IMPACT OF ENTERPRISE RESOURCE PLANNING (ERP) SYSTEM MISFIT ON INFORMATION QUALITY: A MODERATED MODEL OF ALIGNMENT STRATEGIES

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UNIVERSITI SAINS MALAYSIA

2012

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P-COM 0008/09(R)

Thesis submitted in fulfillment of the requirements

for the degree of

Master of Science (Computer Sciences)

JULY 2012

ACKNOWLEDGMENT

The completion of this thesis would not have become a reality without the invaluable support, encouragement, and inspiration of several individuals and organizations. Hence, I wish to present my appreciation to all those who have provided their supports in many different ways. Firstly, I would like to express my deepest gratitude to my main supervisor, Puan Rosnah Idrus for her valuable guidance and support during this journey. I am deeply indebted as her constructive comments helped to clear the cobweb and kept me moving on the right track. I also wish to thank my co-supervisor, Dr. Wong Wai Peng from the bottom of my heart for all the supports, advices, and patience. I am very fortunate to study under her supervision. She is always enthusiastic in reading, discussing, and giving feedbacks on all aspects of my thesis.

I owe particular thanks to Jasmine Yeap, who is willing to sacrifice her time in discussing and providing feedbacks on various aspects of my thesis. A special acknowledgement also goes to Professor T. Ramayah particularly in providing comments on the statistical analysis techniques and research methodology. Apart from that, I also acknowledge my gratitude toward intellectual support from Puan Umi Kalsom Yusof. Special thanks go to David Cheang, Nasuha Lee, Cornie Chong, and others in assisting in the pilot study and data collection process.

I would also like to express my gratitude to Universiti Sains Malaysia for the USM Fellowship scheme and Postgraduate Research University Grant Scheme (PRUGS) which make it possible for me to conduct the research thus achieve my master degree. Particular thanks also go to Puan Azlina Yusoff and Encik Redzuan Asmi for their effective administrative supports. Greatest thanks for go my fiancée, Sui Yien for her unlimited patient, dedication, and supports to move me forward. Last but not least, I wish to thank my family members, especially my parents in giving me mental and emotional supports and become my constant motivation to accomplish this thesis.

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ABSTRAK

Syarikat-syarikat perniagaan telah beralih daripada sistem perisian "pembangunan sistem dalaman" kepada sistem berpakej yang dibangunkan oleh vendor untuk kegunaan perniagaan umum sejak sedekad yang lalu. Salah satu perisian berpakej yang paling luas digunakan adalah sistem Perancangan Sumber Enterprais (ERP). Sistem ERP kini dikenali kerana membolehkan organisasi perniagaan mencapai penyepaduan data, peningkatan prestasi operasi, dan memperolehi kelebihan strategik. Walau bagaimanapun, lebih daripada separuh pelaksanaan sistem ERP telah dilaporkan gagal dan tidak mencapai faedah yang dijangkakan. Para penyelidik telah menegaskan bahawa punca utama kegagalan tersebut ialah ketidak-padanan ERP; iaitu salah-jajaran di antara fungsi-fungsi sistem ERP dengan keperluan organisasi. Pengubahsuaian sistem ERP dan penyesuaian proses-proses perniagaan telah dikemukakan sebagai cara membolehkan penjajaran proses-sistem yang lebih baik. Namun sangat sedikit bukti empirikal wujud untuk menunjukkan bahawa potensi strategi-strategi penjajaran tersebut telah tercapai. Oleh itu, objektif penyelidikan ini adalah untuk mengkaji impak ketidak-padanan ERP terhadap kualiti maklumat sistem ERP dan bagaimana impak tersebut dipengaruhi oleh strategi penjajaran sistem-proses iaitu pengubahan sistem dan penyesuaian organisasi. Dalam kajian ini, ketidak-padanan ERP dihuraikan kepada ketidak-padanan input, ketidak-padanan proses, dan ketidak-padanan output untuk menyediakan maklumat yang terperinci tentang intensiti impak-impak tersebut. Sebanyak 305 set soal-selidik telah dipungut dari pengguna-pengguna sistem ERP dalam sektor pembuatan di hub-hub perindustrian serata Malaysia berdasarkan pensampelan bertujuan.

Dengan menggunakan pendekatan analisis Permodelan Persamaan Berstruktur (SEM), dapatan kajian menunjukkan bahawa setiap komponen ketidak-padanan ERP memikul pemberat yang berbeza dalam mempengaruhi kualiti maklumat sistem ERP. Ketidak-padanan proses didapati mempunyai impak negatif terbesar terhadap kualiti maklumat, diikuti oleh ketidak-padanan input dan kedua-dua ketidak-padanan didapati dikurangkan secara lebih efektif oleh strategi pengubahsuaian sistem. Walau bagaimanapun, bukti menunjukkan bahawa ketidak-padanan output tidak memberi kesan signifikan terhadap kualiti maklumat dan kesannya itu lebih efektif dikurangkan oleh strategi penyesuaian organisasi. Ini bermakna sekiranya ketidak-padanan adalah dari jenis proses atau input, masalahnya lebih baik diselesaikan oleh pengubahsuaian sistem tetapi jika ketidak-padanan adalah dari jenis output, masalahnya lebih sesuai diselesaikan oleh strategi penyesuaian organisasi melalui perubahan dalam amalan atau prosedur perniagaan. Kajian ini akan dapat membantu pengamal-pengamal seperti pengurus-pengurus ERP and IT untuk mengutamakan penyelesaian masalah-masalah ketidak-padanan ERP ini mengikut tahap keseriusannya. Lebih penting lagi, kajian ini membekalkan maklumat kepada para pengurus mengenai strategi penjajaran manakah yang lebih sesuai untuk mengurangkan impak ketidak-padanan ERP mengikut jenis masalah ketidak-padanannya yang tertentu.

