Solution Management pointed out that:

We now do better strategic management from the standardised work processes and with data from the upgraded ERP system [Vice President of Enterprise Solution Management].

Organisational learning and knowledge sharing among staff was also achieved at Case Two. The ERP system upgrade brought about a new way of operating the ERP system, the end users gained new technological, business and analytic knowledge and skills from using the upgraded ERP system and new work processes. As emphasised by the ERP Financial Accounting Manager:

I have noticed that our employees are becoming better skilled at using the system as well as business processes. I see a lot of discussions taking place exchanging knowledge and learning from one another [Vice President of SAP ERP Financial Accounting Management].

The above discussion shows that the organisation has enhanced various capabilities with the ERP system upgrade such as data-driven decisions, improved financial management, reduced operational and labour costs, enhanced organisation learning and knowledge sharing.

5.3.6. Summary of findings from Case Study Two

Although Case Two ended up with a full system upgrade, the upgrade took place in a phased form. It started with a technical upgrade, then moved to a functional upgrade and then to full system upgrade. It is noted that even with the full system upgrade this organisation maintained some of its unique business functions and processes by updating the software and re-writing some codes to customise them to meet the requirements of the upgraded ERP system.

The reasons for upgrading the system at Case Two were to meet the demands of business growth both nationally and globally, to have a system that could integrate transactions across subsidiaries and to have a central finance system. To be able to manage integrated data from mobile technologies also influenced the need for a more capable IT system. HRM and reduced labour costs were also

noted as motivations to acquire an advanced IT system. Retaining an ongoing vendor support for the system seems to be a compelling reason to upgrade the whole system for Case Two as well.

Requirements for upgrading the ERP system in Case Two seem to be the same as in Case One. They cover top management support, cross-functional teams, ERP consultants, a budget, project management, process changes and change management.

Improvements achieved from the upgraded system include integration of larger volumes of real-time data within the organisation and from business partners, transparency in all business data, data analytics for reporting and decision-making, a centralised financial system for finance management, knowledge sharing and organisational learning, as well as reduced costs.

5.4 Case Study Three

5.4.1. Case organisation profile

Case Three is an official national lottery business, a state government-owned enterprise with a legal identity in Thailand. The organisation is a member of the World Lottery Association (WLA) and the Asia Pacific Lottery Association (APLA), both of which are acknowledged as the global authority on the lottery business for ethical and best practice standards. This organisation was founded in 1874. In the past, the regular government lottery was run by the revenue department which aimed to raise funds for supporting government charitable activities as well as other public services. In 1939, the first Government Lottery Office Committee was appointed by the Ministry of Finance to manage a lottery operation in the country. The lottery bureau was an important source of state revenue for the government of Thailand. Besides managing lottery standards, this organisation prints and distributes lottery tickets.

The main products and services of the organisation are state lottery tickets, prize payment services and other printed material such as postal orders, tollway coupons, bus tickets, expressway coupons and national park and wildlife tickets.

The organisation has a vision to increase government revenue, support social responsibilities and develop employee competencies. In doing so, it always abides by and upholds good governance principles. In 2015, the organisation reported revenue from sales and services to the tune of USD 1.88 billion and a profit of USD 23.72 million for the year. It employs about 1,200 employees in Thailand.

The organisation needed an IT system to support its business operations and management for efficient operations across its various business functions and to improve good customer services. It is for this reason that the organisation installed an ERP system, SAP R/3 version 4.0b, in the year 2000. However, since

then the organisation has been expanding, and accordingly upgrading its IT system. The next section will discuss the types of ERP system upgrades, motivation, business changes and outcomes from upgraded system.

5.4.2. Organisation Three's ERP system

The organisation implemented the ERP system, SAP R/3 4.0B, in 2000 to operate various business functions in the organisation. The ERP system integrated finance, accounting, production, inventory, procurement, and sales and distribution. Additionally, the organisation also integrated the ERP system with other systems in the organisation such as a lottery allocation system, a lottery prize payment system and an in-house HRM system.

Over the years the ERP system implemented in the year 2000 could not support the demands from other stakeholders in the lottery industry. The business operations had grown so much that users had to use other tools such as Microsoft spreadsheets to manage data.

As a result, since 2005 (when vendor support for SAP R/3 4.0B ended), the organisation outsourced IT support, which incurred huge costs. Therefore, in 2012 Case Three upgraded their ERP system to SAP version ECC 6.0 with a need to improve the system performance power. With the upgraded ERP system it replaced most of business modules. A number of other applications such as HRM and procurement were integrated to this system. The Chief of the Internal Audit Division explained that:

... at that time there were some issues with the old ERP system and it didn't support our current business operations. Additionally, our staff complained that the current system was affecting their performance as it could not support the requirements of business, which had grown [Chief of the Internal Audit Division].

Information collected from the ERP system upgrade document highlighted that the main organisational motivations to upgrade the ERP system were to increase

data integration requirements from all business functions in the organisation and to improve business processes required for international standards. The organisation also intended to improve customer service by reaching out to customers via multiple channels. The transformation of the back office into a smart office with improved IT based risk management and improved HR competencies required an upgraded IT system.

The upgraded ERP system included new functionalities which enabled the organisation to enhance all business functions through the new technology. The upgraded ERP system also created an opportunity for the organisation to streamline business processes and eradicate most manual work. This helped achieve operational efficiencies. The Chief of the Finance Division explained:

... another reason was to reduce manual work and to modernise our SAP system to support online applications such as e-payment. Our organisation required an effective IT system to support our business operations and to provide better customer service [Chief of the Finance Division].

Due to the initial ERP system not being able to offer effective support to the growing business, the organisation wanted to have technology supported business operations and improved customer service. Case Three had to upgrade its ERP system to SAP version ECC 6.0 in 2012.

A further concern, aside from managing technical issues with the ERP system, as mentioned earlier, the ERP vendor was no longer able to provide maintenance and support for the previous ERP version. This was a compelling reason for the organisation to upgrade its ERP system. This motivation was explained by the Chief of the IT Development Division:

One reason for upgrading the SAP system was due to the an end of technical support from the ERP vendor for SAP version 4.0B in 2007 which pushed us to upgrade the system to a new version [Chief of the IT Development Division]

The above response indicates that the organisation needs to gain ongoing vendor support for the technology.

Although the motivations for the ERP system upgrade are both business related as well as technical, another consideration for management was considering the type of upgrade that would be the best for the organisation. The next section describes how the organisation made a decision on which type of ERP system upgrade to adopt.

5.4.3. Type of ERP system upgrade

The type of ERP system upgrade chosen was influenced by the purpose of the upgrade, the upgrade costs, and anticipated benefits. As previously discussed in the literature review chapter, there are three types of ERP system upgrades. These consist of technical, functional and full system upgrades (Schäumer 2007; McKendrick 2012a). Since the organisation required most of the modules from SAP ERP version ECC 6.0, the organisation decided on a full system upgrade. The organisation replaced its SAP R/3 version 4.0b with SAP ECC 6.0 in order to increase the system capacity and enhance functionalities, as well as implement new and additional applications such as e-procurement, e-payment and web applications. The Chief of the Procurement Division explained:

... to improve and increase system performance, the whole system should be upgraded to provide enhanced new functions. The upgraded SAP system covered some functions that we didn't have in our old ERP system. The upgraded SAP system was more capable and it entailed improved operational and process efficiencies [Chief of the Procurement Division].

The full system upgrade improved the speed of the whole business operation and decreased human error by automating all business processes at once. The next section explains the requirements that the organisation needed to prepare for the ERP system upgrade.

5.4.4. Requirements for ERP system upgrade

As with the adoption to all new technologies, it was important for Case Three to establish the requirements for upgrading its ERP system. These requirements include top management support, budget, people, a project plan, time management, business and user requirements, the upgraded system acceptance test and data preparation for migration to the upgraded ERP system. In addition, a new IT infrastructure platform for running the upgraded system and additional SAP user licenses were identified as requirements for the ERP system upgrade at Case Three.

Top management supported the decision to upgrade the ERP system and approved financial support for the project. Top management was involved at all stages of the new system implementation. As explained by the Chief of the IT Development Division:

... top management involvement was a must in terms of decision-making on any changes with the upgrading system which affected our operations [Chief of the IT development division].

A budget for upgrading the ERP system covering all costs, activities and project management including software license, new hardware, a database server, and ERP consultants was another important requirement. The CIO said:

We obtained a government budget from the Ministry of Finance to improve our IT systems. When we planned to upgrade our SAP system, we prepared budget for the new SAP version upgrade [CIO].

The CIO's response indicates that the budget for upgrading the ERP system was obtained from the government.

Another key requirement for a major upgrade project was that the project team be made up of the right people to be involved in the project. For Case Three the ERP System Upgrade Project team consisted of key users from each business

function and process owners, IT staff, ERP consultants, an external expert IT implementation service, the CIO and senior management. The head of the IT department explained that it was important to include one representative from each business function to understand the requirements for business functions in managing change. The Chief of the IT Development Division explained that:

We invited users from all business functions to participate in the SAP upgrade project. These people informed the team of the requirements for their business function so that they could understand the process changes that would be required for the new system to support the business function
[Chief of the IT Development Division]

Each member of the project team had a specific role. For example, the IT representative explained the technology issues, the external implementation team provided guidance on how to proceed with the implementation of the new system, and the project management team developed a plan for timely completion of the project.

The project management team closely followed the SAP implementation methodology which covers the full project life-cycle implementation roadmap. Chief of the IT Development Division explained:

The project time duration was an important consideration to manage all activities within the project time frame. This included user's requirements, the system design, the system prototype and implementation [Chief of the IT Development Division].

The above response suggests that a project plan is necessary for upgrading ERP systems as it helps identify upgrade details and helps complete the project within the timeframe.

The involvement of users was important in the ERP System Upgrade Project to gain an insight into the organisational operations which could be improved with the new IT system. As expressed by the Chief of the Procurement Division:

I was a member of the ERP system upgrade team that informed the team about the procurement system, what was working well and what needed to be improved on [Chief of the Procurement Division].

At Case Three a system acceptance test was considered to be an important requirement. A system acceptance test assesses the upgraded ERP system to check if the implemented system meets the needs of the business function. This assessment was done by users of each ERP supported business module. The Chief of the Finance Division said:

We were trained to use the upgraded system and the consultant team invited us to attend the UAT (User Acceptance Test) sessions which helped us to verify that the system could work properly in our business scenarios before go-live [Chief of the Finance Division].

The UAT would help iron out problems if any before the technology was fully applied to the organisation.

Upgrading the hardware, OS and database for the upgraded ERP system was required to ensure all components were compatible with the new software. As the workforce at Case Three had grown since the initial ERP system was implemented, additional SAP user licenses were required to ensure all could use the system.

Business processes supporting most business functions in the new system had to be changed to ensure these processes were aligned with the new ERP system business modules. The Chief of the IT Development Division explained this as follows:

Business process changes are also required for the SAP upgrade. We had done it once when we first implemented our initial SAP system. However, some business processes were changed along with the SAP upgrade. I must say, this time [with the upgraded SAP system] business process changes are aimed to align the process to the SAP supported functions and also to

standardise our business processes [Chief of the IT Development Division].

This business process change remains to be a major requirement with all technology implementation and upgrade.

Although all process changes are not included in this case study, important processes that were changed include finance, HRM, procurement and budget management:

For financial management in terms of the bank deposits and interest calculation, the upgraded SAP system enables our staff to use a cash interest rate calculation function in the upgraded system to check our interest and income records, deposit statements, and deposit amounts with dates. We can verify our financial data and the accounting department can also check this data at the same time [Chief of the Financial Division].

... with the payroll module, now we can integrate data from the new HRM module to calculate and process employee payments [Chief of the Financial Division].

The new procurement process helps our purchasing staff to track all procurement transactions in the upgraded system more effectively [Chief of the IT Development Division].

The upgraded ERP system incorporated web technology which enabled e-procurement, called 'PR web-flow', at Case Three:

The PR web-flow (e-procurement) was employed to replace old purchasing via documents and automate the procurement process. Now all purchasing requisitions are initiated and created by the requesting departments [Chief of the Material Management Division].

As the Chief of IT Development Division reported:

Our budget management process was changed due to the deployment of the fund management module from the upgraded ERP system. This process was redesigned and aligned with the new fund management module [Chief of the IT Development Division].

In summary, for the upgraded ERP system, a number of process changes were incorporated at Case Three indicating that business process change is an important requirement for upgrading ERP systems. The next section highlights the outcomes achieved from the ERP system upgrade at Case Three.

5.4.5. Outcomes from ERP system upgrade

The upgraded ERP system at Case Three provided improvements to business functions and processes that resulted in effective integration of large volumes of data from numerous sources and technologies, accessible on the ERP platform for effective decision-making. Due to enhanced data-driven decision-making, Case Three is now managing its finances better, has reduced costs associated with inventory, and has improved customer service. Due to the new technology the organisation has enhanced communication within the organisation which has resulted in greater knowledge sharing.

The upgraded ERP system has enabled a greater integration of data from different business functions, technologies and processes. The CIO explained:

Due to ERP system upgrade our business processes are now more standardised and data is better integrated across the organisation. This has helped with effective decision-making [CIO].

The Chief of the IT Development Division pointed out that:

The upgraded system greatly helped us achieve improved data management. Now the end users can use accurate data to generate reports from the upgraded SAP system for more effective decisions [Chief of the IT Development Division].

As explained by the Chief of the HRM Division:

I find that the upgraded SAP system brought about better data management in the organisation because it comes with a large database to store, categorise and manage all data. With the SAP HR module, we can record all required HR data and better manage and use the data in the system [Chief of the HRM Division].

From the above responses it is clear that the upgraded ERP system at Case Three supported integration and management of large volumes of data. This helped generate reports and improved decision-making based on reports generated by analysed data on different aspects of business.

The high level analytic tools the upgraded ERP system offers supports the organisation to manage inventory and associated cost better. The upgraded ERP system provides all information on inventory which has helped the organisation better manage customer demands and improve customer service. The Chief of Material Management Division explained that:

Now I can view all inventory data for both the headquarters and the factory in the upgraded SAP system. We can better manage and monitor our inventory accounting and inventory stock. The online real-time inventory stock data helps us manage lead times for orders as well as materials in process [Chief of the Material Management Division].

Due to the nature of business at Case Three, the management of inventory entails huge costs, has an impact on production times and on customers. The upgraded ERP system has enhanced transparency on all data, including data on the inventory which supports the organisation to manage lead times for production and provide better customer service.

The head of IT department at Case Three explained that data visibility on the upgraded ERP system was so good that it also highlights errors in the system.

This helps the technical and helpdesk staff to detect and fix errors which could lead to management problems. The head of IT said:

Our work operations in the organisation are more standardised and aligned with the upgraded SAP system. The processes and data are more transparent and the system is intelligent enough to highlight errors in the system, as well as in any business function [Chief of the IT Development Division].

Detection of errors in data, technology or in a business module has become easier due to the data displays in the upgraded ERP system. This helps the organisation to find quick solutions to errors and achieve operational efficiencies.

In upgrading the ERP system, Case Three implemented e-procurement for all purchases required by the organisation. E-procurement not only sourced strategic suppliers online, it integrated the system with finance for purchase order approvals for each department in the organisation. Implementation and use of e-procurement resulted in knowledge sharing on placing online orders, sourcing strategic suppliers, bidding for online auctions and attaining online approvals and delivery notifications. The Chief of the Material Management Division said:

With new PR webflow (e-procurement), we shared our knowledge on budget, procurement, finance, online orders and the upgraded ERP system. Furthermore, we also communicated and shared this knowledge with all end users from all departments to ensure a smooth transition to e-procurement [Chief of the Material Management Division].

The material manager's view was confirmed by the Head of the Procurement Department:

In regards to the new e-procurement process, all users from all business functions had to learn the new operation and process. All users had to be responsible for the purchasing requests from their departments. This also

enhanced users' understanding of the upgraded ERP system, how to operate it and how the system would reject a wrong data entry [Chief of the Procurement Division].

By upgrading the ERP system Case Three has been able to enhance knowledge sharing, make decisions guided by data analytics, achieve greater efficiencies due to data analytics and report generation capabilities of the system.

5.4.6. Summary of findings from Case Study Three

The type of ERP system upgrade at Case Three was full system as the old ERP system in the organisation could no longer support the business of the organisation.

Reasons for upgrading the ERP system at Case Three are varied. Firstly, Case Three had grown in business for which the old ERP system could no longer provide effective support. Due to this the employees had to use applications offline which meant duplication of work, data format differences, and errors that were not easily detected. The organisation also aimed to achieve a 'smart office' concept with automated processes, integrated data and decisions guided by data analytics. The organisation also needed to improve the ERP system performance power and obtain the ongoing ERP vendor support. Due to these reasons an upgraded ERP system became a necessity at Case Three. Business changes required for the upgrade at Case Three are business process changes to support each upgraded business module in ERP system SAP version ECC 6.0.

Some of the requirements for the upgrade at Case Three are common requirements for upgrading a large IT system, however, some requirements were unique. The important requirements for upgrading the ERP system at Case Three include top management support, the budget, the people, a project plan, a cross functional project team, ERP consultants and new IT infrastructure platform. The unique requirements at Case Three were the services of a

specialist external IT implementation team and UAT after the implementation to ensure correct operation of the system.

Improvements achieved at Case Three as outcomes of the upgraded ERP system are largely data related. The organisation was able to effectively manage large volumes of data integrated from different processes and business functions, external orders and from business partners on one platform. This data was analysed to make strategic decisions, to provide better customer service and to reduce costs associated with inventory and incorrect purchase orders. The organisation also achieved better finance management, operation efficiencies, enhanced communication within the organisation and greater knowledge sharing.

5.5 Case Study Four

5.5.1 Case organisation profile

Case Four is a large organisation that packages and distributes food such as rice and canned food (fruits and vegetables). It was established in 1979 and is based in Thailand. The business is divided into two major units: the rice business unit and the canned food unit. The *rice* business unit focuses on packaging Thai Jasmine rice, sourced from numerous suppliers. Rice packaging is certified by ISO 9002 & ISO 14001 Certificate for quality management.

The *canned food* business unit produces canned food, instant food and beverages. In this unit, the organisation also provides a wide range of services, including professional sourcing, product planning and management, quality control, warehousing, export documentation, and freight and transportation of finished goods.

In 2014, the company reported a revenue of USD 462 million and USD 935,000 profit for the year. Since its establishment in 1979 the organisation has gone on to operate several business branches across the country. Due to business growth and expansion, the need for a comprehensive management system became critical for the organisation. ERP systems assist such organisations to integrate data across multiple business functions. For Case Four the initial ERP system was adopted in 2005 to integrate all business units and functions, to ensure more efficient access of the same information across the organisation for the management of business operations. Just as an organisation needs a system to help manage its business efficiently and effectively, the system must be upgraded regularly in order to meet new and changing business needs. The key questions that are important for this study relate to how such organisations go about upgrading their systems. Thus, in the following sections of this chapter, motivations for a system upgrade, reasons for the type of upgrade chosen and

requirements for an effective upgrade are examined. The outcomes from the upgraded ERP system in terms of organisational capabilities are also discussed.

5.5.2 Organisation Four's ERP system

As mentioned above, the organisation needed a sophisticated IS to efficiently store, manage and share information across all business functions for the management of business. The organisation implemented the initial ERP system SAP version ECC 5.0 in 2005 to integrate information and all business processes in the organisation. As part of the system, the organisation also deployed PeopleSoft HRM for the integration of HR in the organisation.

However, due to business growth and expansion, the organisation had outgrown the initial ERP system over the years. The existing ERP system, for example, had become slow in processing a growing number of business transactions, which resulted in all round inefficiencies and a frustrating experience for staff and customers. The management therefore conducted an ERP system assessment which evaluated the current system performance to understand the system performance gaps. It then evaluated how improvements could be achieved from the business modules and new functions of the latest ERP version. A system assessment report was produced, outlining the anticipated improvements from the upgraded ERP system to make a case for the upgrade. Accordingly the ERP system was upgraded to SAP version ECC 6.0 in 2010.

The ERP system upgrade is an important activity in the ERP software life cycle and it requires the organisation to clearly articulate its motivations and objectives to make a decision on the type of upgrade. Due to the high cost of upgrading an ERP system and the potential impact on business, the right choice of the system is essential.

At Case Four the main motivations for upgrading the ERP system to SAP ECC 6.0 in 2010 were to increase the whole system performance efficiency to include

new business functionalities and modules from the new system to support scalability and the expanded business demands. The General Manager of Software Application Development explained the motivation for ERP system upgrade at Case Four:

The SAP version [ECC 5.0] was responding slower than before. Our users were complaining about this problem which was slowing down their work. Hence, we decided to evaluate our SAP system performance. Moreover, our existing hardware was quite old as well. So, we decide to upgrade the SAP system and replace the old hardware to increase system performance [General Manager of Software Application Development].

The above response confirms that an important reason for upgrading the ERP system at Case Four was that the old system could no longer support the expanded demand of the business for the organisation.

Furthermore, new business demands such as developing multidimensional reports started to emerge. The Sales and Retail Manager explained:

The old SAP system could not support our new business requirements such as generating sales reports. The upgraded SAP system entailed new features that generated reports highlighting problems and articulating new and changing business demands [Sales and Retail Manager].

According to the above response, the upgraded ERP system offered new functionalities and sophisticated analysis and reporting features which were required for quick and effective decision-making and responding to changing business demands quickly.

As highlighted previously, business expansion was an important motivation for upgrading the ERP system at Case Four. In 2011, the management established a new rice processing factory which required an ERP system to support the end-to-end rice production, in export as well as domestic sales. According to the General Manager of Software Application Development:

We established a new company which mainly produced a unique rice product and also traded as a rice exporter. Upgrading the ERP system to SAP version ECC 6.0 was therefore required to support our new business unit as well as other product plants across the country [General Manager of Software Application Development].

A reason to upgrade the ERP system was, therefore, the need to achieve technology supported business functions such as the management of international sales orders. Another reason for upgrading the ERP system at Case Four was that the new system supported new features for integrating data from mobile technologies and supported greater automation of business functions. The Assistant Vice President of IT said:

The new SAP version provided a good support to integrating from mobile and other technologies. Additionally, the system supported 'Salesforce automation' which was required by the organisation to support and improve our sales operations [Assistant Vice President of IT].

The system that could support greater data integrations was required by the organisation.

One of our business partners requested that we integrate their order data with our ERP system. In order to integrate certain business functions with business partners for automated orders an upgraded system was required [Assistant Vice President of IT].

The above response indicates that the upgraded ERP system was required for greater integration of data and for automating business processes.

As with other case studies, Case Four also capitalised on the ongoing support that the vendor was to provide for the maintenance of the system that came with the upgraded ERP system. The General Manager of Software Application Development pointed out that:

At that time, our SAP consulting firm informed us that the support from the ERP vendor was coming to an end. Subsequently, we also considered upgrading to the new version to attain continued technology support from the vendor [General Manager of Software Application Development].

For Case Four, reasons for upgrading the ERP system include: the need to avoid operating a business with an obsolete system; the need for a system to support the demands of business growth and automation of business processes, a greater integration and management of data, the need for a system to generate reports for quick business decisions and for ongoing vendor support for technology maintenance.

5.5.3 Type of ERP system upgrade

As discussed in earlier cases, there are three types of ERP system upgrades. Each choice of upgrade is undertaken for different reasons and offers different outcomes. The organisation made the decision to adopt a full system upgrade to SAP version ECC 6.0. The key driving reason was to increase overall system performance in all aspects of the business. This was pointed out by the General Manager of Software Application:

Well, we upgraded the whole system at once to improve the entire system capacity, although we gradually deployed the new functions of the business modules from the upgraded system [General Manager of Software Application].

The Sales and Retail Manager explained as follows:

... In my opinion, the full system upgrade was supposed to be more cost effective than upgrading each single module one by one. If we selected technical and then functional upgrades, it would require shutting the system down several times which would impact on our business [Sales and Retail Manager].

In summary, the above data analysis highlights that the adoption of the full system upgrade at Case Four was based on the fact that it was cost effective, the implementation of which could be accomplished with minimum disruption to business. The next section examines the essential requirements that the organisation had to pay close attention to in order to guarantee a successful upgrade of the ERP system.

5.5.4 Requirements for ERP system upgrade

For successful the upgrading of an IT system, all involved have to carefully consider the requirements for the new system and its implementation and successful operation. Some of the key requirements, according to the literature and earlier case studies, include securing top management support who in turn ensure sufficient budget allocation, having the expertise to implement the upgrade and upgrading the hardware required. Additional requirements are user-acceptance testing, preparation of organisational data for migration to the new system, and changes to some business processes for the business modules in the new system.

Involvement of other senior management to form an executive steering committee at Case Four was also identified as an important requirement for the approval of the budget for upgrading the ERP system.

The steering committee at Case Four, which included senior management always ensured that the upgrade project was on track and monitored at each stage to ensure timely completion of the project. Without this level of top management involvement, the ERP System Upgrade Project would not have progressed as smoothly. This was explained by the General Manager of Software Application Development:

... we also engaged an executive steering committee for our upgraded SAP project. They were required to participate in the upgraded project as well as

made decisions on the critical upgrade issues [General Manager of Software Application Development].

The above response indicates that a steering committee comprised of senior management is a useful requirement for the upgrade project.

The ERP system upgrade is a significant investment and the cost of upgrade varies according to the type of upgrade undertaken. As discussed above, the organisation made the decision to adopt a full system upgrade, which required significant funds. Thus an adequate budget to cover all upgrade costs such as new software, hardware and other activities was an important requirement. The General Manager of Software Application Development further emphasised that:

... we had an approved budget from the executive management for the SAP upgrade project for the new hardware and also new software to improve our existing ERP system upgrade [General Manager of Software Application Development].

Another requirement for an IT system upgrade is people, with diversified expertise and technical skills. Recruiting the right people to be members of the project team is an essential requirement. The project team was made up of technical IT staff, functional IT staff and a team of external SAP consultants. The technical IT staff were responsible for the new IT infrastructure, and the functional IT staff had knowledge of the ERP supported business functions. The external ERP consultants provided overall guidance on upgrading the ERP system to the project team. The consultants were also responsible for guiding the implementation of the system so that it would provide both technical and business solutions. They also provided end-user training for the business functions supported by the new ERP system. The General Manager of Software Application Development said:

Our IT functional staff worked with the SAP consultants in the SAP upgrade project. They gathered user requirements from the representatives from all business functions across the organisation. The consultants analysed the gathered requirements, implemented the upgraded system and trained our SAP system end users [General Manager of Software Application Development].

The above response indicates that technical and functional IT teams formed the main team, supported by the external SAP consultant hired to provide advice on system upgrade solutions.

UAT was another important requirement for upgrading the ERP system at Case Four. The UAT is an assessment conducted to ensure the upgraded ERP system works accurately in relation to each business function tested by users (employees). The General Manager of Software Application Development pointed out:

We invited our key users from relevant departments and business units to participate in the unit acceptance testing sessions. They were required to test the upgraded SAP system to ensure that the system worked properly before it went live [General Manager of Software Application Development].

UAT of the new system helped align the business modules from the new upgraded system to the business functions. This helped iron out problems and to accurately apply the upgraded of software to each business module in the organisation.

Data cleansing for the migration of organisational data to the new ERP system was also noted to be an important requirement. Organisational data cleansing and formatting for the new system was undertaken by the functional IT team for each ERP business module. The data from the old ERP system was retrieved, examined and verified by data owners from all business functions in the

organisation and formats were changed if required. As explained by the General Manager of Software Application Development:

Data conversion was another important activity required in the upgraded SAP project at our company. The SAP consultants exported data from our old SAP system, and our IT functional team cleaned and checked the data, then migrated it to the upgraded SAP system [General Manager of Software Application Development].

The General Manager of Software Application Development further explained that the finalised data was then transferred to the upgraded SAP system.

For the data migration, our IT functional team as well as the SAP consultants performed this task. Finally, our IT functional team examined the migrated data in the upgraded SAP system for correctness [General Manager of Software Application Development].

The above responses indicate that data cleansing and formatting is a requirement for the upgraded ERP system to effectively support the business functions.

In order to achieve efficiencies from the upgraded ERP system, it is essential to identify processes that need to be changed. Business process changes for ERP system upgrade are typically conducted in two ways. One option is that the organisation changes the business process to align it with the upgraded system modules during and alongside the ERP system upgrade process (Subramoniam, Tounsi & Krishnankutty 2009). Alternatively, another option is that the organisation finishes upgrading its ERP system and then changes its business processes in order to align them with the upgraded ERP system. Case Four adopted the former option in order to align the business processes with the upgraded ERP functionalities and modules whereby business process changes were undertaken alongside the upgrade process. The Assistant Vice President of IT stated that:

The Business processes change is an essential requirement for the SAP system upgrade. As I mentioned when we started using our initial SAP system in 2006, we didn't really know whether the system was well-aligned with our business processes. However, when we upgraded our SAP system, we comprehended which business processes required change or improvement to enhance operational efficiency [Assistant Vice President of IT].

The General Manager of Software Application Development also confirmed that business process changes were required in order to capitalise on the enhanced system performance abilities of the new system:

These business processes were changed to align them with the functions of the new ERP system. It was also required for new applications such as split balance sheets, and to generate reports from data integrated from different business functions [General Manager of Software Application Development].

Business process changes seem to be an important requirement to align the modules of the new system to organisational processes.

As mentioned in the organisation background section, the organisation's core business is rice manufacturing and international trade. The adoption of the upgraded ERP system was essentially undertaken to improve the management of business and to reduce operational complexity. The organisation therefore made major process changes in sales management and its sub-processes including intercompany sales, sales orders with customer credit limit management, sales data integration with the accounting module, and sales forecasting. The organisation also implemented new intercompany sales functions via the new ERP system to support cross-business sales management and business expansion. The sales process was adjusted to align with the new functions as well as to improve operational efficiency across the various business units and branches. The new intercompany sales process allowed the business units to check overall product availability at all storage locations in the

organisation as well as to buy and sell products, and undertake billing and payments from within a single ERP process. This process reduced multiple and manual handling of documents such as purchase orders (from a buyer unit) and sales orders (from a sales business unit). The intercompany sales process also enabled sales representatives to check stock availability and to quickly respond to the market demands. The Assistant Vice President of IT said that:

We deployed the new SAP function called 'intercompany sales' to sell our rice products via any of our business units. Moreover, our sales representatives are able to check the stock before responding to market demands [Assistant Vice President of IT].

For customer management, the organisation changed the process for customer credit limit checks to include sales orders for the upgraded ERP system. This was meant to eliminate repetitive work operations and reduced the amount of rework for sales orders, data errors and re-keying efforts. The Sales and Retail Manager asserted that:

With the upgraded SAP system, I find that our sales orders are processed faster because we removed repetitive work operations and avoided inputting the data again as the system enabled editing of erroneous data. The new process assisted our staff to process sales orders faster [Sales and Retail Manager].

Moreover, the new customer credit limit management for sales orders enabled timely delivery of products to their customers. The ERP Solution Manager mentioned:

Changing the sales orders with a customer credit limit management process helped us to faster deliver products to our customers [ERP Solution Manager].

Due to emerging new technologies, the organisation decided to employ the mobile technology with the upgraded ERP system to accommodate its mobile

sales channel known as mobile van sales. With the upgraded ERP system the van sales staff used mobile devices to process their sales, unlike in the past system of manual operations. With the new ERP system, the mobile sales representatives integrated data such as product types, quantity and price from the ERP system with their mobile devices. This new process supported the van sales staff in daily end-to-end sales processes such as creating sales orders, checking inventory stock levels, billing and making payments. The General Manager of Software Application Development explained that:

Our food store business unit deploys mobile devices with the upgraded SAP system to support its mobile van sales. Thus new process integrated sales data from the upgraded SAP system to the mobile devices for daily sales. Customer orders were accepted on mobile devices and automatically integrated back into the upgraded ERP system anytime the mobile devices connected to the internet [General Manager of Software Application Development].

The above response shows how the sales process was changed to make sales and customer orders mobile by integrating data from the main system to mobile devices. Together with mobile sales, the sales forecasting function was deployed from the upgraded ERP system to accurately assess inventory levels.

The Sales and Retail Manager confirmed that by deploying the new sales forecasting function, they managed sales forecasting a lot better:

... now they operate this task (sales forecast) in the upgraded SAP system and have completely withdrawn sales forecasting on Excel spreadsheets. The sales forecast data in the upgraded SAP system, supports accurate sales data [Sales and Retail Manager].

By deploying the new sales forecasting module from within the upgraded ERP system, the organisation changed the sales process that existed with the old system.

Inventory management was another essential process for the company in their rice manufacturing and trading. The organisation operated its business branches and units, as well as rice processing factories across the country. The management of inventory stock and finished goods was critical. The management aimed to improve the inventory levels by changing the inventory stock transfer process across business locations which was effectively enabled by the new system. This replaced the manual inventory stock management and control function used in the past. The ERP Solution Manager explained that:

In the past, we encountered some problems such as seeing the quantity in stock in the system although physical inventory had yet to come. We weren't able to access our actual inventory stock against the data in the system. Therefore, with the upgraded SAP system, we decided to use two steps for stock transfer function between plant to plant and changed our business process to facilitate the operations accurately [ERP Solution Manager].

Processes supporting inventory management were changed to take advantage of the advanced inventory management module in the upgraded ERP system.

It was noted that the organisation had to make some changes in the financial accounting process to align it with the new 'business area' function of the upgraded ERP system. The business area in the ERP system indicates specific business segments or areas in the organisation within the financial accounting module. The business area is also used for segment reporting of the organisation in financial statements such as a balance sheet and P&L account statements. As explained by the General Manager of Software Application Development:

We deployed a new 'business area' function in the financial module which required financial users to key data in this field. The change in this process impacts the way data is inputted in the upgraded SAP system. The system users are required to key-in the business area data for all financial transactions [General Manager of Software Application Development].

In order to gain more financial data visibility, the end users were encouraged to input additional business area data with financial transactions in the upgraded ERP system. This useful information informed executive management in decision-making. The General Manager of Software Application Development further pointed out:

The business area data supports us in creating split balance sheets from the upgraded SAP system and meeting our executive management demands to use for decision-making on business management [General Manager of Software Application Development].

Changed processes to align with the business functions in the new system resulted in quick and improved decision-making.

A purchasing order function in the procurement module of the upgraded ERP system was implemented to improve procurement. Thus business processes were streamlined and automated to support end-to-end procurement in the organisation. The General Manager of Software Application Development explained:

... We changed our procurement process along with the upgraded SAP system in order to deploy new purchasing functions. All business functions and units now create their purchasing orders in the upgraded SAP system. This way we access all online purchasing data in the ERP system, for approval and payments [General Manager of Software Application Development].

The purchasing process was changed to align all procurement data to the new module in the upgraded ERP system.

5.5.5 Outcomes from ERP system upgrade

The adoption of the ERP system upgrade does not only improve its system performance but also provides opportunity for the organisation to revisit and

improve its business processes, which enhances numerous capabilities in the organisation. These capabilities include better integration of data from different sources, greater data visibility and improved information management, all of which increase strategic decision-making and improved customer services.

In the case of Case Four, the upgraded ERP system provided better information management in the organisation. The organisation not only uses the ERP system but also deploys other IS to support business operations and management. It was understood, for example, that the latest versions of the ERP system could seamlessly integrate and connect with data from different sources for operational efficiencies and for better data management. This supported effective decision-making. The Assistant Vice President of IT stated that:

... The upgraded SAP system integrated data from different sources which helped decision-making. For instance, we can now choose our representative factories which can produce products at minimum costs and deliver products to the customers on time. Better data integration helps us with production planning [Assistant Vice President of IT].

The General Manager of Software Application Development also confirmed that the upgraded ERP system entailed better data integration from various sources and technologies in the organisation:

In my opinion, the upgraded ERP system increased our ability to make better production plans with accurate data from both the upgraded SAP system and from data integrated with international sales. In addition, the domestic rice sales data from the upgraded SAP system supported our sales team to generate weekly or monthly sales forecast to visualise sales numbers and enabled the production planning team to further improve rice production plans [General Manager of Software Application Development].

The statement above also indicates that the upgraded ERP system improved data integration from different sources in the organisation. This helped strategic decision-making and the achievement of operational efficiencies.

The General Manager of Software Application Development further pointed out that the data visibility enabled the top management to use the online real-time data to support decision-making:

As I mentioned earlier, the changed stock transfer process in the upgraded SAP system helped us to review the online product transactions and stock on-hand data for all production plants more precisely. We use this data to recheck the actual stock level against the data in the upgraded SAP system. In addition, data in the upgraded SAP system is now real-time and supports executive management in strategic decision-making [General Manager of Software Application Development].

Moreover, the upgraded ERP system was more accessible and supported executive management to access the required data to support decision-making on all business issues. The Assistant Vice President of IT mentioned that:

According to my experience from meetings with our executive management, I noticed that they make decisions based-on the information and reports which came from the upgraded SAP system [Assistant Vice President of IT].

The above responses showed that the transparent data in the upgraded ERP system enhanced strategic decision-making and boosted business management effectiveness.

As discussed earlier, the sales representatives at this organisation deployed mobile devices to support the sales operation. The sales representatives accessed the upgraded ERP system via their mobile devices and used the real-time sales and inventory data to respond to their customers. The ERP Solution Manager said that:

The upgraded ERP system enabled us to manage and deliver the right products to our customers in regards to their specific needs and its product specification. We also delivered them to our customers on time [ERP Solution Manager].

Apparently, the organisation improved customer service due to accurate sales data and improved inventory management in meeting customer demands.

The analysis above shows that the organisational capabilities enhanced from upgrading the ERP system associated with the business process changes at this organisation include better integration of data from different sources, greater data visibility and improved information management, strategic decision-making, and improved customer services.

5.5.6 Summary of findings from Case Study Four

The type of ERP system upgrade at Case Four was full system due to cost efficiencies, and because it could be accomplished with minimum disruption to business.

Reasons for upgrading the ERP system at Case Four included the need for a system to effectively support the demands of business growth, automation of business processes, greater integration and management of data and the need for a system to generate reports for quick business decisions. Another reason was to obtain the ongoing vendor support for technology maintenance.

Requirements for the upgrade at Case Four included sufficient budget, top management support, and a cross-functional project team with representatives from different sections of the organisation. External ERP consultants were identified to be an important requirement in Case Four for providing overall guidance on upgrading ERP system. They were also responsible for guiding the implementation of the upgraded ERP system. Additionally, upgrading the hardware, a UAT, and preparation of organisational data for migration to the new system was also required. Business changes required for the upgrade in

Case Four are once again changing some business processes to align them with new and upgraded business modules in the new system.

Enhanced organisational capabilities achieved from the ERP system upgrade in Case Four include better integration of data from different sources, a greater data visibility and improved information management. This data helped strategic decision-making and for provision of better customer services.

5.6 Case Study Five

5.6.1 Case organisation profile

Case Five is an IT solutions provider in South East Asia and is based in Bangkok, Thailand. The main products and services of the organisation include providing services related to computer hardware, software, setting up a computer network, system installation, software customisation, and maintenance of IT systems. The mission of the organisation is to provide a variety of IT services to its clients while maintaining customer service at a high level. The organisation uses a certified quality management system (ISO 9001:2008) to ensure its business and operations are in line with recognised global standards for the delivery of services, and it generally depends on Capability Maturity Model Integration (CMMI) for software process improvement.

The organisation's focus is in six major areas of consulting and software development, providing outsourced IT services, financial and banking technology services, IT services, professional services and a data centre. In 2014, the company reported a revenue of USD 126.86 million, and profit for the year was USD 3.6 million. The organisation currently has 1,300 employees, the majority of whom are skilled IT professionals and software engineers.

An adoption of the initial ERP system at this organisation was due to the need to increase flexibility in business management to improve business efficiencies. The ERP system is the core backend computing system for the organisation which facilitates business operations and management. As the business continues to grow, the ERP system in the organisation needs to be upgraded to support the expanded businesses. The next section will examine the motivations for ERP system upgrades, the type of upgrades adopted, the requirements of upgrades and the outcomes the organisation achieved from the upgraded ERP system.

5.6.2 Organisation Five's ERP system

An ERP system is a large IT system that enables an organisation to access real-time data, improve reporting and share information across business functions to support business decisions. The organisation implemented the initial Oracle E-business suite version Release 11i in 2005 to replace its legacy financial accounting system. Since the nature of business the organisation is involved in is generally project based, it also adopted the project management module to better manage project progress tracking and resource management in a multi-project environment. Due to business growth, the organisation needed an IT system that would support integration of information from all business units. Since the existing ERP system was aging and was not able to manage large volumes of data, the management explored the feasibility of a new Oracle E-business suite version to replace the existing ERP system. As an outcome, the management made the decision to upgrade the existing ERP system to Oracle E-business suite Release 12 (R12) in 2015. This new system came with an improved budget management and control module that helped manage the budget more efficiently. The upgraded Oracle ERP system entails modules such as Customer Relationship Management (CRM) and business intelligence as well. Thus, more real and accurate information is available for top management and the organisation's business partners. The ERP system at Case Five is the Oracle E-business suite version R12. The business modules deployed from Oracle E-business suite version R12 at Case Five include general ledger, accounts payable, accounts receivable, fixed asset management, budget management and control, project billings, project costing, sales order and purchase order and procurement.

Reasons for the ERP system upgrade as analysed from interview responses with various senior managers at Case Five show that improvements to the management of business was an important reason to upgrade the ERP system to Oracle E-business suite version R12. Due to business growth and expansion the organisation had to manage larger volumes of data for which the upgrade of the

IT system at Case Five became a necessity. The Assistant Vice President of Finance and Management Information Systems (MIS) explained that:

Our executive management had to access large volumes of data to support decision-making and business management. The upgraded ERP system is able to provide information management and reports which support the executive management requirements [Assistant Vice President of Finance and MIS].

It was also noted that an IT system with enhanced system performance abilities and a large database was required at the organisation. As the Accounting Manager commented:

Our existing Oracle ERP R11i system has been used in the organisation for a decade. As we know that technology becomes obsolete rather quickly, it is important to keep up with new systems to better support the business [Accounting Manager].

The above response indicates that one of the reasons to upgrade the ERP system at Case Five was to improve technology in the organisation so that it better supported Case Five's business operations. This reason was also reinforced by the Assistant Vice President of Finance and MIS who explained:

Our old servers were used around ten years after the initial ERP system was implemented. We needed new servers which were capable of storing larger volumes of data accumulated in the last ten years. Hence, we took the opportunity to upgrade the organisation's ERP system [Assistant Vice President of Finance and MIS].

The above responses indicate that aging technology needs to be replaced to better support business growth which requires management of larger volumes of data.