IMPACT OF ENTERPRISE RESOURCE PLANNING (ERP) SYSTEM MISFIT ON INFORMATION QUALITY: A MODERATED MODEL OF ALIGNMENT STRATEGIES

ABSTRACT

Businesses have moved away from "in-house developed" software systems to packaged systems developed by vendors for businesses in general since the past decade. One of the most prevalent packaged systems is Enterprise Resource Planning (ERP) system. ERP systems are now recognized as the enabler for businesses to achieve data integration, improve operational performance, and attain strategic advantage. However, more than half of the ERP implementations are reported as failed and did not achieve the expected benefits. Researchers have asserted that the failures are mainly attributed to *ERP misfits*, i.e. the misalignments between the ERP system functionalities and the organizational requirements. Modification of the ERP system and adaptation of the business processes have been posited as the means to enable better system-process alignment. But very little empirical evidence exists to demonstrate that the potential of these alignment strategies have been realized. Thus, the objective of this research is to examine the impacts of *ERP misfits* on the *information quality* of ERP systems and how they are affected by the alignment strategies, namely *system modification* and *organizational adaptation*. In this study, ERP misfit is decomposed into *input misfit*, *process misfit*, and *output misfit* to provide detail information about the intensity of their impacts. A total of 305 sets of questionnaire are collected from the ERP system users in manufacturing sector in industrial hubs throughout Malaysia based on purposive sampling. Using Structural Equation Modeling (SEM) analysis approach, the findings reveal that each component of the *ERP misfits* carries different weights in influencing the *information quality* of ERP systems. *Process misfit* is found to have greatest negative impact on information

quality, followed by *input misfit* and they are both found to be reduced more effectively by *system modification*. However, evidence shows that *output misfit* does not significantly affect information quality and it is reduced more effectively by *organizational adaptation*. This means that if the ERP misfits are of process or input type, the problems are better resolved by ERP *system modification* but if the misfits are of output type, the problems can be resolved better by *organizational adaptation* strategy via changes in business practices or procedures. This study will help practitioners, such as ERP and IT managers, to prioritize the ERP misfit problem solutions according to their severity. More importantly, the study provides information for the managers regarding which alignment strategies better suit what particular kind of misfit problem.

CHAPTER ONE

INTRODUCTION

1.1 Overview of Chapter

This chapter starts with an introduction to the research topic, which is followed by a discussion on the research background in Section 1.3. Subsequently, problem statements that provide the motivations behind this study are discussed in Section 1.4. Based on the problems identified, research questions and objectives are derived in order to be addressed by this study. Next, the importance of this research study is expressed in Section 1.6, while scope of the study is defined in Section 1.7. Finally, the overall structure of this thesis is presented in Section 1.8 to mark the end of this chapter.

1.2 Introduction

By definition, enterprise resource planning (ERP) systems are standard software packages designed to integrate the data of a business organization. Underlying the system, a centralized database serves as the integrating mechanism that consolidates the data from various business functions, such as manufacturing, accounting, and marketing (Shehab, Sharp, Supramaniam, & Spedding, 2004). In this respect, the major reason that drives the businesses to adopt ERP system is to enable data visibility and transactional interoperability. This is a business environment where the data is flowing seamless across every part of the business and most of the data transactions are automated. With such data transparency, the businesses are hoping that effective decision making and management governance can be achieved.

Given the unprecedented level of data integration and related benefits that can be provided by the system, ERP system has become the fastest growing market in the software business. Its eventual global market size is estimated to be 1 trillion US dollars by the year 2010 (Calisir & Calisir, 2004). The proliferation of ERP has not gone unnoticed in Asia. Indeed, recent years have witnessed a dramatic increase in ERP adoptions in Asian countries. The Asia Pacific region was the third largest market segment for ERP systems, with the

spending of 3,631 million US dollars on ERP system in 2007. Moreover, the market in Asia Pacific was estimated to reach 12 percent of total spending in year 2012, with market value of 5,723 million US dollars (Jacobson, Shepherd, D'Aquila, & Carter, 2007). These numbers indicate that the ERP market is growing rapidly and gaining its ever increasing importance in Asian region.

ERP systems can provide array of benefits that are ranged from informational, operational to strategic (Shang & Seddon, 2002). Figure 1.1 shows these outcomes of ERP system and the relationship between the outcomes. Informational benefit is the most important outcome of ERP system, which aims to improve the *information quality* of the organization. Informational benefits include but not limited to improvement in information accuracy, retrieval of real time information, and reduction in data redundancy. In terms of operational benefits, the system enables lead-time reduction, improved response to customer queries, on-time shipment, and improved productivity. From the strategic perspective, ERP system provides the potential to support business growth, build cost leadership, and encourage business alliances.

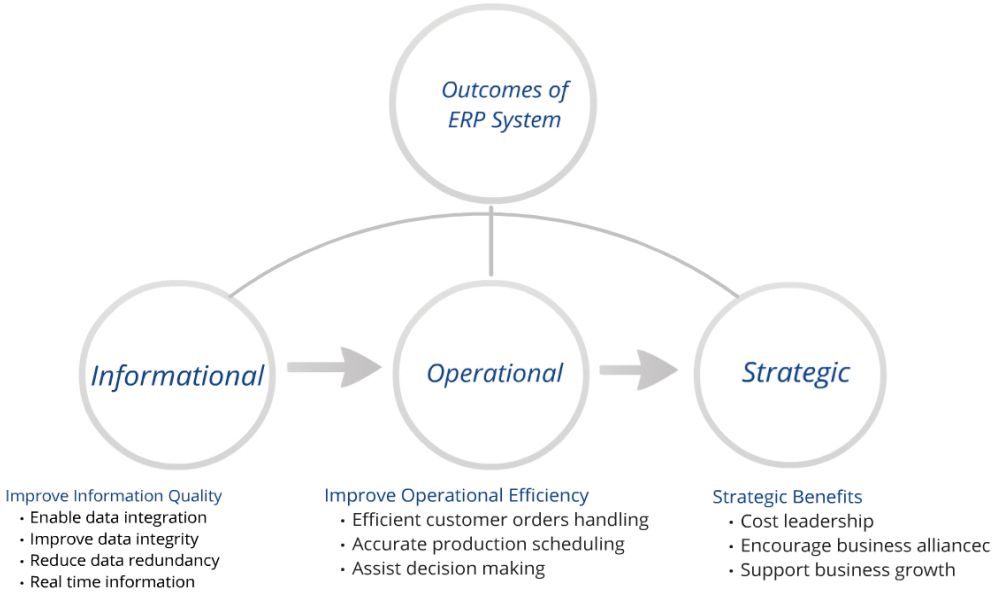

Figure 1.1 Outcomes of ERP System

Nonetheless, both the latter operational and strategic benefits do not come automatically with the acquisition of the ERP system. Instead, they could only be attained provided that the ERP systems are implemented successfully and the business knows how to take the advantage of the high quality information. This implies that quality information is a direct outcome of ERP system, compared to operational and strategic outcomes of ERP system which eventually depend on the effectiveness the employees of the organization to utilize the information produced by the ERP system. In this sense, *information quality* is the predecessor of operational and strategic outcomes. This idea has been long recognized and tested by the Delone and McLean's IS success model (Delone and McLean, 2003). In addition, *information quality* is critical to the overall *system quality* and also a success factor of the ERP system (Davis, 1993). In contrast, poor *information quality* often causes the ERP system to fail.

1.3 Background of Study

In opposite to the attractive merits of ERP system, the implementation of ERP system is well known to be a large scale project that poses different challenges to the organization. The ERP implementation requires enormous amount of financial resources, time, and changes throughout the business. Generally, ERP systems cost tens of millions of dollars for a medium sized firm and upwards of 300 to 500 million dollars for large organizations (Mabert, Soni, & Venkataramanan, 2003). More than 60% of the costs is devoted to setup, installation, customization, in which higher than the cost to acquire the ERP system (Katerattanakul, Hong, & Lee, 2006). Notwithstanding all these resources invested, there is no guarantee of the ERP system success. Scholars have reported that three quarters of ERP projects have failed. Moreover, nearly one in five of the ERP projects are aborted before completion (Soh, Kien, & Tay-Yap, 2000).

Researchers have widely recognized that the failures of ERP systems are mainly attributed to the poor fit between the ERP systems and business requirements (Gao, Zhang, & Wang, 2008; Holsapple, Wang, & Wu, 2006; Gattiker & Goodhue, 2004; Swan, Newell,

& Robertson, 1999). The poor fit between the ERP systems and business requirements is commonly coined as *ERP misfit* or *ERP misalignment* by previous studies. These terms carry the same meanings and can be used interchangeably.

The adverse outcomes of ERP system are illustrated as in Figure 1.2. The immediate outcomes of ERP misfits would be lack of quality information or poor *information quality*, such as outdated information and increased data redundancy. It is common that the poor *information quality* consequently lead to massive disruptions in business operations, such as large increases in unfilled customer orders, inaccurate production scheduling, and poor purchasing decision. This is because the effectiveness and efficiency of these business operations highly depend on the quality of information produced by ERP system. While from a strategic point of view, scholars claim that ERP misfits limit business strategy differentiation, reduce flexibility, and jeopardize business agility (BIskanius, Halonen, & Möttönen, 2009; Gattiker & Goodhue, 2002). In addition of causing the failure of ERP projects, researchers have pointed out that ERP misfit can cause hundred to thousand millions dollars of financial lost in a single organization and even could lead to bankruptcy in severe cases (Sia & Soh, 2007; Soh, Sia, Wai, & Tang, 2003). This emphasizes that *information quality* is critical to the performance of EPR system, and thus determine the success or failure of the system.

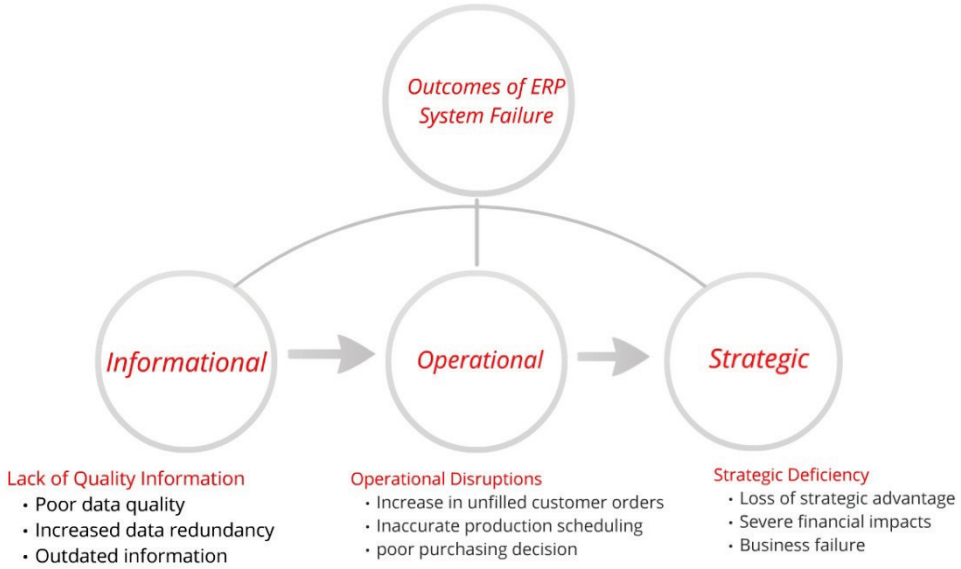

Figure 1.2 Adverse Outcomes of ERP system

Eventually, the competitive advantages of the organization may diminish. This is especially true for those organizations which highly capitalize on their uniqueness and flexibility to cater the niche markets (Olsen & Sætre, 2007). This is because ERP system imposes rigid business structure and processes on the organizations and thus refrain them from reacting responsively to the dynamic market conditions and vast variety of customer orders. The aforementioned description has reflected the nature of small and medium enterprises (SMEs) which constitute more than 95% of business settlements in Asia Pacific Region (Anonymous, 2010).

In addition, previous studies have also postulated that ERP misfit is intensified when the businesses in Asian region adopt ERP systems developed by major vendors, such as SAP and Oracle (Sia & Soh, 2007; Rajapakse & Seddon, 2005a; Soh et al., 2000). The researchers explained that this is due to the fact that ERP systems offered by the major vendors are developed based on management practices and philosophies in Europe or United States. These systems are often found to be incompatible with business practices in Asian region that require the operational flexibility, ad-hoc data collection, and unique planning processes of the companies operating (Eric, Klein, & Jiang, 2006). Thus, ERP misfits are expected to be more critical in Asian countries, such as Malaysia.

1.4 Problem Statements

Despite the profound impacts of ERP misfit and sheer size of ERP market in Asian countries, researches that have empirically examined the impacts of ERP misfit are scarce for the throughout understanding of the ERP misfits. Most of the existing studies are case study-based and focus more on building the theoretical foundations to explain the occurrence of ERP misfits (Eric et al., 2006; Soh & Sia, 2004; Soh et al., 2003; Gattiker & Goodhue, 2000). In contrast, the impact of ERP misfit is a much neglected topic in the field. Yet, such studies are important to provide insightful findings for the derivation of the solutions to ERP misfit (Wieder, Booth, Matolcsy, & Ossimitz, 2006; Gattiker & Goodhue, 2002; Das & Narasimhan, 2001). This is because this aspect of study enables the practitioners to strategize

and prioritize the solutions based on characteristics of the impact. Without comprehensive understanding about impacts of ERP misfit, the derivation of effective solutions to ERP misfit is a daunting task. Eventually, the organizations which have implemented ERP systems might continuously lose their precious resources due to improper solutions; where else the organizations which plan to acquire ERP systems might cancel their plan because of the unpredictable risks resulted by ERP misfit. Therefore, these signify that there is a strong **need for more researches that empirically study the impacts of ERP misfit on information quality** in order to close up the gaps in the existing body of knowledge.