The new ERP system was adopted at Case Five to increase capacity and to support integration with new features such as web applications and mobile technologies. The new ERP system also integrates data and information from the company's business partners. Thus, advantages of the new system which entailed an enhanced system performance, a user-friendly interface, new functionalities and an ability to generate different types of reports became a compelling reason to upgrade the ERP system at Case Five. As described by the Assistant Vice President of Finance and MIS that:

... the new functions of Oracle R12 motivated us to upgrade our ERP system. With the Oracle R12 we gained a friendly user-interface, ability to generate customised reports, additional business functions and an increased system performance capacity [Assistant Vice President of Finance and MIS].

As mentioned in Cases One to Four, new systems come with ongoing vendor support for the technology which is a huge advantage to the organisations adopting the technology. Similarly, Case Five gained an ongoing system support by upgrading their ERP system to Oracle E-business suite version R12. Maintaining continued support from the vendor, therefore, became another reason for the ERP system upgrade at Case Five. The Assistant Vice President of Finance and MIS explained:

By upgrading the Oracle E-Business suite system to version R12 we gained continued technical support from the vendor [Assistant Vice President of Finance and MIS].

The Vice President of Finance and MIS confirmed that:

Gaining continued vendor support for our ERP system was important for the organisation [Vice President of Finance and MIS].

The above discussion indicates that reasons for upgrading the ERP system at Case Five include the need for a system to support business growth, to replace

an almost obsolete system, to be able integrate new features of web applications and data from mobile technology, to manage larger volumes of data and to generate customised reports for managerial decisions as well as to gain ongoing vendor support for the technology.

Understanding the reasons for upgrading ERP system is important. However, carefully considering which type of ERP system upgrade to choose is equally important. The next section examines the type of ERP system upgrades chosen for the adopting organisation.

5.6.3 Type of ERP system upgrade

The type of ERP system upgrade to choose was another critical aspect that the management carefully considered. These considerations consisted of the strategic goals and objectives of the upgrade, the upgrade costs and long-term benefits of the technology. As previously discussed in the literature review chapter, there are three types of ERP system upgrades including technical, functional and full system upgrades (Schäumer 2007; McKendrick 2012a). Case Five decided on a full system upgrade although it implemented it in a phased manner replacing one module at a time. The organisation began its upgrade by first focusing on technical improvements, then upgrading business functions of finance, project billings, project costing, sales order processing, purchase order processing and procurement. The Vice President of Finance and MIS said:

... we decided to conduct a technical upgrade first and kept our as-is processes. Then we continued to implement the new features and functions in phases until the full system was upgraded [Vice President of Finance and MIS].

The above response indicates that at Case Five technical improvements were the first type of upgrade. This was followed by a functional upgrade in a phased form; that is, upgrading one business function at a time, leading to a full system

upgrade. The next section discusses the requirements for the ERP system upgrade at Case Five.

5.6.4 Requirements for ERP system upgrade

The organisation needs to gain an understanding of the requirements for ERP system upgrades in order to successfully implement the upgraded project within the timeframe, to estimate the cost and to meet the objectives of the upgrade. The requirements for the ERP system upgrade include a feasibility study of the new ERP version, a budget, people, a project plan and changes to business processes.

An understanding of the new system, its performance abilities, the business modules and functions that it would support, and the impact on business processes supporting the business functions were important at Case Five. The Vice President of Finance and MIS said:

Upgrading our ERP system required us to study a lot on the new ERP version and we also did some system testing. We had to understand the impact of the ERP system upgrade, new data structures and report structure the new system would support. We were also concerned about whether our existing reports could be migrated to the upgraded system. In my opinion, the ERP system upgrade required a lot of changes to existing business operations [Vice President of Finance and MIS].

Seemingly, a feasibility study on the suitability of the new system to existing business, and the changes required, are important requirements for upgrading an ERP system.

The second most important requirement at Case Five was the budget. To upgrade a system an organisation requires considering the cost of a software license fee, new infrastructure such as new hardware and consultancy charges. The Vice President of Finance and MIS explained that:

A budget is necessary for ERP System Upgrade Projects. Previously we estimated the budget to be approximately ten million Baths for new servers. The management decided deploy new 'Linux' platform and it saved a lot of money on the hardware. Additionally, the consulting firm charged us around three to four million Baht for implementation which was a major cost in the upgrade project [Vice President of Finance and MIS].

The above comment indicates that budget is a very important requirement to cover the costs of various aspects of the new technology and ERP System Upgrade Project.

Additionally, executive management support was involved to provide support, approve appropriate project funding and direct the whole ERP System Upgrade Project. The top management was required to ensure the ERP System Upgrade Project was achieved on time and within the budget to meet the end goal of the ERP system upgrade. The Assistant Vice President of Finance and MIS said:

Our executive management was engaged to the ERP System Upgrade Project since we required the funding for the ERP system upgrade. They were also required to participate in the upgrade project, make decisions and ensure the ERP System Upgrade Project moved forward [Assistant Vice President of Finance and MIS].

The above indicates that an executive management support is an important requirement for the ERP System Upgrade Project.

To achieve ERP system upgrade success, a good project plan is required to complete the project on time and to achieve upgrade project outcomes within budget. An upgrade project plan includes milestones, resource planning, business requirements, the composition of the project team, and end-user training. As explained by the ERP System Upgrade Project Manager:

We had a project plan to manage and control the project. However, a project schedule and time frame is also important to achieve and to deliver the

project on time and within budget [ERP System Upgrade Project Manager].

A carefully developed project plan and a carefully considered project team were essential requirements for upgrading the ERP system at Case Five.

As in earlier case studies, end users of the system representing each business function in the organisation were required to join the project team to ensure that the new modules were correctly applied to support each business function in the organisation. Representation from IT functional staff from the MIS department, hardware engineers, database administrators, programmers and representatives from each business functions were required to join the ERP system upgrade team. Furthermore, Oracle consultants and an ERP project manager were also included. As explained by the Assistant Vice President of Finance and MIS:

The upgraded Oracle ERP project included me and my MIS team, our system users, ERP consultants and the project manager formed the ERP system upgrade team [Assistant Vice President of Finance and MIS].

The Accounting Manager said:

Our project team consisted of programmers, an IT supported team, the MIS team and accounting and administrative officers from five business functions in our organisation. The project team attended meetings and gained knowledge on the new ERP system and related issues [Accounting Manager].

The ERP System Upgrade Project Manager also explained as follows:

My team consisted of hardware engineers and a database administrator who have knowledge of the system, hardware and IT infrastructure. Additionally, we also have three ERP consultants, two programmers and a project manager who worked in this project [ERP System Upgrade Project Manager].

It was also noted at Case Five that a cross-functional team is an important requirement for upgrading ERP systems.

Gathering business requirements for each business function is an important requirement as well. The business requirements helped align the organisational business functions to the modules in the upgraded ERP system. The business requirements ensured that the upgraded ERP system resulted in support and met the desired business results. The Vice President of Finance and MIS pointed out:

Well, most of the new requirements came from our executive management team. They needed many things from our ERP system such as new reports and multidimensions of data to support their decision-making [Vice President of Finance and MIS].

The Accounting Manager further explained that the business needs were established from representatives from all business functions across the organisation. He said:

I had many meetings with representatives from all business functions to identify new business requirements for the upgraded ERP system [Accounting Manager].

The above responses indicate that business requirements for a new system are identified equally by senior management and end users.

Since an upgraded ERP system comes with intelligent software, it generally requires installation on new hardware and needs to be supported by a larger database. The Vice President of Finance and MIS said that:

We used a standalone server which was called 'M3000' for our previous ERP version which was not adequate for the upgraded ERP system. With the ERP system upgrade, we changed our IT infrastructure to a private cloud and

increased additional hardware storage by adopting the platform 'VMware' to increase scalability [Vice President of Finance and MIS].

For the upgraded ERP system Case Five also adopted new hardware to support the new system as well as a private cloud to store data.

End-user training helped staff in the organisation to gain knowledge and skills in operating the upgraded ERP system. This training also helped users understand the new functionalities of the new system which supported their daily work. As expressed by the Assistant Vice President of Finance and MIS:

This was a good opportunity to train all users to clearly understand how to precisely operate the new Oracle ERP system [Assistant Vice President of Finance and MIS].

End-user training remains an important requirement for the successful use of any new IT system.

Furthermore, migrating some of the reports and data from the current system to the new system is an important requirement for the adopting organisation. The Vice President of Finance and MIS explained that:

We had to ensure that some reports from the old system were moved to the new system. These reports were significant for our daily operations [Vice President of Finance and MIS].

The above response indicates that some data and reports from the old system have to be reformatted for the new system.

Being an IT service provider Case Five used the Capability Maturity Model Integration (CMMI) which is a process improvement model for the software development industry to manage IT projects in the organisation. Deploying the CMMI assisted the organisation in maintaining its standardised business processes and operations. The Vice President of Finance and MIS explained that:

When we upgraded our Oracle ERP system we didn't change any business processes because we deploy CMMI which tends to improve all processes in the business [Vice President of Finance and MIS].

Due to the nature of business at Case Five, and due to the use of international standards for software development processes, the organisation believes that it was not required to make any changes to its business processes.

However, some changes to the procurement process were made to streamline and automate procurement within the ERP system. The procurement process was changed to e-procurement allowing each business function to create its purchasing orders in the upgraded system. These were also approved electrically by the authorising agents in the organisation. As explained by the Assistant Vice President of Finance and MIS:

Our procurement process was adjusted in terms of purchasing approval. The purchase-to-pay process is now online and more automated. Moreover, the financial accounting staff are able to verify the purchase orders and approve them online, allowing orders to be placed [Assistant Vice President of Finance and MIS].

Seemingly, the minor change to the procurement process enabled the organisation to better manage purchasing data in the upgraded ERP system as well as improve the purchasing efficiency.

Requirements for upgrading the ERP system at Case Five include the following: an understanding of the new system, a feasibility study for the suitability of the system for organisational business, a budget, executive management support, a project plan, a cross-functional project team, involvement of key users from each business function, an assessment of new requirements to support the system such as new hardware, ERP end-user training, data and report migration to upgraded ERP system and some changes to the business process.

5.6.5 Outcomes from ERP system upgrade

It was noted that the organisation deployed the upgraded ERP system only a short while before the researcher collected the data at this company. The management reported some capabilities that were enhanced by the new ERP system. Improvements such as a greater data visibility, data analytics, better decision-making and new knowledge were noted.

The upgraded ERP system enabled the organisation to gain better real-time data from all business functions. The management encouraged the ERP system end users across the organisation to input data into the upgraded ERP system. The real-time data supported the ERP system users and management to gain greater data visibility for decisions to manage business operations. The Vice President of Finance and MIS said:

We have accurate data in the upgraded ERP system to support us to make better decisions. I can access the system and can clearly see our sales pipeline from the sales order module and realise how many products we [the organisation] have to order to reach the expected sales volumes. I can forecast our sales volumes along with existing sales orders from our customers such as when we are able to deliver products to our customers and when we will receive payment from our customers [Vice President of Finance and MIS].

The above response shows that accurate and visible information from the upgraded ERP system better supports the management of sales and improved decision-making.

Dealing with large volumes of data is a characteristic of the business for Case Five. The upgraded ERP system supported enhanced data management facilitates with analytics for numerous types of analysis. The upgraded ERP system better supported real-time and accuracy of data. As explained by the ERP System Upgrade Project Manager:

We already have a large volume of data which we stored for a decade, and we generate more data each day which requires analytics. We need business intelligence software to support us to do more data analysis in the organisation and in each business for improved decision-making [ERP System Upgrade Project Manager].

The above response also indicates that big data management, data analytics and intelligent reporting helped make smarter decisions as well as improve business management.

The upgraded ERP system helped end users to learn more and increase their knowledge of the upgraded ERP system. This in turn supported them to operate the system effectively for their daily work. The ERP System Upgrade Project Manager pointed out that:

At this stage, I found that our system users were able to cope with those changes [to new system version] and accommodated them with the upgraded system. It indicated that our system users had been learning new knowledge from using the upgraded ERP system. Additionally, they also experienced that the upgraded ERP system wasn't too difficult to operate. For that reason, I noticed that our users were adjusting themselves to work with the upgraded ERP system and operating the system more efficiently [ERP System Upgrade Project Manager].

The ERP system upgrade enhanced new technological knowledge amongst users which in turn helped improve business operations in the organisation.

Enhanced organisational capabilities achieved from the upgraded ERP system at Case Five include better real-time data integration, big data management, greater data visibility and smart data analytics which in turn support improved business decision-making. Better sales management, enhanced new learning and knowledge of the system among the users and improved business operations in the organisation were also noted.

5.6.6 Summary of findings from Case Study Five

The type of ERP system upgrade at Case Five was full system in a phased form. It started with technical improvements, followed by a functional upgrade: that is, upgrading one business function at a time leading to a full system upgrade.

The reasons for upgrading the ERP system at Case Five include the need for a system to support business growth, to replace an almost obsolete system and to be able to integrate new features of web applications and integration of data from mobile technologies. To manage larger volumes of data, to generate customised reports for managerial decisions as well as gaining ongoing vendor support for the technology were identified to be reasons for the upgrade.

Requirements for upgrading an ERP system at Case Five include an understanding of the new system, a feasibility study for the suitability of the system to organisational business, a budget, executive management support, a project plan, a cross-functional project team, involvement of key users from each business function, an assessment of new requirements to support the system such as new hardware, ERP end-user training, data and report migration to upgraded ERP system and some changes to business process.

Enhanced organisational capabilities achieved from the upgraded ERP system at Case Five include better real-time data integration, big data management, greater data visibility and smart data analytics which in turn support improved business decision-making. Better sales management, enhanced new learning and knowledge of the system among the users and improved business operations in the organisation were also noted.

5.7 Summary

This chapter presents case study findings from five large organisations that upgraded their ERP system in the last six years. It also examines the ERP system upgrade issues of each case which include ERP system upgrade history, reasons

for the ERP system upgrade, the type of upgrade chosen, the requirements and the organisational capabilities enhanced from the ERP system upgrade. The next chapter will present an insightful discussion of the cross-case analysis (among Case One, Two, Three, Four and Five).

Chapter Six: ERP System Upgrade Issues: A Cross-Case Analysis and Discussion of Findings

6.1. Introduction

Following Chapter Five, which presented the five case studies, this chapter presents a cross-case analysis of the findings from the five case studies. The observations from the different case studies are compared and contrasted in order to arrive at a common conclusion regarding the following: the key motivations for Enterprise Resource Planning (ERP) system upgrades, the determinants for the type of ERP system upgrades that the different organisations adopted; the key requirements for effective ERP system upgrades, and the organisational capability enhancements achieved following the ERP system upgrades.

The cross-case analysis is guided by the theories of the Dynamic Capabilities and Benefits Dependency Network. The objective was to establish the relationship between ERP system upgrades and the business changes required to achieve enhanced organisational capabilities and benefits from the ERP system upgrade. Through the Dynamic Capabilities lens, firms have the ability to integrate, build and reconfigure existing resources and skills to address the rapidly changing environment from a set of processes and activities and to produce a particular outcome (Teece, Pisano & Shuen 1997). Eisenhardt and Martin (2000) extend this theory by outlining Dynamic Capabilities that include integrated resources, a reconfiguration of resources within firms, changed processes, knowledge creation, new alliances, and acquisition of new external resources. According to Peppard, Ward and Daniel (2007), the Benefits Dependency Network entails four elements: the IT system; enabling changes; business changes; and benefits achieved, which relate back to the objectives of

the investment. This theory explains that a new technology is an enabler for achieving benefits by making possible new ways of working with business changes within the organisation. Due to these changes, positive outcomes – generally referred to as benefits are achieved.

Background information about the case organisations is presented in Section 6.2, followed by a cross examination of ERP system upgrade history in each case study in Section 6.3. The choice of ERP system upgrade type is considered in Section 6.4, while reasons for the ERP system upgrades are discussed in Section 6.5. This is followed by a cross examination of the necessary requirements for ERP system upgrades in Section 6.6., and the organisational capabilities enhanced from ERP system upgrades in Section 6.7. Finally, a summary of the case study findings are presented and discussed in Section 6.8.

6.2. Case organisations

The ERP system upgrade environment and processes at five organisations from different industry sectors in Thailand were studied, using qualitative interview methods and document analysis. A detailed organisational profile was presented at the beginning of each case study in Chapter Five, however Table 6.1 presents a consolidated profile summary of the key features for each organisation.

Table 6.1 Organisation profile

Case	Case One	Case Two	Case Three	Case -Four	Case Five
Type of industry	Building materials	Agriculture and food	Printing and lottery	Food	Information Technology (IT)
ANZSIC Code	203	014, 017, 111	161, 920	116	700
Turnover (USD) Year 2016	12.3 billion	13.5 billion	1.8 billion	462 million	126.86 million
Number of employees	51,000	14,817	1,200	1,000	963
ERP system	SAP	SAP, PeopleSoft-HRM	SAP	SAP	Oracle
Year of most recent ERP system upgrade	2013	2013	2010	2010	2015

*ANZSIC = *Australian and New Zealand Standard Industrial Classification (2008)*

From Table 6.1 it can be seen that the five case studies are from different industry sectors, all of which upgraded their ERP system in the recent past. Four organisations upgraded their ERP system from SAP (Systems, Applications and Products in Data Processing), while Case Five upgraded its ERP system from Oracle. Although SAP seems to be a popular ERP system, this research confirms that ERP systems are also available from other vendors such as Oracle.

6.3. ERP system upgrades

The five organisations have been using ERP systems to support their business since late 1990s and early 2000s. The main aim of the initial ERP implementation at these organisations was to support their business operations and management, or to replace their legacy systems. A history of ERP system adoption and upgrade is presented in Table 6.2

Table 6.2 ERP system adoption and upgrades history in each organisation case

ERP system upgrades	Case One	Case Two	Case Three	Case Four	Case Five
ERP system	SAP	SAP, PeopleSoft	SAP	SAP	Oracle
Year of initial ERP system implementation	1998	2003	2000	2005	2005
Initial ERP version	R/3 3.0D	SAP R/3 4.6C, PeopleSoft version 8.0	R/3 4.0B	ECC 5.0	R11i
Number of upgrades till 2015	3	2	1	1	1
Year of upgrade and upgrade version	2000 (SAP R/3 4.0B)	2006 (SAP ECC 5.0)	2010 (SAP ECC 6.0)	2010 (SAP ECC 6.0)	2015 (Oracle R12)
	2004 (SAP R/3 4.7, switched to PeopleSoft HRM)	2010 (PeopleSoft version 9.0)			
	2013 (SAP ECC 6.0 included HRM)	2013 (SAP ECC 6.0)			

From the data in Table 6.2 it is seen that Cases One and Two upgraded their initial ERP system a number of times while Cases Three, Four and Five adopted

a one-off full system upgrade. Case Studies One and Two adopted the SAP system with integrated business modules to manage their business operations; however, they used the PeopleSoft Human Resource Management (HRM) module from Oracle. This indicates that while upgrading an ERP system, business modules from SAP and Oracle can be easily integrated.

Seemingly the adoption of new IT systems, such as ERP system upgrades, in the Thai business environment was influenced by business's needs and always followed strategic decisions by the high level management of the organisations (Arunthari & Hasan 2005). The organisations aimed to gain benefits and advantage from the adopted new innovation and deployed these new IT systems as a tool to maintain and improve a competitive advantage (Arunthari & Hasan 2005). Although this study draws upon case studies from Thailand context, there is no expectation that the process and outcomes of the ERP system upgrades will be unique because being universal business operation systems, their implementation and use is expected to be similar irrespective of context.

6.4. Types of ERP system upgrade

Once organisations have established their motivations for upgrading the ERP system, they can choose from three types of ERP system upgrade. These comprise a technical upgrade, a functional upgrade and a full system upgrade (Schäumer 2007). The technical upgrade generally leads to an improved technology platform (Oseni et al. 2013). The functional upgrade is the implementation of enhanced business functions in the existing ERP system (Oseni et al. 2013), while the full system upgrade involves replacing the existing system with a new version of the system (Hamerman, Moore & Vitti 2010).

Making the choice between these three types of upgrades is very important and is determined mainly by the organisation's main need, i.e., the key business objectives that the organisations wish to achieve. The types of ERP system upgrade adopted at the five case studies are presented in Table 6.3.

Table 6.3 Types of ERP system upgrade in the five cases

ERP system upgrade	Case One	Case Two	Case Three	Case Four	Case Five
Types of upgrade	Full	Full (Phased)	Full	Full	Full (Phased)

As discussed in Chapter Five a full system upgrade enables greater integration of data, supports business growth, facilitates new ways of managing people and provides better data access for analytics and decision-making. The full system upgrade also modernises and avails the latest technology and functionalities of the ERP system to support business transformation. It increases the whole ERP system performance and implements new modules to meet new business demands, improves the speed of the whole business operation and decreases human error by automating all business processes at once. The full system upgrade was considered to be cost effective and was accomplished with minimum disruption to business at Case One, Three and Four.

Although all five organisations adopted full system upgrades (Table 6.3), they followed two different approaches. Cases Two and Five upgraded their ERP system in a phased form, while Cases One, Three and Four upgraded the whole system in one-go. Cases Two and Five undertook a technical upgrade first, followed by a functional upgrade and finally completed the full system upgrade in two years. Apparently, this stepwise implementation was meant to improve the technological platform first, which would then support the remaining upgrades and additional modules more effectively.