With regard to the ERP misfit issues, researchers have commonly agreed that the ERP misfits can be resolved through two alignment strategies, namely *system modification* and *organizational adaptation* (Chen, Chen, & Road, 2009; Shehab et al., 2004). *System modification* is to close the gaps between the system and organization by modifying the ERP system to fit with the organization, whereas *organizational adaptation* involves the changes in organizational architecture in order to fit with the ERP systems. In earlier time, most of the ERP analysts and consultants strongly discourage the organization from modifying the ERP systems (Shehab et al., 2004; Brehm, Heinzl, & Markus, 2001; Markus, Axline, Petrie, & Tanis, 2000). Instead, organizations are advised to adapt their business processes and structures in order to align with the ERP systems. They have claimed this is the most effective way of implementing ERP systems and to allow the organizations to gain performance improvement by adopting the "best practices" in the industry. Nevertheless, there are increasing numbers of researchers questioning the legitimacy of the "best practices" and tried to prove that the out-of-the-box implementation (i.e. purest form of ERP system without any modification) is impractical and problematic (Morton & Hu, 2008; Light, 2005; Brehm et al., 2001; Light, 2001; Swan et al., 1999). In other words, this school of thought advocates that in additional to *organizational adaptation*, *system modification* is necessary to make the ERP systems work effectively. In this respect, both modification of the ERP system and adaptation of business process have been postulated as the means to enable better

alignment between the ERP system and the organizational requirements. Nevertheless, to date, very little empirical evidence exists as to demonstrate that the potential of the alignment strategies has been attained. In fact, most of the existing studies that looked into this issue are based on qualitative studies or anecdotal evidences, in which their findings may bind to the specificity of their study cases (Ahmed & Sherer, 2007; Ashley, 2005; Light, 2001). In addition, there is no single conclusion can be drawn from these studies, as different studies show different answers. Hence, **empirical studies are required to systematically investigate the effects of *system modification* and *organization adaptation*,** in order to produce rigorously tested and generalizable results.

Very often, the previous studies that have specifically investigated the ERP misfit focused on human-related issues or managerial aspects, such as technology acceptance, organizational culture, management commitment toward ERP project, user resistance, user computer self-efficacy, and trust on the system vendor (Rajapakse & Seddon, 2005b; Sheu, Chae, & Yang, 2004; Madapusi & Ortiz). In contrast, very few studies have examined the ERP misfit from the *system* point of views, albeit the ERP systems themselves are huge systems with complex design and architecture layers. And yet, many ERP misfits arose are system-related and technical-related issues. For instance, companies have reported that after they have struggled with ERP system modifications, they eventually learnt that the *system modifications* were unnecessary after all (Markus et al., 2000). This is due to the fact the companies did not understand the technical natures of the ERP system and ERP misfits. Furthermore, the researchers were surprised when they found out that the companies reported that system-related misfits such as data quality and reporting functionality are more critical to them than other soft aspects such as relationship with the vendor and supports from the top management. However, studies on the system-related ERP misfits are rather neglected in the mainstream of ERP literature which focuses more on managerial and human-related issues. This study thereby asserts that investigating ERP misfit from the system point of view would be beneficially in terms of providing implications that

specifically look at the root cause of ERP misfit. Of importance here is to stress that there is a **need to investigate ERP misfit** from the **perspectives of system design and architecture.**

In reviewing the problem statements, the following research questions are raised.

i. Does *ERP misfit* negatively influence information quality of the ERP systems?
ii. Could the impacts ERP misfit reduced by *system modification*?
iii. Could the impacts of ERP misfit reduced by *organizational adaptation*?

1.5 Research Objectives

In corresponding to the research questions posed, the main objective of this research is to examine the impacts of ERP misfit on information quality and how the impacts are affected by the alignment strategies, namely system modification and organizational adaptation. The following refined research objectives are developed in order to be addressed in study:

i. To examine the impacts of *ERP misfit* on information quality.
ii. To examine whether the impacts of ERP misfit on the outcomes of the ERP systems could be reduced by *system modification*.
iii. To examine whether the impacts of ERP misfit on the outcomes of the ERP systems could be reduced by *organizational adaptation*.

1.6 Values of the Study

As aforementioned, most of the existing explanations on the impacts of the ERP misfit and the alignment strategies are based on exploratory qualitative studies or anecdotal evidences. Hence, the generalizability of these findings across other contexts is unknown. Moreover, the quantitative studies that attempted to systematically validate the explanations are scarce, and the data analysis methods used are rarely rigorous (Gattiker & Goodhue, 2002). Therefore, this study develops the research model based on the reasoning and findings

from previous studies and enables them to be rigorously tested with empirical approach. By doing so, these reasoning can be empirically validated and to have improved generalizability. Eventually, future researchers and practitioners can apply these findings and reasoning confidently.

In addition, this study examines the impacts of ERP misfit from the *system design and architecture* perspective. Investigating the ERP misfit from this angle is imperative in the sense that technical natures of ERP misfit can be understood. Through better understanding about the ERP misfits, practitioners such as ERP project managers, directors, and other decision makers will to able to make informed decision in developing countermeasures for ERP misfits. At the meantime, the findings of this study would be able to enrich the ERP literature which currently has focused more on managerial and cultural aspect of ERP misfit.

Another value of this study is attributed to its investigation on the effects of *system modification* and *organizational adaptation*. The two alignment strategies for closing the gaps between the ERP system and the business requirements are the topics under ongoing disputation in both research and business societies. Different schools of thought assert that one of the alignment strategies is superior to its counterpart. Nevertheless, this study asserts that the solution to ERP misfit is not deterministic. Instead, the appropriateness of the solution greatly depends on the natures of misfit under investigation and the very different context where the system is deployed. The dynamic view of this study would introduce a new way of looking into the alignment strategies. Of more importance here is this study systematically investigates the effects of both alignment strategies, in attempt to provide empirically grounded findings to help both academicians and practitioners in resolving ERP misfit.

1.7 Scope of the Study

In order for a study to be useful, it is critical to delineate the scope of the study. By such, the scope of the study can be realistic, specific, and manageable. As the outcome,

scrutinized analysis and discussion can be done in order to provide more useful implications of findings. More importantly, specific scope enables the research to make a significant breakthrough in a niche area of the research field. Thereby, this section discusses the scope of this study.

This study investigates *ERP misfits* from the perspective of system *design and architecture*. In this respect, the definition of *ERP misfit* is confined as the misalignment between functionalities of EPR systems and functional requirements of the organization. Nonetheless, other ERP misfits do exists. For instance, scholars who adopted the social perspective have asserted that misfits may also have resulted from the incompatibility of subjective culture and value of the organization (Hawari & Heeks, 2010). These ERP misfits are more accurately reflecting the managerial or cultural related misfit, which tend to be the interests of social scientists or business management. This study excludes the discussion on such cultural misfits as they are not in the interests of this study. More importantly, such refinement of the scope of study enables this study to specifically focus on the system-related misfits.

Furthermore, the focus of this study is the misfit in terms of the *functional requirements* such as information processing, rather than *non-functional requirements* such as reliability, interoperability, and security. This is given that the *functional requirements* specify the end result that the ERP system supposes to accomplish and deliver to the users (Kaindl, 1993). In this sense, *functional requirements* directly affect the outcome of the system, which are required by the users to carry out their tasks. Added to this, business managers have considered functionality as the most important system attribute to estimate the value of the system (Lene, 2006). On the other hand, *non-functionality requirements* drive the technical and hardware attributes of the ERP system which do not directly influence the deliverables of the systems. Hence, the interest of this study is *functional requirements* that determine the *application architecture* of the ERP system. These misfits of

functional requirements reflect the incompatibilities in terms of business processes, logics, documentation, and reporting which are the main concerns of the organizations.

As a short summary, the scope of this study is illustrated in Figure 1.3. The definition of the ERP misfit is limited to those system-related misfits. Within the system-related misfits, the misfits can be categorized as 1) the mismatch between the capabilities of the system and the *functional requirements*, or 2) the mismatch between the capabilities of the system and the *non-functional requirements*. This study focuses on the misfit between the functionalities of the ERP system and the *functional requirements*, given the justifications provided in the previous paragraph. Thus, the scope of this study is denoted by grey area in the Figure 1.3.

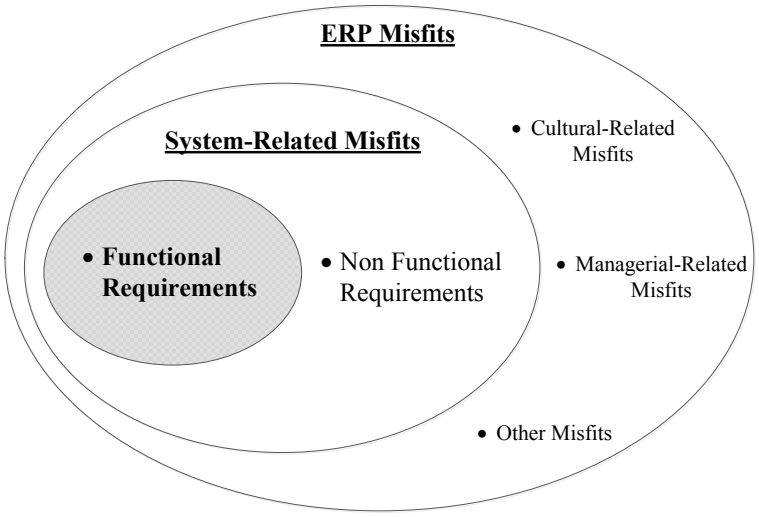

Figure 1.3 Scope of Study

1.8 Structure of the Thesis

This section provides an overview of the structure of this thesis. As the first chapter, *Chapter One* introduces the issues related to the topic under investigation, along with the problem statements and objectives of the study. Apart from that, the importance of the study is presented. The scope of the study is included in the later part of the chapter as well.

The following *Chapter Two* presents the review of relevant literature and the development of the research model in this study. By critically reviewing relevant literatures,

this chapter discusses the gaps in the existing body of knowledge and proposed solutions to close the literature gaps. Then, the variables of interest, along with the theory to support the relationships among the variables are identified through extensive literature reviews. Based on the variables and theory, the research model for this study is developed. In the later part of the chapter, hypotheses are developed in order to be testified.

In *Chapter Three*, the methodology that delaminates the research methods and processes used in this study is presented. This methodology chapter comprises an overview of the research design, elaboration on the population and samples, and the discussion on the development of the measurement items that used to measure the variables in this study. Subsequently, this chapter presents the pilot study where the questionnaires undergo a field pretest in order to gauge the understandability of the respondents toward the contents in the questionnaire. Next, the final data collection processes are discussed. Finally, this chapter briefly presents the statistical analysis techniques used in the study.

After the data was collected, statistical analyses were conducted and the results were presented in *Chapter Four*. At the beginning of the chapter, the response rate of the questionnaire survey is presented. Next, the data are assessed for factorial validity via convergent and discriminant validity tests. After that, the hypotheses are tested using path analysis. The last part of the chapter presents a summary of the result of analyses conducted throughout the study.

Chapter Five provides detail discussions on the findings revealed in *Chapter Four*, followed by the theoretical and practical implications of this study. In the following section, theoretical implications of this study are provided. In addition, practical implications which concern the contributions of this study to the practitioners such as ERP managers, IT managers, and directors are also discussed. Next, the limitations of the study, along with the suggestions for future research are discussed. Finally, a summary of the entire study is provided.

CHAPTER TWO

LITERATURE REVIEW

2.1 Overview of Chapter

The beginning of this chapter introduces ERP system and the characteristics of the system. Subsequently, Section 2.3 presents the definitions and sources of ERP misfit based on literature reviews. Section 2.4 presents the importance of information quality within an ERP system environment and how information quality is related to the performance of business organizations. Section 2.5 discusses the gaps in the existing studies, while the following Section 2.6 identifies the variables related to this study which are gathered from the literatures. The theory and concepts which are used to support the linkage between the variables are presented in Section 2.7. Based on the variables and theory identified, a research model is developed in order to enable the research questions of this study to be answered. Section 2.9 discusses the development of the hypotheses that are derived from the research model.

2.2 Enterprise Resource Planning (ERP) Systems

This section presents the definition of ERP system and its characteristics. The second subsection presents the architecture layers of ERP systems. The main interest here is to provide a brief understanding about the ERP system.