It seems that, irrespective of a phased form of adopting an upgrade or a one-off replacement of the initial system with a new system, from the case study analysis it can be said that a full system upgrade is the most popular type of upgrade.

Although most organisations (Cases One to Five) adopted the full system upgrade, it does not mean that the other two types of upgrade were not an important consideration. The choice of upgrade depends on many circumstances

and there could be a situation where an organisation might choose either a functional or technical upgrade. For instance, sometimes an organisation may choose a functional upgrade in order to improve specific modules of the existing ERP system as well as gain new and specific business functionalities on a new technical platform (Oseni et al. 2013). This type of upgrade could be less expensive than the full system upgrade if the organisation decided to upgrade only some of the required ERP modules instead of the whole system. Conversely, the technical upgrade may be adopted by an organisation that needs to make technical improvements. Nevertheless, it is because a full system upgrade works out as more effective and more beneficial in the long run. This seems to be the main explanation for the organisation's preference.

6.5. Motivations for ERP system upgrade

The key motivations for upgrading the ERP systems in the different organisations were identified and analysed, and these are summarised in Table 6.4. An important observation is that the motivations for the ERP system upgrade can be categorised as either technical or business-oriented, or both. The technical motivations aim to update application software and computer hardware, or adopt new technology and technical support from the ERP vendor in order to improve IT efficiencies. The business motivations aim to use new Information Technology (IT) to improve business-oriented, operational, managerial and workforce effectiveness. Table 6.4 presents a summary of the motivations for an ERP system upgrade identified from the five case studies.

Table 6.4 Motivations for ERP system upgrade in the five cases

Motivations/Cases	Category	Case One	Case Two	Case Three	Case Four	Case Five
Support business growth and expansion	Business	✓	✓	✓	✓	✓
Improve system performance efficiency	Technical	✓	✓	✓	✓	✓
Continued ERP vendor maintenance and support	Technical	✓	✓	✓	✓	✓
Improve people management efficiencies	Business	✓	✓	✓		
Improve data management and reporting to support decision-making	Technical				✓	✓

Motivations/Cases	Category	Case One	Case Two	Case Three	Case Four	Case Five
Take advantage of new features of the new ERP version	Technical				✓	✓
Manage larger volumes of data	Technical					✓
Increase data analytics	Technical			✓		
Improve Information Technology (IT) based risk management	Technical			✓		
Need for a single standardised IT platform	Technical	✓				
Improve technology in organisation	Technical					✓
Gain a better connections to new technology and other business applications	Technical				✓	
Increase integration requirements from all business function in the organisation	Business			✓		
Improve business management	Business					✓
Support new business demands	Business				✓	
Support business transformation (e.g. a finance shared service centre)	Business		✓			
Improve business process as the international standard	Business			✓		
Increase customer service via multiple service channels	Business			✓		
Transform the back office into a smart office	Business			✓		

From Table 6.4, it is obvious that the organisations required systems that have improved performance capabilities and that are able to support business growth (Beheshti & Beheshti 2010; Dempsey, Vance & Sheehan 2013), which entails large volumes of data (Elragal 2014), a larger number of people, the integration of a number of business modules with different business units (McKendrick 2012a) and support for their changing business needs (Otieno 2010). To meet their requirements for business growth an IT system capable of managing large volumes of data and business operations to support the expanded business is required. This finding indicates that ERP system upgrades are for business expansion and improvement, as well as for having a technology system that is integrated and has the capacity to manage larger volumes of data.

Another reason for ERP system upgrades established from the case studies is the need for improved performance power and greater flexibility to manage business changes, growth and globalisation. As explained in Chapter Five, this is

because the organisations eventually start to experience reduced system performance as the business grows and expands, thus putting greater pressure on the existing system. In most cases, the need to boost system performance to cope with growing business scope and complexity forms the key motivation for ERP system upgrades. This finding confirms the observation made by Otieno (2010) that ERP systems are upgraded to support new business demands that require more capable systems.

Organisations also seemed to consider continued vendor technical support as yet another important motivation for an ERP system upgrade. In all cases, vendors announced an end-support date to existing ERP versions, which meant that effective technical support was either completely unavailable or could become very costly for the organisations. Thus ongoing and cost-effective vendor support for system performance was important. Without the continued original vendor support, the organisations would be forced to outsource to independent third-party consultants or to build in-house capacity, both of which would be very costly. This finding also confirmed Dempsey, Vance and Sheehan (2013) and Seethamraju (2015) who also observe the importance of continued vendor support service for the ERP system to be a reason for upgrading the ERP system.

Another major operations development, which clearly motivated the organisations to upgrade their ERP systems, was the need to implement an appropriate system to manage a growing workforce and, by extension, an expanded HRM task. Three of the organisations (Cases One, Two and Three) experienced a large increase in the size of their workforce and needed the more powerful people management system to support more effective HRM. Thus, these three organisations required improved HR functionalities and new technology such as Time Management and Employee Self-Service (ESS), to enable the organisations to track and manage employee working times and other people activities across the enterprise (see Chapter Five).

As organisations grow and expand the scope and diversity of their operations, there is a great need to improve data management and reporting due to the increased volumes of data. The new system must be able to effectively improve the integration of large amounts of data from all business processes, business units and subsidiaries to obtain real-time data to support decision-making on business. This is even more critical in Cases Four and Five which since the first adoption of ERP, experienced significant business expansion. The integration and management of data and information from different operations, including business partners, branches and subsidiaries can be very complex. Failure to manage this aspect effectively can make the organisation inefficient, costly and unprofitable. The organisations therefore needed to ensure their ERP systems increased the ability to capture and process larger volumes of data in real time. This meant real-time information workflow and efficient business processes from all business functions and partners.

Another reason for an ERP system upgrade was to support business transformation in the organisation. This finding is consistent with the observation by Dempsey, Vance & Sheehan (2013) that a consolidation of resources within the organisation is critical to organisational success. In Case Two, for example, the organisation needed to have a centralised, business-driven technology to support business transformation. The organisation, in this case, aimed to improve its business operations through centralised finance services at the headquarters to enable enhanced access to all online, real-time financial data and provided a greater financial support service across the organisation and all its external business functions. For that reason, the organisation required high ERP system performance. Similarly in Case Four, a key driver was the need for the organisation to prepare its ERP system so that it could integrate data and gain a better connection to new technology and other business applications. In this regard, Dempsey, Vance and Sheehan (2013) also report that organisations upgrade their ERP systems in order to assist a growing business to increase business management efficiency through efficient data and

information management. For this reason, the upgraded ERP system offers new and more advanced features and functionalities, which improve system performance and facilitate business efficiencies.

Interestingly, an organisation's (Case Three) decision to implement an upgrade is also motivated by the need to gain increased IT based risk management through improved security features, which prevent hardware and software failures, reduce human error and prevent computer virus attacks. A further and associated technical motivation is to gain upgraded essential hardware and technology to support the above functions and capabilities.

The predominant motivation for ERP system upgrades, as per the case organisations studied here, is the need to enhance the capacity to support enhanced business processes. This is mostly driven by expanding business, both locally and internationally, leading to increased function and location diversity. Furthermore, such expansion often means that several business operation functions grow, including financial, data and information management, and HRM. For organisations to continue operating at efficient and productive levels, it is becoming essential that they upgrade their Operating Systems (OS).

Ultimately, the success of any organisational objective is largely determined by the strength of organisational motivation. This determines the level of available support and resource allocation.

6.6. Requirements for ERP system upgrade

Requirements for ERP system upgrades are a set of basic requisitions for the IT improvement projects to strengthen the project success (Young 2006). These requirements are often numerous and tend to depend on the type of organisation, the objectives for the upgrade, and the type of upgrade being implemented. It is likely, therefore, that different organisations will have a range of requirements – some slight and some significant. A few of the requirements,

however, tend to be standard across all upgrades. These are presented in Table 6.5.

Table 6.5 Requirements for an ERP system upgrade in the five cases

Requirements/Cases	Case One	Case Two	Case Three	Case Four	Case Five
Top management support	✓	✓	✓	✓	✓
Financial Support (budget)	✓	✓	✓	✓	✓
Business process change	✓	✓	✓	✓	✓
• Financial and accounting	✓	✓	✓	✓	
• Procurement	✓		✓	✓	Minor adjustment
• Sales and distribution	✓	✓		✓	
• Human Resource management (HRM)	✓	✓	✓		
• Production	✓				
• Product costing	✓				
• Fund management			✓		
• Inventory management				✓	
A cross functional project team include:	✓	✓	✓	✓	✓
• Key users	✓	✓	✓	✓	✓
• IT staff	✓	✓	✓	✓	✓
• ERP consultants	✓	✓	✓	✓	✓
Project Management Office (PMO)	✓				
ERP/IT support team	✓	✓			
Project management (i.e. project plan, time management)	✓	✓	✓		✓
Technology (i.e. new infrastructure and hardware)		✓	✓	✓	✓
Gathering business requirements				✓	✓
Change management	✓	✓			
System acceptance testing			✓	✓	
Data cleansing and migration				✓	✓
A feasibility study of new ERP version					✓
ERP end-user training					✓
Effective communication	✓				
Basic infrastructure for a project team member	✓				

Table 6.5 shows that due to the high likelihood of emerging ERP system upgrade issues during the project, the organisations also prioritised 'top

management support' as a key requirement to secure. Having support from top management was seen as essential to ensure effective and continuous engagement with the executive regarding resources and direction. On the same point, Leyh & Muschick (2013) conclude that top management support is important for the ERP System Upgrade Project to secure sufficient financial and human allocation for the upgrade process.

The next most common requirements were related to financial support, business process change, a cross-functional team and ERP consultants. These were highlighted across all cases. Project management and Technology were the third most common requirements, shared across four cases. The remaining requirements appeared across two or three cases.

Having sufficient funds is another important requirement. Preparing a budget for an ERP system upgrade is no different from preparing a budget for other IT improvement projects that require adequate budget to cover all activities and other related expenses. The case study findings indicate that the management of each case organisation carefully considered and ensured the appropriate allocation of financial resources. Some of the most important budget items included in the upgrade expenses included software licenses, new IT infrastructure, implementation, maintenance fee, salaries, consultancy services, education and training, change management and project management. In line with these findings, Avram (2010) reports that ERP System Upgrade Projects require sufficient budget allocation to cover purchasing new software, new hardware and implementation costs.

Another important requirement, which is essential for an ERP system upgrade, is business process change. Some process changes have to be effected in order to ensure that the ERP system upgrade meets the organisation's target objectives. Business process changes are specially defined in this research context as changing the existing business processes to align with new functionalities of the new ERP version and the upgraded system. According to Kettinger and Grover

(1995) business process change refers to the overhaul of business processes and organisational structures that limit competitiveness, effectiveness, and the efficiency of the organisation to achieve business improvements and for process innovation. Business process re-engineering (Hammer & Champy 1993), process improvement (Harrington 1991), process innovation (Davenport 1993), and business process redesign (Davenport & Short 1990) are terms that are usually used interchangeably to represent the phenomenon 'business process change'.

IT systems are implemented in organisations to support business functions (Xu 2011). Business changes and re-engineering of processes are required to align the new systems with business functions (Harmon 2007). Although organisations re-engineer the business processes with the initial ERP implementation, it is still essential to redesign and continuously improve the business processes to fit the new system as well as the new modules implemented which support business demands (Davenport, Harris & Cantrell 2004). Wenrich and Ahmad (2009) and Grabski, Leech and Schmidt (2011) also confirm that making changes to business processes is an important requirement for a successful ERP system upgrade. The case study findings highlight that while upgrading an ERP system, making changes to business processes is not only an essential requirement to align business functions to the upgraded modules supported by the new system, it is also an advantage as it allows dysfunctional business processes in the organisations to be improved. Some examples of business process changes with the ERP system upgrade in the case organisations are presented in Table 6.5.

As stated in Chapter Five, business process changes for ERP system upgrades are typically implemented in two ways. However, implementation can also occur in three ways. In the first option, the organisation may improve the business processes before conducting the ERP system upgrade or any IT improvement project in order to prepare the business processes to settle with the new IT system. This approach can be used with any significant processes that the organisation intends to improve in terms of efficiency. Alternatively, the organisation can change the business processes to align them with the upgraded

system during and alongside the ERP system upgrade process (Subramoniam, Tounsi & Krishnankutty 2009). Some examples of processes changed by this approach as evident from this research include finance and accounting processes, budget management and procurement processes (see Table 6.5). These processes were changed during the ERP system upgrade process in order to align them with the new functionalities of the new technology. Thirdly, the organisation can finish upgrading its ERP system and then change its business processes in order to achieve alignment with the upgraded ERP system. A process related to sales and marketing management, for example, can be changed after the ERP system upgrade so as to meet the changing market demand. The business process changes undertaken alongside the ERP system upgrade was undertaken in different ways by the organisations in this study. Whichever approach an organisation takes, the purpose of changing business processes is to ensure an effective implementation of the new upgraded ERP system (Wenrich & Ahmad 2009; Grabski, Leech & Schmidt 2011).

It is clear that four organisations (Cases One, Two, Three and Four) undertook significant business process change alongside their ERP system upgrade. It is also important to note that the different organisations implemented different business process changes. For example, Case One implemented the highest number of business process changes followed by Cases Three, Four, Two and Five with the least indication of business process change. The different numbers of business process changes in individual organisations are dependent on different motivations and requirements in order to achieve their ERP system upgrade goals. The organisation in Case One changed the most business processes with the ERP system upgrade. This may have been because it acquired or merged many businesses as its business grew and it intended to make standard business processes for its business functions and subsidiaries. The organisation in Case Five showed the slightest changes to the business process with the ERP system upgrade. This might be because of the organisation's already robust standard processes which supported its existing business

operations and management. As observed by Beatty and Williams (2006) and Erickson and Scott (2007) the requirement for business process changes has to be justified based on need. Additionally, the organisations also intend to develop faster and more efficient processes across the business functions (Davenport 1993). In terms of operational improvement, this research findings indicate that finance and accounting, procurement, HRM, and sales and distribution are the most common business process changes required for upgrading ERP system. These processes are important because they are basic elements that operate tasks and activities in the businesses as well as leading organisations to achieve their goals.

Finance and Accounting

The financial and accounting process is one of the most important processes in the organisations that focuses on managing and determining all of the business's financial aspects. In order to capture the financial data across the organisation, the subsidiaries and the business units, the financial and accounting process was changed in four case organisations to align with new financial and accounting functionalities of the new ERP version as well as to support business transformation. The four organisations (Cases One, Two, Three and Four) changed this process in order to gain real-time financial data across the organisations to achieve greater integration of data from different processes to support data transaction requirements for accounts and financial management. Furthermore, the organisations also utilised the multidimensional financial reports from the upgraded ERP system to improve business management as well as make better business decisions. Seemingly, changes to the financial and accounting process made by Case Two tended to align with the new finance shared-services operation as well as the upgraded financial accounting module. This module ensured that the organisation could utilise its resources and improve the financial and accounting management efficiency in the organisation.

In summary, the organisations changed the financial and accounting processes to align with the upgraded financial and accounting module in the upgraded ERP system. This improved real-time financial data integration and access from all business functions across the organisation and subsidiaries. It also assisted the organisations in capturing transparent information and achieving finance management efficiency.

Procurement

The organisations in Cases One, Three, and Four made major changes to the procurement process, while the organisation in Case Five made only minor adjustments to this process to align it with the upgraded ERP system. For the four organisations, the main reason for changing the procurement process was to implement e-procurement and mobile technology that would enable procurement staff to faster manage and track the purchasing transactions in the upgraded ERP system. Additionally, the new procurement process associated with the ERP system upgrade and mobile technology allowed authorised staff to approve the purchasing transactions via mobile devices. This resulted in improved procurement operation efficiencies in the organisations. Furthermore, the organisations also improved data flow between relevant processes such as financial accounting (accounts payable) and inventory management as well as improved data processing for procurement in real time with purchase orders, goods received and accounts payable. Surprisingly, the interviewees in Case Two did not highlight the change of the procurement process in relation to the ERP system upgrade. This may have been due to the possibility that the organisation already had a sufficient procurement process management in place.

In summary, the procurement process was changed in order to improve its operations. This was achieved by aligning the changed process with the upgraded ERP system as well as mobile and web-application technologies. As a consequence of the information age, the organisations were able to employ the new technology to enable their employees to better operate the procurement

process. The organisations were also able to reduce procurement operation time, given that at any time or from any place employees could access the upgraded ERP system from their mobile devices or via web-application.

Sales and distribution

Another important process of the manufacturing and distributing organisations in this study is that of sales and distribution. This process assists the organisation with creating sales and marketing plan through to distributing products and services to their customers. The case study findings indicated that with the adoption of ERP system upgrades, three of the organisations (Cases One, Two and Four) decided to change their sales and distribution process in order to improve this process for operation efficiencies as well as to align it with the function supporting sales and distribution in upgraded ERP system. Seemingly, these case organisations activated new sales functions that assisted them to manage sales and automate end-to-end sales processes across the organisations and their business partners in one single process. Deploying new mobile technology also assisted sales representatives and sales department to access real-time data from the upgraded ERP system from anywhere, at any time. It also enabled faster operating sales functions and supported efficient decision-making. As a result, the organisations were able to capture and utilise real-time sales data, which assisted them to develop the right products for meeting market demands, to boost their sales volumes and to improve sales management. Additionally, real-time sales data also supported the distribution of products to the right places in a timely manner. Interestingly, during the data collection, Case Three indicated that it was going to change its sales and distribution process due to new organisational policies and establish a new marketing and distribution channel. This was in response to changing market demands as well as improving customer service.

In summary, the above finding implies that the sales and distribution process can be changed during and after an ERP system upgrade in order to reduce process bottleneck and meet new business demands.

Human Resource Management (HRM)

A very important asset in organisations is that of Human Resources (HR), and Human Resource Management (HRM) is a process well supported by an upgraded ERP system. As discussed earlier, the organisations' aim to improve people management efficiency by upgrading the ERP system enabled them to deploy new HR functionalities and new mobile technology which assisted them to achieve this goal. In order to utilise these new functionalities such as the ESS, time and labour management, and people management web applications as well as mobile technology, a re-engineering of HRM process was also needed. This process would align with these new functions of the upgraded HRM module. The three organisations (Cases One, Two and Three) undertook HRM process changes alongside the ERP system upgrade. For example, the re-engineered new HR process allowed the employees to self-manage their own data on leave entitlements and performance-related achievements through the upgraded HR system, which reduced huge HRM administrative operation time. It seems that the organisation in Case One also deployed the mobile technology and encouraged its employees to use the ESS via their mobile devices. This enabled them to operate their HR activities task anywhere and at any time. The association between new HRM process and the upgraded ERP system also enabled the HRM team to plan and focus more on employee relationship management and other employee development activities. The management also benefitted from accurate real-time employee data for decision-making and efficient people management. The new HRM process eliminated the need for old manual works and spreadsheet reports, and it replaced these with new functions in the upgraded system. It also better streamlined and integrated HR and financial accounting data for payroll processing in a standard manner and reduced error in the system. Hence, changing the HRM process with the ERP

system upgrade enabled the organisation to improve workforce management efficiencies across the organisations. However, two of the organisations (Cases Four and Five) did not highlight the people management process change in relation to the ERP system upgrade.

In summary, the organisations changed the HRM process in relation to the ERP system upgrade in order to improve people activities management within the organisations.

Another important requirement for the ERP system upgrade identified in this research is a cross-functional team. The cross-functional project team for ERP system upgrades in all five cases comprised of key users from each business function, IT staff, and ERP consultants. Kimberling (2012) suggests that organisations undertaking the ERP System Upgrade Projects need to ensure that they arrange adequate project resources such as people to incorporate the upgrade tasks. Leyh and Muschick (2013) refer to ERP consultants who provide technical and business solutions as well as implementation advice to be an important set of people required for the ERP system upgrade. Other people in the project team were IT support team in Cases One and Two and a Project Management Office (PMO) in Case One. The PMO in Case One included one representative from each business function to ensure the upgraded business functions were aligned to their business objectives. Additionally, a unique requirement at Case Three was the services of a specialist external IT implementation team. Thus, this research indicates that for upgrading ERP systems a cross-functional team is an important requirement.

In terms of project management, the case study findings also reveal that the organisations' management executive paid specific attention to preparing a project plan. This is consistent with the views expressed by Whang, Lee and Kim (2003) and Olson and Zhao (2006) suggesting that to achieve success with IT projects, the organisations are required to prepare a clear and good document plan detailing activities and tasks to be performed and the timeframes for each

task. The project plan was an important requirement for case organisations One, Two, Three, and Five.

Upgrading the existing ERP system to a new version also requires new IT infrastructure such as OS platforms, hardware, database and new technology that is compatible with the new ERP software version (Olson & Zhao 2007). The case study findings showed that all except Case One identified IT infrastructure to be an important requirement for an ERP system upgrade. This requirement helped the organisations to better manage growing data volumes as well as to reduce hardware maintenance costs.

Interestingly, a User Acceptance Testing (UAT) after the implementation is a unique requirement at Case Three and Four to ensure correct operation of the system. A feasibility study prior to update is also a unique requirement at Case Five to uncover the strengths and weaknesses of the new ERP version as well as benefits that the organisations would gain from the new ERP version.