2.2.1 Definition and Characteristics of ERP System

American Production and Inventory Control Society (APICS) has defined an ERP system as "a method for the effective planning and control of all resources needed to take, make, ship, and account for customer orders in manufacturing, distribution, or service company" (Koh, Gunasekaran, & Rajkumar, 2008, p. 246). Additionally, scholars have defined enterprise resource planning as the information systems designed to solve the problem of information fragmentation in organizations by consolidating all the transactional processes into a standardized system environment in order to improve the dissemination of

critical information to users and to improve data consistency (Somers, Nelson, & Karimi, 2003). Similarly, ERP systems have been defined as configurable software packages that enable the integration of transactions-oriented data and business processes throughout an organization in order to present a holistic view of the business (Calisir & Calisir, 2004; Markus et al., 2000; Davenport, 1998).

In reviewing the literatures, it is commonly found that researchers use different wordings to describe ERP systems, depending on the theoretical lenses that they adopted. Although the definitions vary in their orientation, these variations of definition tend to contain a set of similar keywords that describe the characteristics of ERP systems. Considering these keywords are imperative to understand the characteristics of ERP systems, this study has made the efforts to identify and explain the common keywords found in ERP definitions. Table 2.1 shows the most commonly keywords used to describe the characteristics of ERP systems and their respective citations. These characteristics of ERP system are then discussed in the subsequent paragraphs of this section.

Table 2.1 *Common Characteristics of ERP Systems*

Keywords	Literature
Data Integration	(Shiau, Hsu, & Wang, 2009; Gattiker & Goodhue, 2005; Abdinnour-Helm, Lengnick-Hall, & Lengnick-Hall, 2003; Davenport, 1998)
Uniform Architecture	(Berchet & Habchi, 2005; Yen & Sheu, 2004; Markus et al., 2000; Davenport, 1998)
Standard Software Package	(Wu, Shin, & Heng, 2007; Abdinnour-Helm et al., 2003; Brehm et al., 2001; Klaus, Rosemann, & Gable, 2000; Holland & Light, 1999)
Best Practice	(Sia & Soh, 2007; Shehab et al., 2004; Liang & Xue, 2004; Madapusi & Derrick, 2003; Swan et al., 1999)
Configurable Software	(Larsen, 2009; Wu et al., 2007; Buonanno et al., 2005; Soffer, Golany, & Dori, 2003; Swan et al., 1999)
Deterministic Technology	(Holsapple et al., 2006; Boersma & Kingma, 2005; Lengnick-Hall, Lengnick-Hall, & Abdinnour-Helm, 2004; Koch, 2001; Soh et al., 2000)

A keyword commonly found in the definition of ERP system is “data integration”. This keyword refers to the characteristic of ERP systems which consolidate the data across various business functional areas through a centralized database. This characteristic enables ERP system to deliver reliable and accurate information to the users. This is because the database centralization reduces data duplication, prevents unauthenticated modification to

the data, good maintenance of document version, and eventually improves data integrity (Buonanno et al., 2005). In addition, this characteristic of ERP as integrated system enable a state in which everyone knows what everyone else is doing in the business, which known as data transparency. For instance, the sales department places a customer order on their marketing module and the transaction ripples through the entire company. Inventory records and parts supplies are updated automatically. Subsequently, production schedules and balance sheets reflect the changes. As the result, feedback cycles are fast and responsive. Users able to access to timely information to make effective and informed decision (Gupta & Kohli, 2006; Shang & Seddon, 2000). In this sense, ERP systems also improve the coordination among business functions via data integration.

Another characteristic of ERP systems is "uniform platform". This implies that an ERP system is an information system that supports the entire organization, through a unified operating platform. In contrast to legacy systems, different departments may adopt different software applications. The exchange of data among the departments is problematic since the data may not be accessible directly by other software, and manual efforts often needed to extract the data and re-enter into another system. Moreover, the information in a legacy system is spread across different computer systems thus increasing both direct and indirect costs. Direct costs include maintaining the different systems, entering data more than once, and reformatting data from one system in order to be used in another. In direct costs, which are even more important, reflect the costs of communication failure, negative impacts on management control, planning and forecasting (Abdinnour-Helm et al., 2003). ERP is a single platform system to replace the legacy systems and to enhance system maintainability, interoperability, and data quality. In the ERP environment, a single piece of software is used throughout the whole organization.

The most common description given to ERP systems probably is "standard software packages". This characteristic implies that ERP systems are software that are developed to be used by general class of organization from different industries (Gupta & Kohli, 2006;

Brehm et al., 2001), rather than specifically developed to meet the business requirements of a particular organization. An ERP system is generic or standard, in the sense that the system is a standard representation of how a typical organization conducts its business. ERP vendors have claimed that the pre-packaged business processes are the "best practice" processes of the industry, which they identify through various researches, field studies, and industrial linkages. From the perspectives of ERP system developers and consultants, it presumes that ERP systems embody universally applicable best practices, which should be implemented as far as possible without modification (Swan et al., 1999).

In addition, ERP is often viewed as a deterministic technology because organizations are often forced to align their business processes with the "best practice" processes embedded in the ERP systems (Holsapple et al., 2006). Studies have indicated that ERP systems are not merely software applications, but the systems capable of altering enterprise architecture, by imposing its own logics on the organizations' strategy, processes, and procedures. For instance, SAP R/3 as one of the major ERP system, currently stores over 1,000 pre-packaged processes that represent best practice processes such as in financial, logistics, production, and human resource (Shehab et al., 2004). Implementing an ERP system requires the organization to undergo an organization-wide restructuring in order to tally with the process-oriented structure as required by ERP systems (Holsapple et al., 2006; Chen, 2001). Very often these restructurings involve rudimental changes, in which are disruptive and could last for very long period. Such changes could severely influence the business performance and might challenge the survival of the business if the business process reengineering is failed.

"Configurable software package" is another important characteristic of ERP system, which implies that the organizations could configure the standard software package in order to meet their business requirements. By manipulating configuration parameters, the organizations choose among the pre-packaged business processes, logics, and rules in the ERP systems that best represent their organizational context (Olsen & Sætre, 2007). For

instance, organization A chooses “dynamic order quantity” function, rather than “fixed order quantity” function that suit its operational context. Even with this flexibility, an organization will find it mostly impossible to configure an ERP system to fit their functional requirements exactly (Mabert et al., 2003). Hence, organizations are required to either change their processes to fit the ERP system or to modify the system to meet their specific requirements.

2.2.2 Architecture Layers of ERP System

Most of the ERP systems adopt client-server architecture in which the processing loads can be shared between the clients and server. Most importantly, the architecture of ERP system can be categorized into three main layers, namely data layer, application layer, and presentation layer (Basoglu, Daim, & Kerimoglu, 2007). Presentation layer is the user interface or browser for data entry or assessing system functions located on the client side. Application layer is the layer where business rules, logic, and program are located. It continuously communicates with the database via business logic, functions, and rules. Data layer is the layer in which the database manages all the data. Figure 2.1 illustrates the graphical representation of the main architecture layers of an ERP system. Understanding the architecture layers of ERP system will help the researcher in identifying the architecture layer where a particular ERP misfit occurs. Moreover, it provides additional information about the particular ERP misfit from the system architecture perspective, and enables the researcher to relate the ERP misfit to the technical issues of the associated layer.

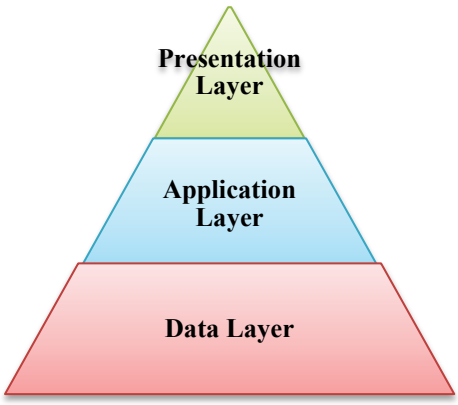

Figure 2.1 Major Architecture Layers of ERP System

2.3 ERP Misfit

This section contains two subsections. The first one presents the origin of the ERP misfit concept, while the latter provides explanation about the sources of ERP misfit. In addition, it is noteworthy that works from Soh and Sia are cited frequently in this study. This is because they are the very first researchers who started the concept of misfit in the ERP study and they are also *guru*s who have conducted a number of very influential researches about ERP misfit. Most of the later ERP misfit studies have referred to their works as a starting ground.

2.3.1 Definition and Background of ERP Misfit

ERP misfit is a specific derivation from a broader concept called *fit of information technology and organization*. The issues of fit between information technology and organization are identified as an important area for Information System (IS) research (Gribbins, Subramaniam, & Shaw, 2006). Researchers have generally defined fit as the match between the requirements of the task and the capabilities of the technologies. The concept of misfit between IT and organization has been developed by IS literature to explain the causes of information system failure. The main idea is that IS failure is determined by the degree of misfit between the IT and organization (Hawari & Heeks, 2010). It is generally expected the misfits between the IT and the organization will lead to mediocre performance of both the system and organization.

In the context of ERP system, misfit is generally defined as the gap between the capabilities of ERP system and capabilities required by the business organization. Wand and Weber (1995) have posited that for an information system to be practical and succeed, its structure must represent a good mapping to the real world it seeks to model. In other words, ERP systems carry their representation of real-world (i.e. enterprise architecture such as business processes, logics, rules, and procedures) via their ontological structure such as objects, properties, relationships, state, and transformation rules. From this viewpoint

therefore ERP misfit is an instance where aspects of the enterprise architecture are not adequately represented by the ontological structures embedded in the ERP systems.

Researchers have also conceptualized ERP misfit based on others perspective. For instance, Soh and Sia (2004) who adopted institutional theory have defined ERP misfit as the result of differences between the social structures embedded in the systems and those embedded in the organization such as norms, cultures, and values. In their later study that adopted system ontological perspective, they defined ERP misfit as the poor fit between system functionality and the organization requirement (Sia & Soh, 2007). Hence, the words "capabilities" of ERP system and "capabilities" required by business organization in the definition of ERP misfit can represent different constructs, ranged from subjective construct such as organizational culture to a concrete substance like system functionality. Researcher should adapt the definition in order to reflect their context of study. In this study, the definition of ERP misfit is confined as the incompatibility between functionalities of the ERP system and the functional requirements of the adopting organization.

2.3.2 Sources of ERP Misfit

Existing literatures have attempted to explain the sources of ERP misfits based on their virtue of knowledge and industrial experiences. This subsection summarizes and discusses the sources of ERP misfit based on the findings of those studies. The sources of ERP misfit are a) one-size-fit-all solution, b) weak client-developer linkage, c) assumptions of ERP system developers, and d) biased reference organizations. They are not meant to be mutually exclusive. Instead, the main purpose here is to provide a preliminary understanding about the potential sources of ERP misfit identified by the previous studies.

(a) One Size Fit All Solution - As aforementioned in Section 2.2.1, ERP systems are "standard software packages" which are developed to meet the common requirements of organization from various industries, sizes, and backgrounds. ERP systems embed the generic ways of a typical organization conducts its business. Although organization can configure the built-in parameters to customize the ERP systems to certain degree, studies

have found that it is impossible to configure an ERP system to exactly fit with the needs of an organization (Mabert et al., 2003). This is because each organization has its own unique characteristics, which are necessary elements for their competitive edge. Furthermore, Olsen and Sætre (2007) have asserted that rigid structure of ERP systems is often insufficient to meet the needs of a niche company. In supporting of these arguments, researches have projected that even the best ERP systems can only fulfill approximately 70 percent of the organizational requirements (Gao et al., 2008; Gattiker & Goodhue, 2004). In short, this is to stress that the standard ERP systems are mostly incapable of fulfilling the specific requirements of the adopting organization.

(b) Weak Client-Developer Linkage – Due to the global presence of ERP markets and variety of clients' background, the system-organization fit in the ERP industry is becoming increasingly complex and challenging (Sia & Soh, 2007). This is because the clients of ERP vendors are dispersed around the globe, characterized with different sizes, industry, and governed by different sets of laws and regulations. Thus, it would be impossible in terms of development time frame and cost to preload the ERP systems with functionalities that are applicable to all the client groups. Moreover, direct involvement of clients is not common in ERP systems development (Swan et al., 1999). As the result, the system functional requirements of the ERP system is much affected by the perception of the developer on what is needed by the clients, rather than the requirements from the real clients . Furthermore, the ERP system developers will not change their systems for a small number of clients, where the cost of such changes is hardly justifiable. Hence, the weak client-developer links suggest those ERP system misfits are evident and inevitable.