What the data confirms here is a point made earlier: aside from those requirements that are basic and common across all ERP system upgrades, the other requirements are mostly context-specific, and emphasis across different cases will depend on individual circumstances. Thus, for example, whereas one organisation might identify end-user training as a key requirement, another might not because its staff are already adequately familiar with the systems. Similarly, 'effective communication' might not be listed by some organisations because they already have effective communication mechanisms in place. From this it is possible to deduce that, though not exclusively, the list of the most important requirements for an ERP system upgrade include top management support, financial support, business process change, key users, IT staff, ERP consultants, project management and Technology. This does not, however, suggest that the remaining requirements are unimportant; rather, these are all very significant for achieving effective ERP system upgrades. Which requirements an organisation chooses to highlight will be determined by many

different factors, including the nature of its business, its business operations, and its existing situation.

6.7. Enhanced organisational capabilities

The adoption of an ERP system upgrade does not only improve an organisation's system performance but also provides the opportunity for the organisation to revisit and improve all business processes within the organisation, which enhances numerous organisational capabilities. It is also important to note that the different organisations achieved different and enhanced organisational capabilities due to their motivations and target objectives for their ERP system upgrade. Therefore, this research finding identifies positive outcomes as a result of ERP system upgrades, as presented in Table 6.6.

Table 6.6 Enhanced organisational capabilities from the ERP system upgrade in the five cases

Enhanced Capabilities	Case One	Case Two	Case Three	Case Four	Case Five
Better integration of data (i.e. larger volume of data, from different sources)	✓	✓	✓	✓	✓
Increased data visibility	✓	✓	✓	✓	✓
Improved data analytics	✓	✓	✓		✓
Big data management	✓	✓	✓		✓
Improved strategic decision-making	✓	✓	✓	✓	✓
Better financial management	✓	✓	✓		
Improved customer services			✓	✓	
Increased new learning (i.e. organisational learning, new knowledge learning)		✓			✓
Improved knowledge sharing		✓	✓		
Reduced costs		✓	✓		
Better people engagement	✓				
Improved procurement efficiency	✓				
Improved sales management performance					✓

Table 6.6 shows that most of the organisations achieved greater and improved information management including better integration of data (McKendrick 2012a; Syed, Gillela & Venugopal 2013; Elragal 2014), increased data visibility,

improved data analytics, and big data management (Elragal 2014) as a consequence of implementing the ERP system upgrade. Given that this is the information age, organisations need high capacity IT systems to increase business performance as well as provide faster real-time data from all aspects of business so as to support strategic decision-making (LaValle et al. 2011; Jayawickrama, Liu & Hudson Smith 2013; Kanellou & Spathis 2013). Therefore, it could be concluded that if the adopting ERP organisations were aiming to achieve enhanced better data integration, increased data visibility, improved data analytics, and big data management, upgrading the full ERP system could be an appropriate choice to adopt. For example, the better data integration capability enables the management and the ERP system end users of all organisations to gain insights from the accurate, consistent, and up-to-date information available for them to use for their work operations as well as to support operational decision-making. This finding confirms the suggestion of McKendrick (2012a), Syed, Gillela and Venugopal (2013), and Elragal (2014) that a significant improvement of the Information Systems (IS) correlated with new technology enables the organisations to enhance big data integration in the organisation and to gather this from various sources (Olson & Zhao 2007; Hu et al. 2014).

As discussed above, growing volumes of data were generated from the global and the domestic sources for each case study, due to business growth and expansion on a daily basis. The organisations needed a powerful ERP system to manage and control these larger volumes of data. Furthermore, the ability to monitor the use of data as well as manage its security became the greatest challenge for the organisations. The findings showed that in the case of four organisations (Cases One, Two, Three, and Five), the ERP system upgrade assisted the organisations to manage big data in an efficient manner. The new technology associated with the upgraded system also provided tools to help this larger volume of data to be organised more efficiently. Additionally, the centralised database controlled the system end users to access the data more

conveniently and in a secure manner. This finding is consistent with Elragal's (2014) view that the new functionalities of the upgraded ERP system enable an organisation's ability to better manage and monitor a larger volume of data which is integrated into the ERP system.

With the ability to better integrate real-time data from all business functions as well as business partners, the upgraded ERP system offered greater visibility into the accurate data, such as sales and purchase order status for improved financial management. All case organisations highlighted improved data visibility in the upgraded ERP system. For example, as shown in Case Five, top management was able to make better business forecasts by capturing accurate and visible information from the upgraded ERP system. In terms of technical support in the organisation discussed in Case Three, the data visibility enabled the IT staff to clearly detect errors in the ERP system. It also enabled the IT staff to support the organisation in performing a prompt problem-solving service for the ERP system end users in the organisation. Moreover, the upgraded ERP system gathered high-quality data and provided strategic reports that allowed the management to gain better data analytics. These reports enabled management to make data-driven strategic decisions with regard to driving business as well as increasing productivity.

In a rapidly changing business environment, organisations need accurate and efficient data to support their management's decision-making. The upgraded ERP systems have improved data integration for both local and international businesses, increased the capacity to process and manage larger volume of data, and provided visible and valuable data that supports the system end users at all management levels. This insightful information is necessary for enabling quick and accurate decision-making on business operations and management at the right time. For example, Case Two's organisation facilitated real-time data integration from the scanned purchasing document attached to the purchasing transactions from business branches and units across the country, which provided faster visible financial information for the management to use when

making business decisions. This finding is aligned with the earlier studies (LaValle et al. 2011; Jayawickrama, Liu & Hudson Smith 2013; Kanellou & Spathis 2013) suggesting that the organisations enhanced strategic decision-making based on data visibility and data analytics enabled by the upgraded ERP system. This system also enabled management of larger volumes of data management from convergent technologies, processes, and business units.

The other significant, enhanced organisational capabilities achieved from the ERP system upgrade are improved finance management (Kim et al. 2011; Oh, Yang & Kim 2014), better customer services, and improved new learning and knowledge sharing (Reychav & Anand 2011). As discussed above, the upgraded ERP system improved ability of data integration and transparency across the organisations. Additionally, the upgraded system improved its capacity to process business transactions for better financial management. The case study findings (Cases One, Two and Four) highlighted that the management was able to promptly access the financial information which supported them to make quick decisions for business management. This finding confirms the view of Kim et al. (2011) and Oh, Yang and Kim (2014) that the adoption of the upgraded IT systems achieve financial performance efficiencies.

Interestingly, better customer service is another enhanced capability achieved by two organisations (Cases Three and Four) through upgrading the ERP system as well as re-engineering the sales and distribution process. Moreover, as discussed earlier the upgraded ERP system enabled integration of data from mobile and web technologies which helped provide better service.

Further, two organisations (Cases Two and Three) highlighted that improved knowledge-sharing capability was enhanced when they upgraded their ERP system. This capability was achieved due to increased operational efficiency and employee competency within the organisations. The ERP system upgrade brought about a new way of operating the ERP system, and the system end users gained new information, knowledge, and skills from deploying the

upgraded ERP system and new work processes. Additionally, the organisations improved many processes with the upgraded ERP system that required the ERP-system users to learn how to operate the upgraded system as well as understand new processes and work practices. The opportunities for learning and knowledge transfer within the organisation were apparent at Cases Two and Five. Moreover, the ERP system upgrade also enabled employees to resolve complex problems faster. This finding confirms the view of Reychav and Anand (2011) that enhanced knowledge sharing and new learning is a Dynamic Capability achieved from IT systems.

Other enhanced organisational capabilities (reduced cost, better people engagement, improved procurement efficiency and improved sales performance) are also important but less emphasised by the organisations. As discussed earlier, given that this is an information-driven era, improved information management with increased volumes of data from numerous sources for analytics and effective decisions were the most notable organisational capabilities achieved from the upgraded ERP system. As discussed in the literature review (Chapter Two), enhanced capabilities lead to improved productivity outcomes. However, from the case study analysis as well as the case with online discussion panel (Chapter Four, page 84), productivity outcomes could not be determined. One explanation for this is that productivity outcomes from IT systems are generally long-term (Beheshti & Beheshti 2010). Another explanation is that outcomes from IT systems are not well recorded in organisations, therefore improvements from ERP system upgrades in terms of productivity outcomes could not be determined in this study.

6.8. Summary of Case Study findings

The full system upgrade was adopted by the participating organisations in this study in order to improve the whole system performance with new functionalities and features as well as to obtain new modules of the core ERP system to meet new business demands. The findings also reveal that the

organisations upgraded their ERP system with the same ERP vendor (e.g. SAP and Oracle) following their initial ERP implementation and upgraded the latest ERP versions (SAP ECC 6.0 and Oracle E-business suite R12).

This research highlights that a *full system upgrade* is the most popular type of upgrade adopted by the organisations and a more worthy investment due to cost effectiveness and value-addedness. This is evident in the way the upgrade increases the performance of the whole system and changes the associated business processes, aligning them with the better-performing modules of the upgraded system. Furthermore, it also supports business transformation as well as changing business processes to make them more flexible and scalable in response to the changing business environment.

This research has established significant reasons for why ERP system upgrades are beneficial to organisations. The research has highlighted the need for a system with improved performance to meet the needs of business growth and the upgraded ERP system achieves this. Another reason for upgrading the ERP system is to gain ongoing vendor support for the system which, is a necessary requirement for the effective operation of a large IT system.

Due to business growth and expansion, organisations have to manage a larger number of employees for which a HRM system is needed. Such a system would benefit from an upgraded ERP system. More importantly, business expansion requires integration of very large volumes of data from different sources for which analytic reporting abilities in an IT system is a requirement. The upgraded ERP systems are able to meet this requirement adequately. Other reasons for upgrading ERP systems in organisations identified from the case studies include the need for a single standardised IT system to support business management, integrated business functions and changing business demands, and to have a 'smart office' concept with automated processes and integrated data for decisions guided by data analytics.

The requirements for upgrading an ERP system range from top management support and a cross-functional team to budget and business process change.

Enhanced organisational capabilities achieved from the upgraded ERP system include better data integration, big data management, data visibility, data analytics and data-driven decisions. The upgraded ERP system in this study enhanced the financial management efficiency and better people engagement. It also improved knowledge sharing in the organisation from the new system, and improved customer service with enhanced flexibility to change. The upgraded ERP system and business processes change reduced costs resulting in increased operational efficiencies.

The next chapter will address the contributions to theory and practice. It will also discuss the implications of the research findings. Furthermore, it will identify the research limitations of this study and provide suggestions for further research.

Chapter Seven: Conclusions

7.1. Introduction

This research addresses an important Enterprise Resource Planning (ERP) system issue: upgrading ERP systems. Earlier research on the initial ERP systems is vast, addressing implementation issues, benefits, business process re-engineering, success factors, global business support and ERP system management.

The focus of this research is on upgrading an ERP system either to replace a system that can no longer meet the business demands of the organisations or to improve the existing ERP system performance and increase business operations efficiency to innovate the IT systems in the organisations. The primary purpose of this research was to explore the ERP system upgrade issues in the adopting organisations and to understand the requirements for an ERP system upgrade for enhanced organisational capabilities.

Specifically the research question for this study is:

How are organisational capabilities enhanced by upgrading ERP systems and upon what rationale and motivation are system upgrades commonly made?

7.2. Research contributions and implications

This research based on an online discussion panel and a qualitative multi-case study analysis makes a useful contribution to the field of Information Systems (IS) and ERP Systems studies. Through the Dynamic Capability lens, the reconfiguration of existing resources such as upgrading an ERP system, based on associated business changes enhance organisational capabilities for superior performance in rapidly changing business environments (Teece, Pisano & Shuen 1997; Eisenhardt & Martin 2000). Furthermore, this study reveals that

organisations do not only improve their existing IT system by upgrading ERP system but also achieve business change required as change enablers to achieve positive outcomes (Peppard, Ward & Daniel 2007).

Figure 2.1 in Chapter Two was used as a research framework to guide this study for understanding ERP system upgrade, requirements and outcomes. However, based on the findings of the online discussion panel and the case study analysis, this research proposes the ERP System Upgrade Productivity Network presented in Figure 7.1.

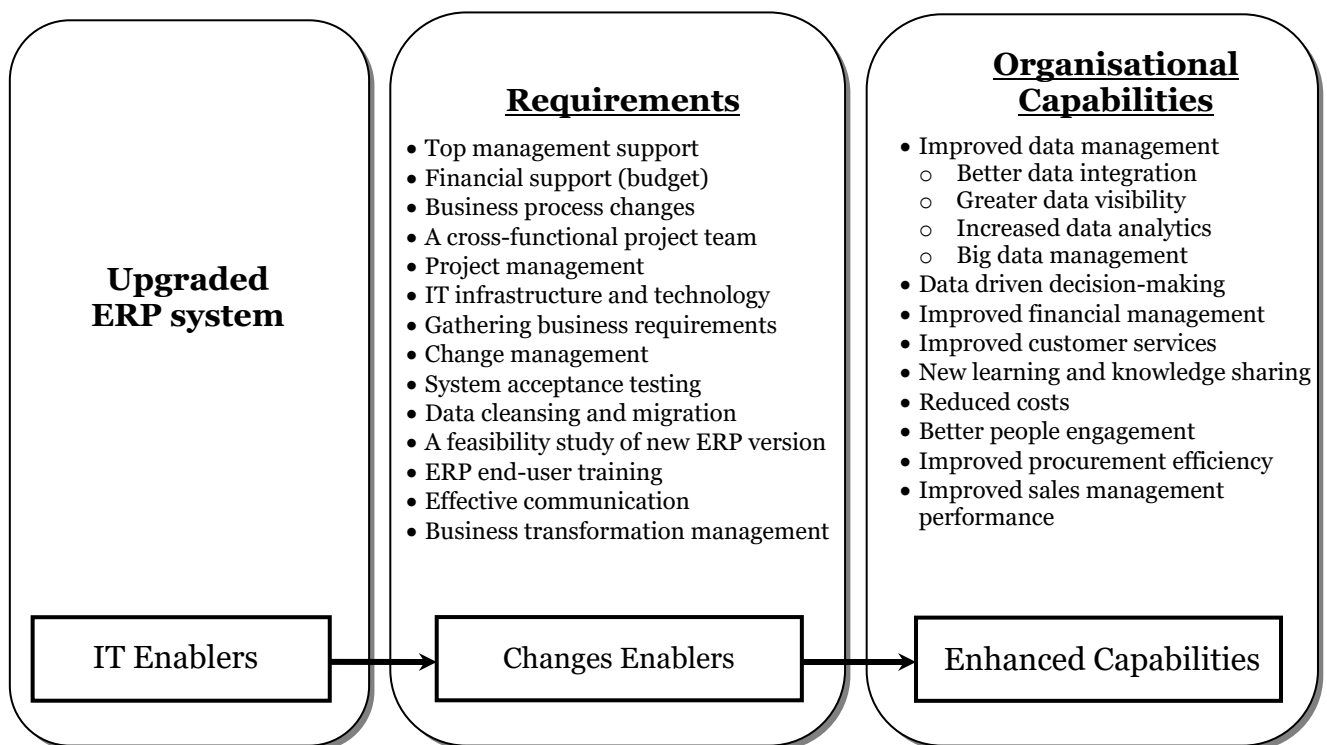


Figure 7.1 An ERP System Upgrade Productivity Network

Figure 7.1 highlights this study's findings that the ERP system upgrade is an IT enabler (Ward & Daniel 2006; Peppard, Ward & Daniel 2007) for which the change enablers include top management support, financial support, business process changes and a cross-functional project team. Other change enablers are project management, IT infrastructure and new technology, gathering business requirements, change management, system acceptance testing, data cleansing and migration, a feasibility study of the new ERP version, ERP end-user

training, effective communication and business transformation management. With these requirements the organisations upgrading their ERP systems are able to enhance their capabilities of big data management and decision-making, to provide better customer service and to improve and enhance business process (finance, procurement and sales management) at reduced costs.

This research extends existing knowledge on ERP systems by highlighting issues of ERP system upgrade to extant theory on ERP systems. This research highlights that full system upgrades are cost effective and present greater benefits to the organisation. It confirms that reasons for upgrade include meeting the demands of business growth, globalisation of operations, improved system performance power and more importantly to lock in ongoing supplier support for the system. Although requirements for upgrading an ERP system include people, a budget, top management support, project management and the role of consultants, these requirements have also been recognised as requirements for the implementation of any new IT system. The new requirements for upgrading an ERP system highlighted in this research are a cross-functional team, communication and more importantly the need to change business processes for aligning organisational processes to the upgraded ERP business modules. This research explains that the enhanced organisational capabilities of big data management, better decisions and people management are achieved from the upgraded ERP system by changing business processes supporting each organisational business function.

The implications of the findings from the current research add to the theory on ERP systems and the theories of Dynamic Capabilities and Benefits Dependency Network through the lens of an ERP system as the IT system. It adds to business process re-engineering theory by highlighting the importance of changing business processes for the upgraded ERP systems.

This study also contributes to methodology innovation by employing the online discussion panel via the internet-based blog technology which helped gain the

insight of global ERP system upgrade experts. This was a necessary step in the data collection in this study for the preparation for case studies as it provided input to interview questions.

Since upgrading ERP systems is a type of new technology implementation, this research also contributes to theory on new technology implementation. It extends the theories of Dynamic Capabilities and benefits dependency network from general IT system implementations to the upgrading of large IT systems. The important contribution this study makes is that the upgraded ERP system is an IT-enabler; requirements for the system upgrade are the enabling changes that are essential to gain enhanced organisational capabilities from this new IT system.

Implication for practice

This research has significant implications for managers, ERP experts and consultants and other stakeholders who are engaged in upgrading the ERP systems. With a better understanding of the critical issues in upgrading ERP systems, the practitioners can more effectively manage their ERP System Upgrade Projects, improve organisational business processes and enhance organisational capabilities and improvements. The ERP System Upgrade Productivity Network (Figure 7.1) can be used as a framework to guide an ERP system upgrade in any organisation.

7.3. Limitations and future research

The notable limitations of this study are that the number of participants in the online discussion panel reduced from twelve to nine. However, this is a common limitation of the online discussion panel method as highlighted by Ridings and Wasko (2010). The other limitation of the online discussion panel was that the participants were mostly ERP system upgrade consultants. Although their knowledge of ERP system upgrade was wide, they were unable to extensively comment on outcomes of ERP system upgrades actually achieved

by the organisations. Another limitation of this research is that the case studies were conducted with organisations in one region of the world. This was due to the limited time and resources for the project. Further research on ERP system upgrades is therefore required to understand if the ERP system upgrade issues from this research are similar to those faced by organisations upgrading ERP systems in other regions of the world, what the impact of cultural issues is (if any) on new system adoption, and if the requirements for achieving enhanced capabilities and productivity outcomes from new IT systems are always dependent on business changes, as listed in Figure 7.1.

7.4. Conclusions

The contribution of this study to the existing body of literature on IS and ERP systems is significant. It highlights that upgraded ERP systems are necessary IT enablers that are based on numerous organisational and industry-specific business changes that enhance organisational capabilities.

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Appendices

Appendix A: Invitation E-mail



Dear Sir/Madam,

Please allow me to introduce myself to you. My name is Ruchada Paradonsaree, a PhD student under the supervision of Professor Mohini Singh and Associate Professor Victor Gekara, at the School of Business Information Technology and Logistics, RMIT University, Melbourne, Australia.

I am currently undertaking research, which seeks to better understand business process change requirements for ERP system upgrades and the ways in which such changes and upgrade enhance organisational capabilities and improve productivity.

In order to develop this knowledge I intend to conduct an Online Discussion Panel for data collection. The data collection will involve a wide range of ERP experts with experience and/or interest in ERP system upgrades, who will share their views and experiences on the topic.

This email is to request your kind assistance by taking part in the discussion, which will be conducted in four rounds guided by a set of key questions and coordinated by myself.

Because you have been identified as a person with great experience and expertise in the broad area of ERP, your participation is very important and will be greatly appreciated.

It is envisaged that the findings of the research will greatly increase our understanding of ERP system upgrades, enhanced capabilities, and productivity improvements, as this is an important focus for business and so far not very well researched.

I realise that you are very busy, but I hope that you can find the time to assist me in developing this important research. If you agree to participate I will send you details of the online expert panel with instructions on how to participate.

Please note that participation is completely anonymous and your identity will only be known to me and my supervisors, and not disclosed to the other participants.

Due to the tight timelines for the project, may I request that you confirm your participation *by August 25, 2014*.

With many thanks and looking forward to your kind response.

Yours Sincerely,
Ruchada Paradonsaree
PhD candidate, School of Business IT and Logistics,
RMIT University,
Melbourne, Australia.
Tel: + (61 3) 9925 5403
Fax: + (61 3) 9925 5850
Email: ruchada.paradonsaree@rmit.edu.au

Appendix B: Invitation E-mail for Online Discussion Panel - Round One



Dear Sir/Madam,

Thank you for agreeing to participate in an online discussion panel for ERP system upgrades: The impact of ERP system upgrades on business changes and organisational capabilities; a view from the Thailand Business context.

The online panel starts from today (September 23, 2014). As I explained previously, for each round of discussion, you will be given a week to respond and you are kindly required to set aside about 30 to 40 minutes anytime in the each round. Another invitation for the second round will be sent on Tuesday the 7th of October, 2014.

If you agree to participate, your password is xxxxxxxxxxxx

By clicking on the following https://bpcforerpupgradesresearch.files.wordpress.com/2014/09/pls_oep.pdf, you will find an invitation for you to participate in this project. Please read this information to understand the project and your rights as a participant.

All information provided by you will be anonymous and used for this research project only.