(c) Assumptions of ERP System Developers – Researchers have noted that ERP system developers inscribe their perceptions and management philosophies into the ERP systems, reflected in the functionalities and features of the ERP systems such as reporting hierarchies, data transformation rules, and standard operating procedures (Holsapple et al., 2006; Soh & Sia, 2004). The developers' perceptions and management philosophies are

influenced by their existing knowledge, resources, locations, and networks when they develop the ERP systems. The point in here is to assert that the "best practices" made by the ERP system developers are not necessary valid, since they are based on the developer's best knowledge and reference at the time of developing the system. When the business condition changes, there is no guarantee that the process that embedded in ERP system is still the best. It is also difficult for ERP developers to continually tweak their products to keep pace with changing industrial requirements (Light, 2005). Previous studies have also provide anecdotal evidence to prove the "best practice" premise is not always the case (Gao et al., 2008; Swan et al., 1999), and there is an increasing number of researchers questioning the validity of the "best practice". As the result, organizations often find that the ERP systems are not compatible with their business processes.

(d) Biased Reference Organizations - Additionally, ERP system developers need reference organizations to collect likely organizational requirements for the development of ERP systems. The reference organizations are drawn on the network resources to which the ERP developers have access. Soh and her colleagues (2004; 2007) have asserted that the reference organizations often are the organizations from ERP developers' home market and other markets in which they have a major presence. These markets tend to be defined by national and industry boundaries. Thus, the business processes, procedures, logics, and management philosophy embedded in the ERP systems therefore reflect the organizational requirements of the reference organizations. Such system requirements would be different from the context of many other organizations, especially if these organizations are from different countries and industries than the original group of reference organizations. In other words, the functionalities in the ERP systems are designed based on the requirements of the reference organizations, which is different from the requirements of the organizations that will actually implement the ERP system. Thus, the organizations might find some of their requirements are not met by the ERP systems, particularly if their functional requirements are greatly different from those of the reference organizations.

2.4 Information Quality

In general, information quality is a terminology to describe the quality of the content of information systems. Information quality has become a critical concern of organizations and Management Information Systems (MIS) research (Lee, Strong, Kahn, & Wang, 2002). It is found that information quality is critical to the overall quality of an information system. The most recognized application of information quality in IS studies would be in DeLone and McLean IS Success Model (Delone & McLean, 2003), in which the information quality is one of the main factors to predict IS success. Information quality is the most important factor to the success of information system, given that the ultimate goal of most information system is to provide high quality information to the users. This argument is supported by previous studies which found information quality generally carries greater weights, compared to other factors such as system quality (Wu & Wang, 2006; McGill, Hobbs, & Klobas, 2003; Seddon & Kiew, 1995).

As in other information systems, information quality is vital for ERP system to perform effectively. It is commonly agreed that effective ERP systems require the organization to obtain and maintain high-quality information (Moon, 2007; Hongjiang, 2006). For instance, in order for ERP system to operate perfectly, it would require 100% accurate bill-of-material (BOM) and inventory records (Turbide, 1999). Davis (1993) has noted that ERP systems have a reputation for being difficult and often unsuccessful – it is not the ERP system itself, it is the underlying information quality problems that make it difficult. Thus, it is evident that information quality is essential for the performance and success of ERP system.

Apart from that, information quality also plays critical role in the performance of business decision making. This is because business decision makers often implicitly depend on the quality of information to make decision. The impact of information quality on decision making has been investigated in several studies (Madnick, Wang, Lee, & Zhu, 2009; Madapusi, 2008; Parush, Hod, & Shtub, 2007; Jung, Olfman, Ryan, & Park, 2005). There is

a consensus that information quality is positively associated with decision making performance. In the ERP environment, users rely on the information provided by the ERP system to make decision in their routine tasks, such as order size and machines allocation. Hence, information quality reflects the effectiveness of the ERP system in aiding the users to accomplish their tasks.

In addition, evidences have indicated that information quality affect organizational performance. Redman (1992) has reported that inaccurate and incomplete information potentially adversely affects the competitive success of an organization. Moreover, the researcher has also suggested that poor data quality can jeopardize the effectiveness of organization's tactics and strategies (Redman, 1998). In relevant to this, poor quality information is usually cited as a source of lost productivity or failed organization (Bovee, Srivastava, & Mak, 2003; Strong, Lee, & Wang, 1997). A recent study has shown evidence that information quality can be used to predict organizational success (Hongjiang, 2006). As a quick conclusion, information quality is not only critical to the effectiveness of ERP system, but also has prevalent effects on decision making performance and business performance.

2.5 Gaps in the Literature

The impacts of ERP misfit is not an unexplored topic. However, most of the existing studies relied on qualitative approach to investigate the impacts of ERP misfit (Hawari & Heeks, 2010; Sia & Soh, 2007; Rajapakse & Seddon, 2005b; Gattiker & Goodhue, 2004; Liang & Xue, 2004; Sia & Soh, 2002; Gattiker & Goodhue, 2000). In fact, very limited quantitative studies have been done in this specific area, with exception but not limited to Gattiker and Goodhue (2002), Hong and Kim (2002).

Of interest here is the work from Hong and Kim (2002) which has studied the impacts of ERP-business fitness on ERP project implementation success in Korea. Attention is paid to this literature because it shares large extent of similarity with this study and their research

model is built on concrete theories. Thus, the paper is a good reference for this study to build its foundation. A later research by Chen and his colleagues (2009) have replicated the study in Taiwan, in which further validated the applicability of the research model. Nonetheless, there are rooms for further improvement of their works. This study attempts to address the fundamental weaknesses of these two previous studies which are 1) outcome of ERP system, and 2) the uni-dimensional ERP misfit. The detail discussions on these weaknesses are presented in the following subsections.

2.5.1 Outcome of ERP System

In their study, Hong and Kim (2002) have measured the outcome of ERP system based on the successfulness of ERP project implementation. Nonetheless, this study argues that ERP project implementation success is not an appropriate measure for the ERP system outcome, given that it only focuses on immediate outcome of the ERP system and fails to capture the long-term outcome of ERP systems. The following paragraphs provide elaborated explanations for the issues behind the ERP outcome variable, as well as the evidence to support the assertions of this study.

One of the most fundamental difficulties faced by ERP studies is to identify appropriate variable for measuring outcome of ERP system (Eric et al., 2006). The similar challenge is often discussed in the literature which studies other types of information systems. There is a number of studies that has examined the outcomes of ERP system based on business-related performance such as inventory performance, manufacturing performance, Supply Chain Management (SCM) performance, and financial performance (Yang & Su, 2009; Kang, Park, & Yang, 2008; Wieder et al., 2006; Hsu & Chen, 2004; Rabinovich, Dresner, & Evers, 2003; Hunton, Lippincott, & Reck, 2003; Das & Narasimhan, 2001). Nonetheless, this body of ERP outcome measurement has been criticized, mainly by asserting that these business-related performances are the functions of complex and intertwined factors other than ERP system. In other words, the variances measured in