Instruction on how to use this online discussion panel is available on <http://bpcforerpupgradesresearch.wordpress.com/about/>

After reading the above please proceed to Round One Discussion <http://bpcforerpupgradesresearch.wordpress.com/round-1-erp-upgrades-and-business-process-changes-requirements/>

Thanking you very much for your timely responses,

Kind Regards,

Ruchada Paradonsaree
PhD Candidate
School of Business IT and Logistics
RMIT University
E-mail: ruchada.paradonsaree@rmit.edu.au
Phone: 61 3 9925 5403

Appendix C: Invitation E-mail for Online Discussion Panel - Round Two



Dear Sir/Madam,

Thank you very much for your timely and useful response to Round One discussion.

Please click on <http://bpcforerpupgradesresearch.wordpress.com/round-2> for your participation in Round Two discussion and enter password: xxxxxxxxxxxx

You will be given a week to respond and you are kindly required to set aside about 30 to 40 minutes anytime in this round. Could you please response by Monday 27th of October, 2014.

Thanking you for your time and input.

Kind regards,

Ruchada Paradonsaree

PhD Candidate

School of Business IT and Logistics

RMIT University

E-mail: ruchada.paradonsaree@rmit.edu.au

Phone: 61 3 9925 5403

Appendix D: Invitation E-mail for Online Discussion Panel - Round Three



Dear Sir/Madam,

Thank you for participating in Round One and Two of my discussion on ERP system upgrades.

Please click on <http://bpcforerpupgradesresearch.wordpress.com/round-3/> for you participation in Round Three discussion and enter

password: xxxxxxxxxxxx to access a summary of Round Two responses and a set of issue for discussion on organisational productivity improvements.

You will be given a week to respond and you are kindly required to set aside about 30 to 40 minutes anytime in this round. Could you please response by Monday 17th November, 2014.

Your input and time in this project is greatly appreciated.

Kind regards,

Ruchada Paradonsaree

PhD Candidate

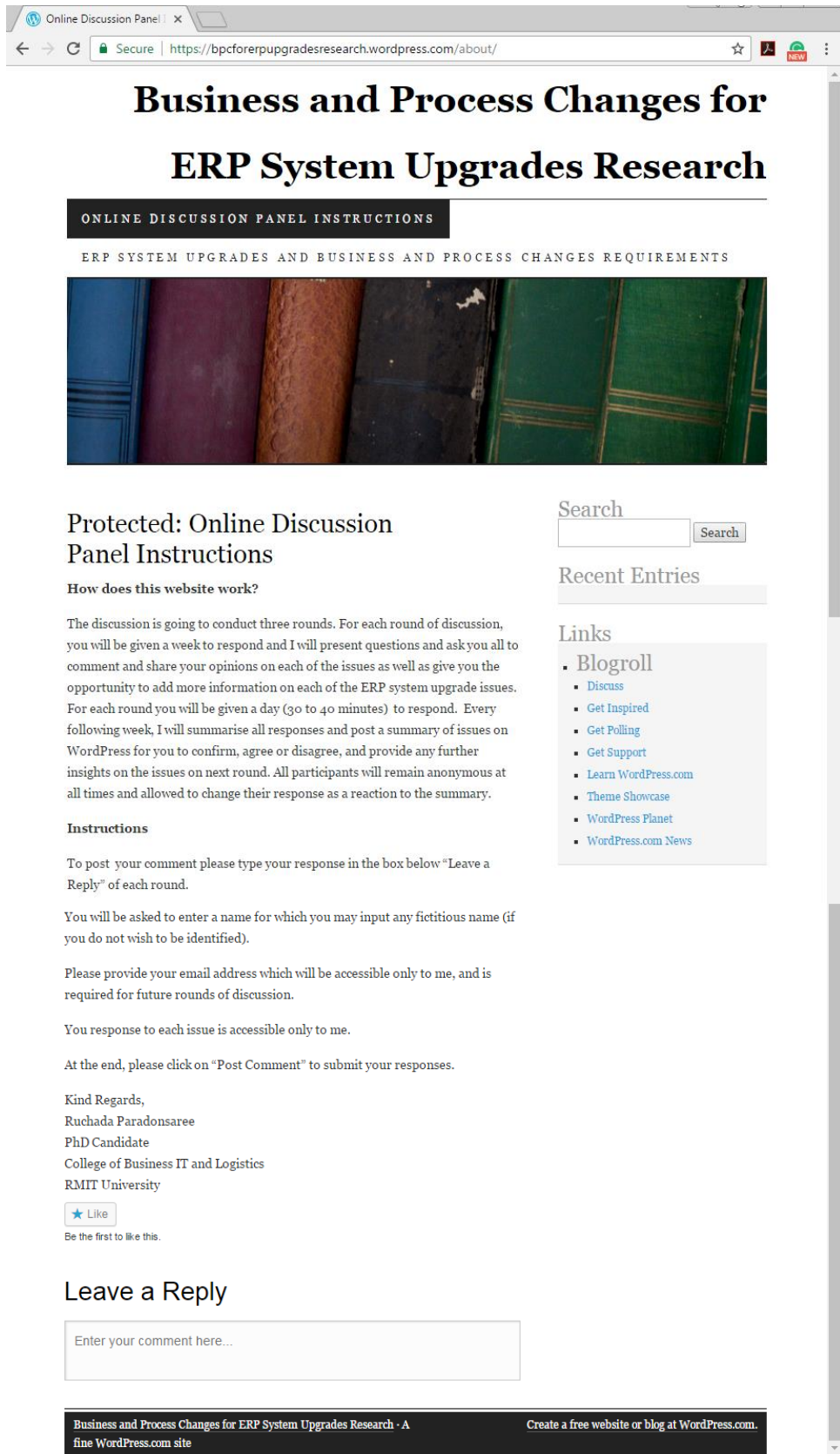
School of Business IT and Logistics

RMIT University

E-mail: ruchada.paradonsaree@rmit.edu.au

Phone: 61 3 9925 5403

Appendix E: Homepage of the Online Discussion Panel




Online Discussion Panel | X

Secure | <https://bpcforerpupgradesresearch.wordpress.com/about/>

Business and Process Changes for ERP System Upgrades Research

ONLINE DISCUSSION PANEL INSTRUCTIONS

ERP SYSTEM UPGRADES AND BUSINESS AND PROCESS CHANGES REQUIREMENTS



Protected: Online Discussion Panel Instructions

How does this website work?

The discussion is going to conduct three rounds. For each round of discussion, you will be given a week to respond and I will present questions and ask you all to comment and share your opinions on each of the issues as well as give you the opportunity to add more information on each of the ERP system upgrade issues. For each round you will be given a day (30 to 40 minutes) to respond. Every following week, I will summarise all responses and post a summary of issues on WordPress for you to confirm, agree or disagree, and provide any further insights on the issues on next round. All participants will remain anonymous at all times and allowed to change their response as a reaction to the summary.

Instructions

To post your comment please type your response in the box below "Leave a Reply" of each round.

You will be asked to enter a name for which you may input any fictitious name (if you do not wish to be identified).

Please provide your email address which will be accessible only to me, and is required for future rounds of discussion.

Your response to each issue is accessible only to me.

At the end, please click on "Post Comment" to submit your responses.

Kind Regards,
Ruchada Paradonsaree
PhD Candidate
College of Business IT and Logistics
RMIT University

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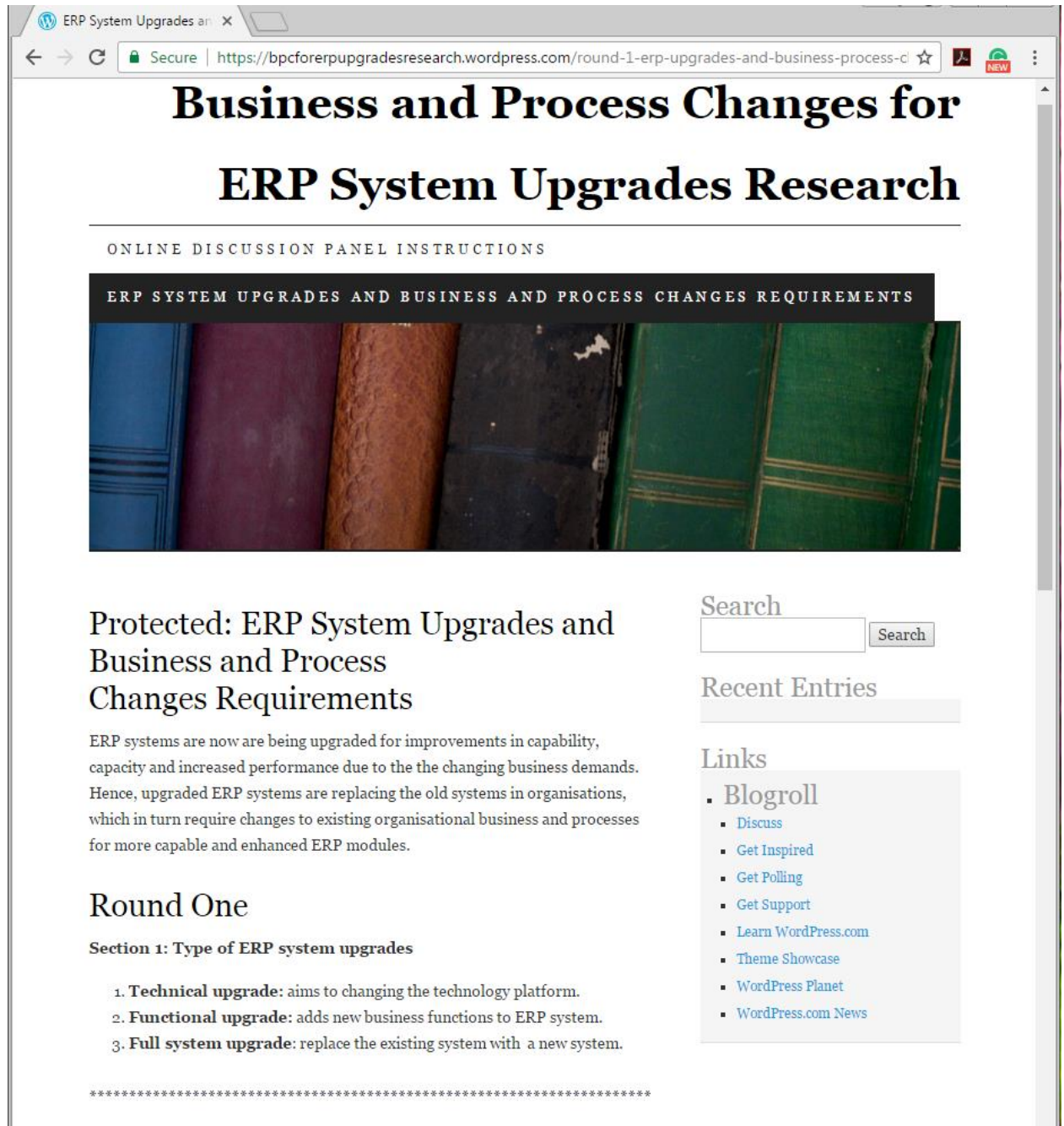
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Appendix F: The Content of the Online Discussion Panel - Round One on Wordpress Blog



The screenshot shows a web browser window with the URL <https://bpcforerpupgradesresearch.wordpress.com/round-1-erp-upgrades-and-business-process-c>. The page title is "Business and Process Changes for ERP System Upgrades Research". Below the title is a sub-header "ONLINE DISCUSSION PANEL INSTRUCTIONS" and a dark banner with the text "ERP SYSTEM UPGRADES AND BUSINESS AND PROCESS CHANGES REQUIREMENTS". The main content area features a large image of several old, worn books with different colored covers (blue, red, brown, black, green). The article title is "Protected: ERP System Upgrades and Business and Process Changes Requirements". The text discusses ERP system upgrades and their requirements. The article is divided into "Round One" and "Section 1: Type of ERP system upgrades", which lists three types: Technical upgrade, Functional upgrade, and Full system upgrade. On the right side, there is a search bar, a "Recent Entries" section, and a "Links" section with a "Blogroll" containing links to Discuss, Get Inspired, Get Polling, Get Support, Learn WordPress.com, Theme Showcase, WordPress Planet, and WordPress.com News.

Business and Process Changes for ERP System Upgrades Research

ONLINE DISCUSSION PANEL INSTRUCTIONS

ERP SYSTEM UPGRADES AND BUSINESS AND PROCESS CHANGES REQUIREMENTS

Protected: ERP System Upgrades and Business and Process Changes Requirements

ERP systems are now are being upgraded for improvements in capability, capacity and increased performance due to the the changing business demands. Hence, upgraded ERP systems are replacing the old systems in organisations, which in turn require changes to existing organisational business and processes for more capable and enhanced ERP modules.

Round One

Section 1: Type of ERP system upgrades

1. **Technical upgrade:** aims to changing the technology platform.
2. **Functional upgrade:** adds new business functions to ERP system.
3. **Full system upgrade:** replace the existing system with a new system.

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Section 2: Business and Process Changes for ERP System Upgrades

Business process re-engineering, process improvement, process innovation and business process redesign are terms usually used interchangeably to represent the phenomenon “business process change”.

Since the original implementation of the ERP systems, business and processes need to change to accommodate the upgraded ERP modules.

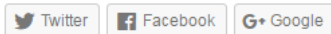
Your comments:

Please provide your comments on the following issues:

1. Please indicate the types of ERP system upgrades you are aware of.
2. Which types of ERP system upgrade (Technical, Functional, Full System) were prevalent in last 5 years.
3. Can you describe the changes in business and processes required to support the upgraded ERP system (eg. *Financial Accounting: General Ledger, Accounts Receivable, Accounts Payable, Asset Accounting, Accounting Management, Controlling, Procurement, Production (Manufacturing), Order Fulfillment (Sales and Distribution), Life-cycle data management, Material planning, Inventory and Warehouse management, Asset management and Customer Services, Human Capital Management, and Project Management*).
4. From your experience and knowledge, please elaborate on issues and problems that can arise from not changing business and processes with ERP system upgrades?
5. What benefits organisations achieve from business and process changes for ERP system upgrades?

Note: Please post your comments in the box below, titled “Leave a Reply”. For your responses to each of the questions, please use the same number as that in the question. To post your comment please add your fictitious name and your email address.

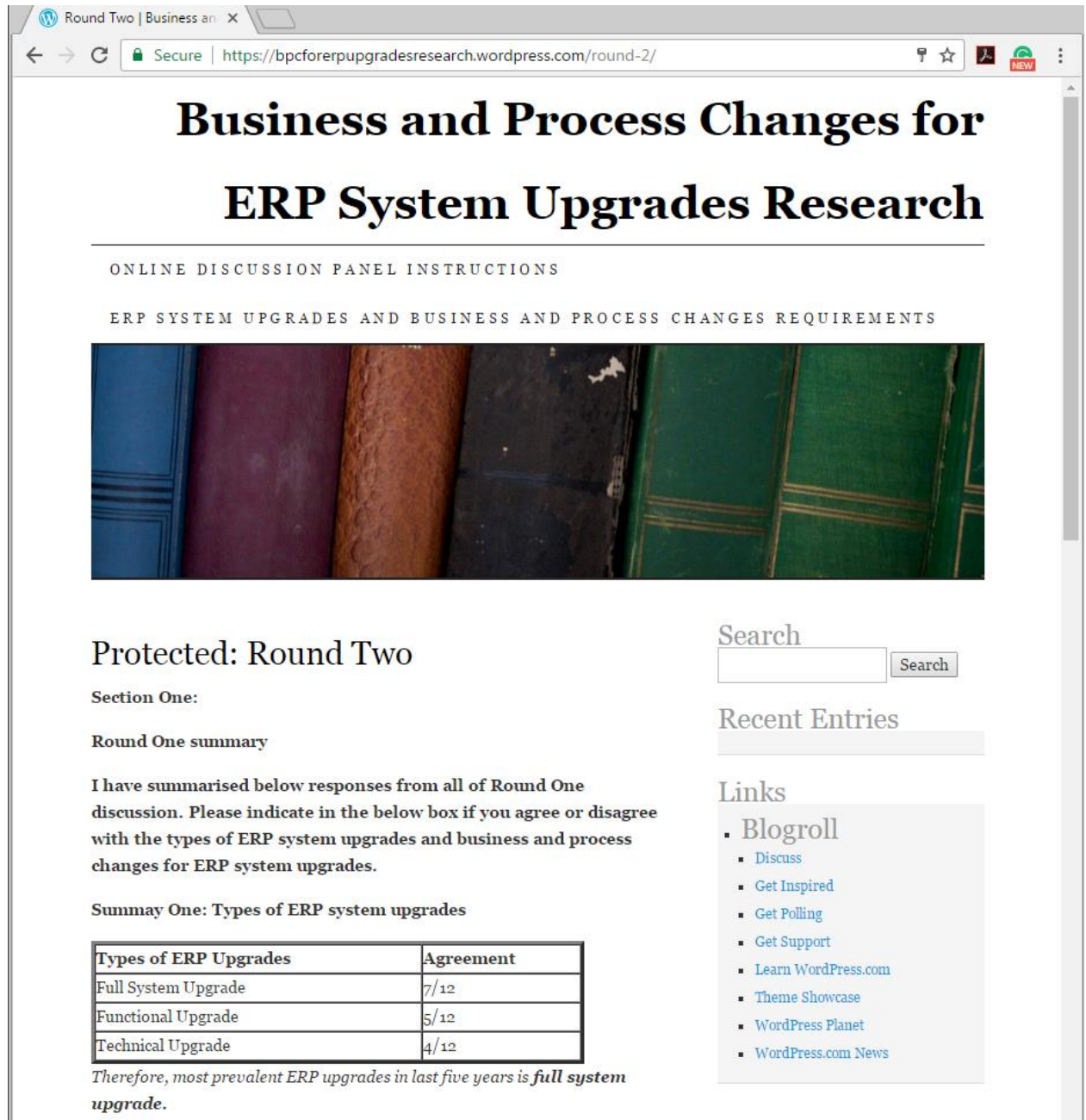
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Appendix G: The Content of the Online Discussion Panel - Round Two on Wordpress Blog.




The screenshot shows a web browser window with the URL <https://bpcforerpupgradesresearch.wordpress.com/round-2/>. The page title is "Business and Process Changes for ERP System Upgrades Research". Below the title, there are two sub-headers: "ONLINE DISCUSSION PANEL INSTRUCTIONS" and "ERP SYSTEM UPGRADES AND BUSINESS AND PROCESS CHANGES REQUIREMENTS". A photograph of several old, worn books with different colored covers (blue, purple, brown, black, green) is displayed. The main content area is titled "Protected: Round Two" and includes a "Section One:" heading. Underneath, there is a "Round One summary" section. The summary text states: "I have summarised below responses from all of Round One discussion. Please indicate in the below box if you agree or disagree with the types of ERP system upgrades and business and process changes for ERP system upgrades." Below this text is a sub-heading "Summay One: Types of ERP system upgrades" and a table with two columns: "Types of ERP Upgrades" and "Agreement". The table contains three rows: "Full System Upgrade" (7/12), "Functional Upgrade" (5/12), and "Technical Upgrade" (4/12). Below the table, the text reads: "Therefore, most prevalent ERP upgrades in last five years is **full system upgrade**." On the right side of the page, there is a search bar, a "Recent Entries" section, and a "Links" section with a "Blogroll" sub-section containing several links.

Business and Process Changes for ERP System Upgrades Research

ONLINE DISCUSSION PANEL INSTRUCTIONS

ERP SYSTEM UPGRADES AND BUSINESS AND PROCESS CHANGES REQUIREMENTS



Protected: Round Two

Section One:

Round One summary

I have summarised below responses from all of Round One discussion. Please indicate in the below box if you agree or disagree with the types of ERP system upgrades and business and process changes for ERP system upgrades.

Summay One: Types of ERP system upgrades

Types of ERP Upgrades	Agreement
Full System Upgrade	7/12
Functional Upgrade	5/12
Technical Upgrade	4/12

Therefore, most prevalent ERP upgrades in last five years is **full system upgrade**.

Search

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Summary Two: Business and process changes required for ERP system upgrades

Business and Process Changes Requirements	Agreement
Financial Accounting(<i>General Ledger, Accounts Receivable, Accounts Payable, Asset Accounting, Accounting Management</i>)	6/10
Procurement	5/10
Order Fulfillment	5/10
Controlling	4/10
Material Mangement	3/10
Human Capital Management	2/10
Logistics	2/10
Production	2/10
Fund management	1/10
Technologies (such as mobile, webpage)	1/10

Your comment: 1. Could you please give your view, and/or further comments on the overall summary findings.

Section Two:

For Round Two issue, please describe the enhanced capabilities achieved from business and process changes for ERP system upgrades. These may include

- Big data management
- Integrated resources and coordination
- Strategic decision making
- Knowledge and learning
- Implementation and change management
- Logistics and supply chain
- Other

Your comment: 2. From your experience, please provide your comments based on the above and add more where necessary.

Note: Please post your comments in the box below, titled “Leave a Reply”. For your responses to each of the questions, please use the same number as that in the question. To post your comment please add your fictitious name and your email address.



Appendix H: the Content of the Online Discussion Panel - Round Three on Wordpress Blog.

The screenshot shows a browser window with the URL <https://bpcforerpupgradesresearch.wordpress.com/round-3/>. The main heading is **Business and Process Changes for ERP System Upgrades Research**. Below the heading are sub-headings: **ONLINE DISCUSSION PANEL INSTRUCTIONS** and **ERP SYSTEM UPGRADES AND BUSINESS AND PROCESS CHANGES REQUIREMENTS**. A photograph of several old, leather-bound books is displayed. The post content includes a section titled **Protected: Round Three** with a sub-section **Section One: Round Two summary**. The text states: "I have summarised below responses from all Round Two discussion. Please indicate in the below box if you agree or disagree with the organisational capabilities enhanced from business and process changes for ERP system upgrades." Below this text is a table with two columns: **Organisational Capabilities enhancement** and **Agreement**. The table lists various capabilities and the number of agreements out of 11. To the right of the main content, there is a search bar, a 'Recent Entries' section, and a 'Links' section with a 'Blogroll' containing links to [Discuss](#), [Get Inspired](#), [Get Polling](#), [Get Support](#), [Learn WordPress.com](#), [Theme Showcase](#), [WordPress Planet](#), and [WordPress.com News](#).

Organisational Capabilities enhancement	Agreement
Strategic decision making	6/11
Integrated resources and coordination	6/11
Big data management	4/11
Knowledge and learning	3/11
Implementation and change management	3/11
Audit Information System	2/11
Logistics and Supply Chain	1/11
Fund Management	1/11

1. Please confirm that you agree with the above and add more if required.

Section Two:

Productivity improvement achieved from organisational capabilities that are outcomes of business and process changes for ERP system upgrades.

- Improved management decision making from a better access to larger volumes of data
- Improved security management of information
- Better customer and partner relationship management
- A competitive advantage
- Improved collaboration within organisation and with business partners
- A better e-business support
- Increased market share
- Global markets
- Other

Your comments:

2. From your experience, please provide your comments based on the above and add more.

3. Can you please briefly explain the relationship between organisational capabilities and productivity improvement you listed above. (for example, 1. strategic decision making leads to Global markets, Increased market share, and Competitive advantage. or 2. Integrated resources and coordination leads to Improve collaboration with in organisation and with business partners, a better e-business support and better customer and partner relationship management, 3. Big data management leads to Improved management decision making from a better access to larger volumes of data and improved security management of information, 4. Audit Information System leads to Improved security management of information, etc.)

Note: Please post your comments in the box below, titled “Leave a Reply”. For your responses to each of the questions, please use the same number as that in the question. To post your comment please add your fictitious name and your email address.

Appendix I: Plain Language Statement (the Proposed Participant Information Sheet and Consent Form in English Language)



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Information Technology & Logistics
Building 80, Level 9
445 Swanston Street Victoria, Australia
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Australia
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www.rmit.edu.au

Invitation to Participate in a Research Project

Project Information Statement

Project Title: ERP system upgrades: The impact of ERP system upgrades on business changes and organisational capabilities; a view from the Thailand Business context

Investigators:

- Ruchada Paradonsaree, (PhD candidature, Collage of Business, School of IT and Logistics, RMIT University, ruchada.paradonsaree@rmit.edu.au)
- Professor Mohini Singh, (Principal supervisor, Collage of Business, School of IT and Logistics, RMIT University, mohini.singh@rmit.edu.au)
- Associate Professor Victor Gekara, (Second supervisor, Collage of Business, School of IT and Logistics, RMIT University, victor.gekara@rmit.edu.au)

Dear Sir/ Madam,

I invite you to participate in my research project, which is part of my PhD degree at RMIT University under the supervision of Professor Mohini Singh and Associate Professor Victor Gekara. Kindly read this information sheet which describes the project, and understand its contents before deciding to participate. If you have any questions about the project, please contact one of the investigators above.

What is the project about? What are the questions being addressed?

The aim of this research is to understand business process changes required for ERP system upgrades due to which organisational capabilities are enhanced leading to improved productivity.

Why have you been approached?

You are approached because you have experience in the area of the ERP system upgrades. Your participation will provide useful insight into issues pertaining to business process changes required for ERP system upgrades. The findings of the research are expected to add to the knowledge on ERP system upgrades, enhanced capabilities, and productivity improvements. If you were interested in the findings, on completion of this project a summary of the findings will be sent to you.

If I agree to participate, what will I be required to do?

If you agree to participate in this research project, you will be interviewed on a set of issues on ERP system upgrades, resulting organisational capabilities and productivity improvements achieved from ERP system upgrades. Each interview will take around 45 minutes to be conducted at a time and location convenient to you. You will be given the opportunity to review your responses before it is considered for analysis.

What are the risks or disadvantages associated with participation?

Your participation in this research is voluntary and there are no perceived risks associated with it. If you are concerned about your responses to any of the issues in any of the discussion rounds, you may opt to withdraw at any time. Information collected will be kept confidential and participant's anonymity will be ensured at all times. The results of the data collected will be analysed for the completion of my PhD thesis only.

What are the benefits associated with participation?

ERP systems are now being upgraded by organisations to renew technology to meet the demands of new business challenges. However, merely upgrading an ERP system does not guarantee success, establishing how they enhance organisational capabilities that will result in improved productivity is essential. Since issues of ERP system upgrades are not very well known to date, your support will help accomplish new issues that can prove to be useful for your organisation as well.

What will happen to the information I provide?

Your responses to the interview questions will be analysed for my PhD thesis and may appear in some academic publications in a manner that will neither identify you, nor your organisation. Research reporting will ensure anonymity. The data will be retained by RMIT University for five years upon completion of the project after which time paper records will be shredded and placed in a security recycle bin and electronic data will be deleted/destroyed in a secure manner. All data will be kept in a locked filing cabinet or password protected computer in the School of Business IT and Logistics, RMIT University in Australia. Data will be saved on the University network system where practicable. Only the investigator and her supervisor will have access to the data.

Any information that you provide can be disclosed only if (1) it is to protect you or others from harm, (2) a court order is produced, or (3) you provide the researchers with written permission.

What are my rights as a participant?

The right to withdraw from participation at any time.

The right to request that any recording cease at any time during the interview.

The right to have any unprocessed data withdrawn and destroyed, provided it can be reliably identified, and provided that so doing does not increase the risk for the participant.

The right to be de-identified in any photographs intended for public publication, before the point of publication.

The right to have any questions answered at any time.

Whom should I contact if I have any questions?

If you have any queries regarding this project please contact:

Ruchada Paradonsaree, email: ruchada.paradonsaree@rmit.edu.au, phone +61 3 9925 5403.

My supervisors:

Professor Mohini Singh, email: mohini.singh@rmit.edu.au, phone +61 3 99253155.

Associate Professor Victor Gekara, email: victor.gekara@rmit.edu.au, phone +61 3 99255550.

The RMIT Human Research Ethics Committee phone +61 3 9925 2251, email: human.ethics@rmit.edu.au.

What other issues should I be aware of before deciding whether to participate?

There are no other issues that you should be aware of as a participant.

Thank you very much for your support to my research project.

Yours Sincerely,

Ruchada Paradonsaree

PhD candidature, School of Business Information Technology and Logistics

RMIT University

Tel: + (61 3) 9925 5403

Fax: + (61 3) 9925 5850

Email: ruchada.paradonsaree@rmit.edu.au

If you have any concerns about your participation in this project, which you do not wish to discuss with the researchers, then you can contact the Ethics Officer, Research Integrity, Governance and Systems, RMIT University, GPO Box 2476V VIC 3001. Tel: (03) 9925 2251 or email human.ethics@rmit.edu.au

Appendix J: Consent Form (in English Language)

**CONSENT FORM
RMIT HUMAN RESEARCH ETHICS COMMITTEE**

COLLEGE	Business
SCHOOL	IT and Logistics
Name of participant	
Project title	ERP system upgrades: The impact of ERP system upgrades on business changes and organisational capabilities; a view from the Thailand Business context
Name of investigator	Ruchada Paradonsaree, email: ruchada.paradonsaree@rmit.edu.au , phone +61 3 9925 5403. Professor Mohini Singh, email: mohini.singh@rmit.edu.au , phone +61 3 9925 1355. Associate Professor Victor Gekara, email: victor.gekara@rmit.edu.au , phone +61 3 9925 5550.

1. I have had the project explained to me, and I have read the information sheet
2. I agree to participate in the research project as described
3. I agree to be interviewed
4. I agree that my voice will be audio recorded
5. I acknowledge that:
 - (a) I understand that my participation is voluntary and that I am free to withdraw from the project at any time and to withdraw any unprocessed data previously supplied (unless follow-up is needed for safety).
 - (b) The project is for the purpose of research. It may not be of direct benefit to me.
 - (c) The privacy of the personal information I provide will be safeguarded and only disclosed where I have consented to the disclosure or as required by law.
 - (d) The security of the research data will be protected during and after completion of the study. The data collected during the study may be published, and a report of the project outcomes will be provided to (researcher to specify). Any information which will identify me will not be used.

Participant's Consent

Participant : _____ Date: _____
(Signature)

If you have any concerns about your participation in this project, which you do not wish to discuss with the researchers, then you can contact the Ethics Officer, Research Integrity, Governance and Systems, RMIT University, GPO Box 2476V VIC 3001. Tel: (03) 9925 2251 or email human.ethics@rmit.edu.au

Appendix K: Plain Language Statement (the Proposed Participant Information Sheet and Consent Form in Thai Language)



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หนังสือเชิญเข้าร่วมโครงการวิจัย (Invitation to Participate in a Research Project)

รายละเอียดโครงการ (Project Information Statement)

ชื่อโครงการ: (Project Title)

การปรับปรุงเพิ่มประสิทธิภาพระบบ ERP: ผลสะท้อนของการปรับปรุงเพิ่มประสิทธิภาพระบบ ERP ต่อการเปลี่ยนแปลงทางธุรกิจและความสามารถขององค์กร; มุมมองจากบริบททางธุรกิจในประเทศไทย

(ERP system upgrades: The impact of ERP system upgrades on business changes and organisational capabilities; a view from the Thailand Business context)

คณะผู้วิจัย (Investigators):

- Ruchada Paradonsaree, (PhD candidate, School of Business, IT and Logistics, RMIT University, ruchada.paradonsaree@rmit.edu.au)
- Professor Mohini Singh, (Principal supervisor, School of Business, IT and Logistics, RMIT University, mohini.singh@rmit.edu.au)
- Associate Professor Victor Gekara, (Second supervisor, School of Business, IT and Logistics, RMIT University, victor.gekara@rmit.edu.au)

เรียน ท่านผู้มีส่วนร่วมในงานวิจัย

ท่านได้รับเชิญให้มีส่วนร่วมในงานวิจัยซึ่งเป็นงานส่วนหนึ่งของการศึกษาด้านปริญญาเอกดำเนินการโดย RMIT University ภายใต้การให้คำปรึกษาของ Professor Mohini Singh and Associate Professor Victor Gekara

เอกสารฉบับนี้อธิบายถึงภาพรวมของงานวิจัยและสิทธิ์ของท่านในการให้ข้อมูลสำหรับงานวิจัย กรุณาอ่านคำชี้แจงโดยละเอียดก่อนตัดสินใจเข้าร่วมกับงานวิจัยครั้งนี้ หากท่านมีข้อสงสัยเกี่ยวกับงานวิจัย กรุณาติดต่อนักวิจัยตามรายละเอียดข้างต้น

งานวิจัยนี้เกี่ยวกับอะไร?

วัตถุประสงค์ของงานวิจัยนี้คือ การทำความเข้าใจเกี่ยวกับความต้องการทำการเปลี่ยนแปลงกระบวนการทำงานทางด้านธุรกิจสำหรับการทำการปรับปรุงเพิ่มประสิทธิภาพระบบ ERP ซึ่งทำให้เกิดการเพิ่มประสิทธิภาพการทำงานขององค์กรและนำไปสู่การปรับปรุงประสิทธิผลขององค์กร

ในการศึกษาจะใช้การสัมภาษณ์ผู้บริหารระดับกลางและระดับสูงที่เกี่ยวข้องกับโครงการการปรับปรุงเพิ่มประสิทธิภาพระบบ ERP ในองค์กรของท่าน จำนวน 6 คน ได้แก่ ผู้จัดการโครงการปรับปรุงเพิ่มประสิทธิภาพระบบ ERP (ERP system upgrade Project Manager), ผู้บริหารฝ่ายการเงินและการบัญชี (Financial Accounting Manager), ผู้บริหารฝ่ายจัดซื้อและพัสดุ (Procurement Manager), ผู้บริหารด้านการตลาดและจัดจำหน่าย (Sales & Distribution Manager), ผู้บริหารด้านเทคโนโลยีสารสนเทศ (IT Manager), ผู้บริหารด้านบริหารทรัพยากรบุคคล (Human Resources Manager) และ ผู้บริหารแผนกอื่นที่มีส่วนเกี่ยวข้องกับโครงการปรับปรุงเพิ่มประสิทธิภาพระบบ ERP ในการสัมภาษณ์จะเก็บข้อมูลเกี่ยวกับประสบการณ์ในโครงการปรับปรุงเพิ่มประสิทธิภาพระบบ ERP ที่นำมาใช้ในองค์กร

ทำไมท่านจึงได้รับการทาบทามให้เข้าร่วมงานวิจัยนี้ ?

ท่านได้รับการติดต่อทาบทามเพื่อเข้าร่วมงานวิจัยเนื่องจากท่านมีประสบการณ์เกี่ยวกับการปรับปรุงเพิ่มประสิทธิภาพระบบ ERP โดยองค์กรของท่านได้แนะนำให้ท่านเข้าร่วมโครงการงานวิจัย ด้วยเหตุผลที่ท่านมีคุณสมบัติเหมาะสมในการให้ข้อมูลเกี่ยวกับการปรับปรุงเพิ่มประสิทธิภาพระบบ ERP ที่องค์กรของท่านได้มีการจัดดำเนินการในช่วงเวลาที่ผ่านมา และท่านได้มีส่วนร่วมกับขั้นตอนดำเนินการปรับปรุงเพิ่มประสิทธิภาพระบบ ERP

การเข้ามามีส่วนร่วมในโครงการวิจัยนี้จะช่วยให้ข้อมูลที่มีประโยชน์สำหรับประเด็นต่างๆ ที่เกี่ยวข้องกับความต้องการปรับเปลี่ยนกระบวนการทำงานไปพร้อมกับการปรับปรุงเพิ่มประสิทธิภาพระบบ ERP นอกจากนี้ ผลสรุปจากงานวิจัยโครงการนี้มีความหวังในการเพิ่มความรู้อาสาสมัครด้านการปรับปรุงเพิ่มประสิทธิภาพระบบ ERP รวมถึงการเพิ่มพูนประสิทธิภาพการทำงานขององค์กรและการปรับปรุงประสิทธิผลที่ดีขึ้นขององค์กร ในกรณีที่ท่านมีความสนใจในผลการวิจัยของโครงการนี้ เมื่อโครงการนี้ดำเนินการจนแล้วเสร็จ ผู้วิจัยจะนำส่งผลสรุปผลงานการวิจัยโครงการนี้ตามความต้องการของท่าน

หากท่านตกลงที่จะเข้าร่วมกับงานวิจัย ท่านจะต้องทำอะไรบ้าง ?

ถ้าท่านตกลงที่จะเข้าร่วมกับงานวิจัยนี้ ท่านจะถูกสัมภาษณ์เกี่ยวกับการปรับปรุงเพิ่มประสิทธิภาพระบบ ERP ที่ส่งผลให้เกิดการเพิ่มประสิทธิภาพการทำงานขององค์กรและการปรับปรุงประสิทธิผลที่ดีขึ้นขององค์กร ในองค์กรของท่าน การสัมภาษณ์จะใช้เวลา 45-60 นาทีโดยประมาณตามเวลาและสถานที่ที่ท่านสะดวกในการให้สัมภาษณ์

ในการเริ่มต้นการสัมภาษณ์ ผู้สัมภาษณ์จะอธิบายเป้าหมายและวัตถุประสงค์ของโครงการวิจัย และขั้นตอนการสัมภาษณ์ ณ เวลานั้น ท่านได้รับโอกาสในการซักถามคำถาม หรือในกรณีที่มีความจำเป็นที่ทำให้ท่านรู้สึกไม่สะดวกสบายกับขั้นตอนการสัมภาษณ์ ท่านสามารถยกเลิกการให้สัมภาษณ์ได้ นอกจากนี้ ผู้สัมภาษณ์จะนำเสนอแบบฟอร์มแสดงความยินยอม (Consent Form) ในการให้ข้อมูลกับงานวิจัยเพื่อท่านลงนามและยินยอมที่จะให้ทำการบันทึกการสัมภาษณ์ด้วยเครื่องบันทึกเสียง ระหว่างดำเนินการสัมภาษณ์ ผู้สัมภาษณ์จะสอบถามท่านด้วยชุดคำถามและตามด้วยคำถามอื่นๆ เพิ่มเติมที่ครอบคลุมเกี่ยวกับหัวข้อการวิจัยและการหารือ ท่านได้รับสิทธิในการปฏิเสธที่จะตอบคำถามบางคำถาม ทั้งนี้ ท่านสามารถถอนตัว หรือปฏิเสธการตอบคำถามที่ท่านไม่ต้องการ หรือให้หยุดการบันทึกเทปได้ตลอดช่วงการสัมภาษณ์ นอกจากนี้ท่านยังสามารถสอบถามเกี่ยวกับงานวิจัยได้ตลอดเวลา ท่านได้รับสิทธิในการตรวจสอบความถูกต้องของข้อมูลภายหลังการสัมภาษณ์ทางจดหมายอิเล็กทรอนิกส์ (e-mail) คณะผู้วิจัยยินดีเป็นอย่างยิ่ง หากท่านต้องการตรวจสอบบทสัมภาษณ์ก่อนที่จะถูกนำไปวิเคราะห์ข้อมูล

ในการเข้าร่วมงานวิจัยนี้ จะมีความเสี่ยงหรือข้อเสียอะไร ?

การเข้าร่วมโครงการวิจัยของท่านเป็นไปตามความสมัครใจและไม่มีผลกระทบและความเสี่ยงในการเข้าร่วมโครงการครั้งนี้ การสัมภาษณ์ของโครงการวิจัยนี้ไม่มีการสัมภาษณ์ถึงข้อมูลส่วนตัวและข้อมูลสำคัญทางด้านธุรกิจ ท่านจะถูกสัมภาษณ์และหารือเกี่ยวกับขั้นตอนการทำงานออฟเกรดระบบ ERP และประโยชน์ที่ได้รับจากการอัปเดตระบบนี้ตามประสบการณ์ที่เกิดขึ้นในองค์กรของท่าน กรณีที่ท่านไม่สะดวกที่จะตอบคำถามใดๆ ท่านสามารถปฏิเสธในการตอบคำถามหรือจะยกเลิกการสัมภาษณ์ได้ตลอดเวลา ข้อมูลที่ได้จากการเก็บข้อมูลครั้งนี้จะถูกเก็บเป็นความลับ รวมถึงรายละเอียดของผู้เข้าร่วมโครงการจะถูกเก็บเป็นความลับตลอดเวลาเช่นกัน ผลที่ได้จากการเก็บข้อมูลจะนำไปวิเคราะห์เพื่อการศึกษาโครงการวิจัยปริญญาเอกของผู้วิจัยเท่านั้น

ในการมีส่วนร่วมกับการงานวิจัยนี้ จะได้ประโยชน์อะไร ?

ในปัจจุบัน องค์กรต่างๆ ได้ทำการปรับปรุงประสิทธิภาพระบบ ERP เพื่อที่เน้นการปรับปรุงทางด้านเทคโนโลยีให้สามารถรองรับความต้องการสำหรับการดำเนินการทางด้านธุรกิจรูปแบบใหม่ๆ อย่างไรก็ตาม การทำการปรับปรุงประสิทธิภาพระบบ ERP ไม่ได้ยืนยันความสำเร็จเสมอไป ทั้งนี้ การปรับปรุงประสิทธิภาพระบบ ERP ที่นำไปสู่การเพิ่มความสามารถในการดำเนินงานขององค์กรและส่งผลให้เกิดการปรับปรุงประสิทธิผลขององค์กรที่ดีขึ้นนับเป็นสิ่งสำคัญอย่างยิ่ง ถึงแม้ว่าเรื่องการปรับปรุงระบบ ERP ไม่ค่อยเป็นที่รู้จักมากนักในปัจจุบัน การมีส่วนร่วมของท่านในโครงการศึกษาวิจัยนี้จะช่วยให้บรรลุผลในการวิจัยรวมถึงเป็นการพิสูจน์ให้เห็นว่าองค์กรของท่านได้รับประโยชน์จากการปรับปรุงระบบ ERP เช่นกัน

การที่ท่านเข้ามามีส่วนร่วมในโครงการวิจัยนี้ส่งผลให้เกิดประโยชน์ในการสร้างความเข้าใจถึงขั้นตอน และประโยชน์ที่ได้รับจากการปรับปรุงประสิทธิภาพของระบบ ERP นับตั้งแต่ที่องค์กรของท่าน ดำเนินการปรับปรุงประสิทธิภาพระบบ ERP คณะผู้วิจัยมีความหวังว่าท่านจะได้รับประโยชน์จาก ผลการวิจัยนี้ นอกจากนี้ สิ่งที่ได้ทำการพัฒนาขึ้นซึ่งเป็นส่วนหนึ่งของการศึกษาวิจัยนี้อาจจะเกิด ประโยชน์ต่อวงการธุรกิจอย่างกว้างขวางและคณะผู้วิจัยมีความหวังว่าผลการศึกษานี้จะนำ ประโยชน์ให้กับวงการธุรกิจในสากล

อะไรจะเกิดขึ้นกับข้อมูลที่ท่านให้ไว้กับงานวิจัย?

ข้อมูลการให้สัมภาษณ์ของท่านจะนำไปทำการวิเคราะห์ข้อมูลสำหรับการจัดปริญญาเอกนิพนธ์ของ ผู้วิจัยและอาจจะปรากฏในเอกสารเผยแพร่ทางด้านวิชาการซึ่งจะไม่มีมีการขอความระบุงถึงตัวท่านหรือ องค์กรของท่าน การรายงานงานวิจัยนี้รับรองการปกปิดและไม่มีมีการเปิดเผยชื่อของผู้ร่วมโครงการวิจัย ข้อมูลสำหรับงานวิจัยนี้จะถูกเก็บรักษาโดยมหาวิทยาลัยอาร์เอ็มไอทีเป็นเวลา 5 ปี หลังจากโครงการนี้ เสร็จสิ้นลง ต่อจากนั้นเอกสารของโครงการที่เป็นกระดาษจะถูกทำลายและทิ้งในภาชนะที่มีการรักษา ความปลอดภัยและข้อมูลทางด้านอิเล็กทรอนิกส์จะถูกทำลายในลักษณะของการรักษาความปลอดภัย ข้อมูลทั้งหมดของการวิจัยจะถูกเก็บรักษาในสถานที่ที่ปิดและรักษาความปลอดภัย หรือ เครื่อง คอมพิวเตอร์ที่มีใช้รหัสผ่านเพื่อรักษาความปลอดภัยของคณะธุรกิจเทคโนโลยีสารสนเทศและลจิสติกส์ มหาวิทยาลัยอาร์เอ็มไอที ประเทศออสเตรเลีย ข้อมูลจะถูกเก็บรักษาในระบบเครือข่ายของ มหาวิทยาลัยตามข้อปฏิบัติของมหาวิทยาลัย ข้อมูลการติดต่อและข้อมูลจากการสัมภาษณ์จะถูกเก็บ เป็นความลับ เฉพาะคณะผู้วิจัยเท่านั้นสามารถเข้าถึงข้อมูลได้ ข้อมูลทุกอย่างจะถูกเปิดเผยได้ ในกรณี (1) ข้อมูลนั้นสามารถปกป้องท่านและบริษัทของท่านจาก ความเสียหายใดๆ (2) คำสั่งศาล หรือ (3) ท่านอนุญาตให้คณะผู้วิจัยเปิดเผยข้อมูลได้

สิทธิของท่านคืออะไรในการเป็นผู้เข้าร่วมโครงการวิจัยนี้?

สิทธิในการยกเลิกการเข้าร่วมโครงการได้ตลอดเวลา

สิทธิในการขอหยุดการบันทึกข้อมูลได้ในระหว่างการให้สัมภาษณ์

สิทธิในการขอให้ยกเลิกหรือทำลายข้อมูลที่ยังมิได้ประมวลผล การจัดหา/การให้/การเตรียมข้อมูลที่ สามารถจะระบุความน่าเชื่อถือได้, และการจัดการที่ไม่ก่อให้เกิดความเสี่ยงสำหรับผู้ร่วมโครงการวิจัย นี้

สิทธิในการป้องกันอัตลักษณ์ของท่าน สำหรับรูปภาพใดๆ ก่อนที่จะนำไปเผยแพร่ในที่สาธารณะ

สิทธิในการที่จะสอบถามคำถามได้ตลอดเวลา

ท่านสามารถติดต่อใครได้บ้าง กรณีที่ท่านมีคำถามสำหรับโครงการวิจัยนี้?

ในกรณีที่ท่านมีคำถามสำหรับโครงการวิจัยนี้ ท่านสามารถติดต่อบุคคลตามรายละเอียดด้านล่างนี้:

Appendices

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My supervisors:

Professor Mohini Singh, email: mohini.singh@rmit.edu.au, phone +61 3 99253155.

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The RMIT Human Research Ethics Committee phone +61 3 9925 2251, email: human.ethics@rmit.edu.au

มีรายละเอียดอื่น ๆ อีกหรือไม่ที่ท่านต้องทราบก่อนที่จะตัดสินใจในการมีส่วนร่วมในโครงการ?

ไม่มีรายละเอียดอื่นใด นอกเหนือจากรายละเอียดข้างต้นสำหรับท่านที่ต้องทราบสำหรับการเป็นผู้ร่วมในโครงการวิจัยนี้

ขอขอบพระคุณเป็นอย่างสูง ที่ท่านให้ความกรุณาข้อมูลอันเป็นประโยชน์ต่องานวิจัยครั้งนี้
ขอแสดงความเคารพอย่างสูง

นางสาวรัชดา ภาตราตรี

นักศึกษาปริญญาเอก คณะธุรกิจเทคโนโลยีสารสนเทศและโลจิสติกส์

มหาวิทยาลัย อาร์เอ็มไอที เมืองเมลเบิร์น ประเทศออสเตรเลีย

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งานวิจัยนี้ได้รับการรับรองจากคณะกรรมการด้านจรรยาบรรณงานวิจัยของ RMIT University หากท่านมีข้อสงสัยหรือต้องการร้องเรียนเกี่ยวกับงานวิจัยนี้ ท่านสามารถแจ้งมาได้ที่: Ethics Officer, Research Integrity, Governance and Systems, RMIT University, GPO Box 2476V VIC 3001. Tel: (03) 9925 2251 or email human.ethics@rmit.edu.au

Appendix L: Consent Form (in English Language)

**แบบฟอร์มความยินยอม (CONSENT FORM)
คณะกรรมการด้านจรรยาบรรณงานวิจัยของ RMIT University**

คณะ	ธุรกิจ
สาขา	เทคโนโลยีสารสนเทศและลอจิสติกส์
ชื่อผู้ร่วมโครงการ	
ชื่อโครงการ	การปรับปรุงเพิ่มประสิทธิภาพระบบ ERP: ผลสะท้อนของการปรับปรุงเพิ่มประสิทธิภาพระบบ ERP ต่อการเปลี่ยนแปลงทางธุรกิจและความสามารถขององค์กร; มุมมองจากบริบททางธุรกิจในประเทศไทย (ERP system upgrades: The impact of ERP system upgrades on business changes and organisational capabilities; a view from the Thailand Business context)
รายชื่อคณะผู้วิจัย	Ruchada Paradonsaree, email: ruchada.paradonsaree@mit.edu.au , phone +61 3 9925 5403. Professor Mohini Singh, email: mohini.singh@mit.edu.au , phone +61 3 9925 1355. Associate Professor Victor Gekara, email: victor.gekara@mit.edu.au , phone +61 3 9925 5550.

1. ผู้ศึกษาวิจัยได้อธิบายโครงการวิจัยให้ข้าพเจ้าได้รับทราบ และ ข้าพเจ้าได้อ่านเอกสารรายละเอียดโครงการแล้ว
 2. ข้าพเจ้ายินดีมีส่วนร่วมในโครงการวิจัยตามที่ได้ทราบคำอธิบายของโครงการวิจัย
 3. ข้าพเจ้ายินดีที่ให้คำสัมภาษณ์
 4. ข้าพเจ้ายินดีที่ให้บันทึกเสียงคำสัมภาษณ์
 5. ข้าพเจ้ารับทราบว่า
- (ก) ข้าพเจ้ามีความเข้าใจว่าการเข้าร่วมโครงการวิจัยของข้าพเจ้าเป็นไปด้วยความสมัครใจ และข้าพเจ้าสามารถที่จะยกเลิกการเข้าร่วมโครงการวิจัยได้ตลอดเวลา รวมถึงยกเลิกข้อมูลที่ข้าพเจ้าได้ให้ไปและยังไม่ได้ทำการวิเคราะห์ (รวมถึงการติดตามว่าข้อมูลได้รับการเก็บรักษาอย่างปลอดภัย)
- (ข) โครงการวิจัยมีวัตถุประสงค์เพื่อการวิจัย ซึ่งอาจจะไม่มีผลประโยชน์โดยตรงกับข้าพเจ้า
- (ค) ข้อมูลส่วนตัวของข้าพเจ้าที่ข้าพเจ้าได้ให้กับผู้วิจัยนั้นจะถูกเก็บรักษาเป็นอย่างดีและสามารถเปิดเผยได้เฉพาะในที่ข้าพเจ้ายินยอมที่จะให้เปิดเผยหรือตามคำสั่งของกฎหมายเท่านั้น
- (ง) การรักษาความปลอดภัยของข้อมูลวิจัยจะถูกรักษาระหว่างและหลังจากการจบการศึกษาของผู้วิจัย ข้อมูลที่ดำเนินการเก็บรวบรวมระหว่างการศึกษานี้จะมีการเผยแพร่ และ จัดทำรายงานเพื่อสรุปผลการศึกษาวินิจฉัยซึ่งจะนำเสนอต่อ..... (กรอกรายละเอียดโดยผู้วิจัย) ข้อมูลใดๆ ที่จะบ่งบอกเกี่ยวกับข้าพเจ้าจะไม่ถูกนำไปใช้

ชื่อ-นามสกุล: _____ วันที่: _____
(ลายมือชื่อ-นามสกุล)

หากท่านมีข้อสงสัยเกี่ยวกับการร่วมโครงการวิจัยนี้ โดยที่ท่านไม่ประสงค์จะหารือกับคณะวิจัย ท่านสามารถแจ้งมาได้ที่:
Ethics Officer, Research Integrity, Governance and Systems, RMIT University, GPO Box 2476V VIC 3001. Tel: (03) 9925 2251
or email human.ethics@mit.edu.au

Appendix M: Interview Tool (in English Language)

Interview Questions

ERP system upgrades: The impact of ERP system upgrades on business changes and organisational capabilities; a view from the Thailand Business context

Organisation profile:

Organisation name:

Address:

.....

.....

.....

Interviewee name:

Position:

Date of interview:

Place:

Language:

Number of years in

present position:

Number of years with

the company

Company Data

1. What is the country of ownership of your company?

2. Is your company Independent Subsidiary Joint venture
 Multinational Corporation Other

3. Industry Classification

4. What is the approximate number of employees in your organisation?

5. When was initial ERP system implemented in your organisation?

6. Which ERP system was this?

7. Which version of ERP system was initially implemented in your organisation?
.....

8. When was the ERP system upgraded?

9. What is the upgraded ERP version?

10. Who is the provider of this upgraded ERP system?

11. ERP modules used in your organisation

.....
.....
.....
.....
.....
.....

1. ERP system upgrades

1. What type of ERP system upgrade was undertaken in your organisation?

- Full system upgrade Functional upgrade Technical upgrade

.....
.....
.....

2. Why did the organisation adopt this type of ERP system upgrade?

.....
.....
.....
.....
.....
.....
.....

3. Please provide reasons for ERP system upgrade in your organisation?

.....
.....
.....
.....
.....
.....
.....
.....
.....

(a) Who were involved with ERP system upgrade in your organisation?

.....
.....
.....
.....

(b) What was their role in the ERP system upgrade?

.....
.....
.....
.....

4. (a) What were the major requirements for ERP system upgrade in your organisation?

.....
.....
.....
.....
.....
.....
.....

(b) Was business process changes a requirement for the ERP system upgrade in your organisation?

.....
.....
.....

2. Business Process changes for ERP system upgrades

Business processes are a set of logically related tasks that use resources of an organisation to achieve a defined business outcome.

1) What business process changes were undertaken with ERP system upgrades in your organisation?

- | | | |
|---|---|--|
| <input type="checkbox"/> Financial Accounting | <input type="checkbox"/> Procurement | <input type="checkbox"/> Order fulfilment |
| <input type="checkbox"/> Account Controlling | <input type="checkbox"/> Logistics | <input type="checkbox"/> Material Management |
| <input type="checkbox"/> Human Capital Management | <input type="checkbox"/> Fund management | <input type="checkbox"/> Manufacturing |
| <input type="checkbox"/> Asset Management | <input type="checkbox"/> Customer Relationship Management | <input type="checkbox"/> Supply Chain Management |
| <input type="checkbox"/> Others | | <input type="checkbox"/> No business process changes |
| | | |

2) If no business process changed with ERP system upgrades, can you explain how the existing processes migrated to ERP modules with greater capabilities?

.....
.....
.....
.....
.....
.....
.....

3) Why was the change in each of the business process required for the upgraded ERP?

.....
.....
.....
.....
.....
.....
.....

3. Organisational capabilities

1. From the upgraded ERP system what has your organisation achieved?

.....
.....
.....
.....

For example:

Integration and coordination of data from different processes	<input type="checkbox"/>
Larger volumes of data management	<input type="checkbox"/>
Greater data visibility	<input type="checkbox"/>
Advanced data analytics	<input type="checkbox"/>
Knowledge management	<input type="checkbox"/>
Knowledge sharing	<input type="checkbox"/>
Organisational learning	<input type="checkbox"/>
Improved inventory management	<input type="checkbox"/>
Better Information management	<input type="checkbox"/>
Budget control management	<input type="checkbox"/>
E-businesses innovation	<input type="checkbox"/>
Business efficiencies	<input type="checkbox"/>
Improved product quality	<input type="checkbox"/>
Innovation	<input type="checkbox"/>
Strategic decision making	<input type="checkbox"/>
Others	<input type="checkbox"/>
.....	

2. Please explain the level of change
 (e.g. knowledge sharing – how has this capability enhanced with ERP system upgrades?, based on which process?, between how many employees, business partners, government?, other))

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4. Productivity Improvement

1. From the upgraded ERP system can you explain which productivity improvements have been achieved by your organisation?

Productivity improvement	By how much/Justification
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Productivity improvement	By how much/Justification
.....
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.....
.....

Appendix N: Interview Tool (in Thai Language)

คำถามการสัมภาษณ์ (Interview Questions)

การปรับปรุงเพิ่มประสิทธิภาพระบบ ERP: ผลสะท้อนของการปรับปรุงเพิ่มประสิทธิภาพระบบ ERP ต่อการเปลี่ยนแปลงทางธุรกิจและความสามารถขององค์กร; มุมมองจากบริบททางธุรกิจในประเทศไทย

ข้อมูลขององค์กร

ชื่อองค์กร:

ที่อยู่:

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ชื่อผู้ให้สัมภาษณ์:

ตำแหน่ง:

วันที่สัมภาษณ์:

สถานที่สัมภาษณ์:

ภาษาที่ใช้สัมภาษณ์:

ระยะเวลาที่ดำรงในตำแหน่ง

ปัจจุบัน:

ระยะเวลาที่ทำงานในองค์กร

แห่งนี้

ข้อมูลทั่วไปของบริษัท (Company Data)

1. เจ้าของกิจการองค์กรของท่านคือประเทศอะไร?

2. องค์กรของท่านคือ
- องค์กรอิสระ (Independent) บริษัทสาขา (Subsidiary) บริษัทร่วมทุน (Joint venture)
 - บริษัทข้ามชาติ (Multinational Corporation) อื่นๆ

3. องค์กรของท่านอยู่ในธุรกิจ/อุตสาหกรรมใด?

4. องค์กรของท่านมีจำนวนบุคลากรจำนวนกี่คน?

5. องค์กรของท่านเริ่มใช้ระบบ ERP ครั้งแรกเมื่อปีไหน?

6. องค์กรของท่านใช้ระบบ ERP ยี่ห้ออะไร?

7. ระบบ ERP รุ่นแรกที่องค์กรของท่านใช้คือรุ่นใด?

8. องค์กรของท่านดำเนินการปรับปรุงเพิ่มประสิทธิภาพระบบ ERP เมื่อไหร่?

9. องค์กรของท่านปรับปรุงระบบ ERP เป็นรุ่นใด?

10. องค์การของท่านดำเนินการอัปเดตระบบ ERP ของยี่ห้อใด?
11. องค์การของท่านใช้ระบบงาน ERP (โมดูล) อะไรบ้าง?
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หัวข้อ 1: การเพิ่มประสิทธิภาพระบบ ERP (ERP system upgrades)

1. กรุณาระบุประเภทของการเพิ่มประสิทธิภาพของระบบ ERP ที่ดำเนินการในองค์การของท่าน?
 - การเพิ่มประสิทธิภาพโดยรวมทั้งระบบ รวมถึงการเพิ่มโมดูลใหม่ๆ สำหรับใช้งานในองค์การ
 - การเพิ่มประสิทธิภาพทางด้านฟังก์ชันของระบบ
 - การเพิ่มประสิทธิภาพเฉพาะด้านเทคนิค.....
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.....
2. กรุณาอธิบายเหตุผลที่องค์การของท่านเลือกการเพิ่มประสิทธิภาพระบบ ERP ประเภทนี้?
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3. กรุณาอธิบายเหตุผลว่าทำไมองค์การของท่านจึงตัดสินใจทำการเพิ่มประสิทธิภาพ(อัปเดต)ระบบ ERP ในองค์การของท่าน?
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4. (ก) มีบุคลากรท่านใด (ตำแหน่ง)/จากแผนกใดบ้างที่เข้าร่วมโครงการเพิ่มประสิทธิภาพ(อัปเดต)ระบบ ERP ในองค์การของท่าน?
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- (ข) แต่ละท่านที่เข้าร่วมโครงการเพิ่มประสิทธิภาพ(อัปเดต)ระบบ ERP มีบทบาท/ตำแหน่งอะไรบ้างในโครงการ?
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5. (ก) อะไรคือสิ่งจำเป็นที่จะต้องมีสำหรับการเพิ่มประสิทธิภาพระบบ ERP ในองค์กรของท่าน?

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(ข) การเปลี่ยนแปลงกระบวนการทำงานด้านธุรกิจเป็นสิ่งจำเป็นที่ต้องมีสำหรับการเพิ่มประสิทธิภาพระบบ ERP ในองค์กรของท่านหรือไม่?

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หัวข้อ 2: การเปลี่ยนแปลงกระบวนการทำงานทางด้านธุรกิจสำหรับการเพิ่มประสิทธิภาพ(อัพเกรด)ระบบ ERP (Business Process Changes for ERP system upgrades)

กระบวนการทำงานทางด้านธุรกิจคือ ขั้นตอนหรือกระบวนการทำงานต่างๆ ที่มีความสัมพันธ์กัน โดยการใช้ทรัพยากรขององค์กรเพื่อให้บรรลุผลทางธุรกิจที่กำหนดไว้

1. ในการเพิ่มประสิทธิภาพ(อัพเกรด)ระบบ ERP ในองค์กรของท่าน มีการดำเนินการเปลี่ยนแปลงกระบวนการทำงานทางด้านธุรกิจใดบ้าง?

<input type="checkbox"/> การเงินและบัญชี	<input type="checkbox"/> จัดซื้อจัดจ้าง	<input type="checkbox"/> การขาย
<input type="checkbox"/> ควบคุมการบัญชี	<input type="checkbox"/> โลจิสติกส์	<input type="checkbox"/> บริหารพัสดุ
<input type="checkbox"/> บริหารบุคลากร	<input type="checkbox"/> บริหารงบประมาณ	<input type="checkbox"/> ด้านการผลิต
<input type="checkbox"/> บริหารสินทรัพย์	<input type="checkbox"/> บริหารลูกค้าสัมพันธ์	<input type="checkbox"/> การจัดการสายโซ่อุปทาน
<input type="checkbox"/> อื่นๆ	<input type="checkbox"/> ไม่มีการเปลี่ยนแปลง	
.....		
.....		

2. กรณีที่ไม่มีการเปลี่ยนแปลงกระบวนการทำงานทางด้านธุรกิจใดๆ ร่วมไปกับการเพิ่มประสิทธิภาพ(อัพเกรด)ระบบ ERP ขอให้ท่านอธิบายว่ากระบวนการทางธุรกิจที่ยังคงเดิมอยู่เหล่านั้นมีการนำไปใช้งานร่วมกับโมดูลต่างๆ ของระบบ ERP เพื่อให้เกิดประสิทธิภาพการทำงานได้มากขึ้นอย่างไร?

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การตัดสินใจเชิงกลยุทธ์ที่เพิ่มขึ้น	<input type="checkbox"/>
ความสามารถด้านอื่นๆ (ระบุรายละเอียด).....	<input type="checkbox"/>
.....	
.....	

2. ขอให้ท่านอธิบายรายละเอียดของการเพิ่มประสิทธิภาพขององค์กรเกิดขึ้นอย่างไร ที่ส่งผลจากการเพิ่มประสิทธิภาพ(ฮาร์ดแวร์) ระบบ ERP ร่วมกับการเปลี่ยนแปลงกระบวนการการทำงานทางด้านธุรกิจ (ตัวอย่างเช่น การแบ่งปันความรู้ในองค์กร – องค์กรของท่านเพิ่มความสามารถด้านนี้อย่างไรจากการใช้ระบบฮาร์ดแวร์ ERP?, บนพื้นฐานของกระบวนการทำงานด้านใด?, ความสามารถในการแบ่งปันความรู้ที่เกิดขึ้นกับพนักงานกลุ่มใดบ้าง, กับลูกค้า, รัฐบาล, อื่นๆ)

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หัวข้อ 4: การปรับปรุงเพิ่มผลิตภาพขององค์กร (Productivity Improvement)

1. จากการทำฮาร์ดแวร์ระบบ ERP ขอให้ท่านอธิบายว่าองค์กรของท่านบรรลุเป้าหมายเพิ่มผลิตภาพขององค์กรด้านใดบ้าง?

การปรับปรุงเพิ่มผลิตภาพขององค์กร	โดยวิธีการใด/เหตุผลสนับสนุน
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Appendices

การปรับปรุงเพิ่มผลิตภาพขององค์กร	โดยวิธีการใด/เหตุผลสนับสนุน
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