ANALYSIS OF CRITICAL SUCCESS FACTORS IN IMPLEMENTING ENTERPRISE RESOURCE PLANNING SYSTEMS IN MALAYSIAN BUSINESS FIRMS

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ABSTRACT
In order to survive in a rapidly changing business environment, Malaysian business firms must improve their own business practices and procedures through Information System. This paper describes the impact of Critical Success Factors (CSFs) during the Enterprise Resource Planning (ERP) system implementations using the responses from 151 organizations that completed or are in the process of completing an ERP implementation and identifying the key benefits of ERP implementation in the firm. The importance of these factors was investigated within Malaysian companies using questionnaire survey method. Our results provide advice to management on how best to utilize their limited resources to choose those CSFs that are most likely to have an impact upon the implementation of the ERP system.

Keywords:
Critical Success Factors (CSFs), Enterprise Resource Planning (ERP), System, Vendor, Business Process

1. INTRODUCTION

The global economic setting is always changing dramatically mainly because of natural calamities, political unrest or financial adversity. Such unwarranted situations stimulate firms to carry out strategic initiative to create and sustain business competitiveness. To this end, adoption of information and communication technologies (ICT) based applications is considered as a significant business growth catalyst since 1980s. ICT applications help firms to streamline business operations, enhance business flexibility, integrate functionalities and improve information flow (Mudiarasan et al., 2009). Successful ICT applications adoption would have positive effect on the adopting firm's economic progress firms (Ettlie et al., 2005). The literature abounds with successful ICT adoption by. Nevertheless, there are also significant numbers of studies that have argued on firms not reaping the expected economic benefit from ICT investment (Robert et al., 2003). A similar stance is also advocated for Enterprise Resource Planning (ERP) system – one of the most profoundly used ICT applications in recent times.

Enterprise Resource Planning systems are being widely used by large enterprises to integrate the business processes and functions into a single centralized system. The software is designed to integrate various modules such as financial, sales, human resource, supply chain, material requirement planning and customer information. Recently the ERP vendors have developed and customized the ERP software for the use of all types of industries. This has created a great demand on the use of ERP among business entities to integrate and maximize their resources. The growing demand for ERP applications among business firms has several reasons, for example, competitive pressures to become a low cost producer, to increase the revenue growth, ability to compete globally, maximizing the resources and the

desire to re-engineer the business to respond to market challenges (Gattiker and Goodhue, 2005).

A lot of firms in the developing countries such as Malaysia face numerous challenges in implementing technologies such as Enterprise Resource Planning (ERP) systems, including a lack of human and financial resources to support such initiatives (Wright et al., 2002). Furthermore, the government's commitment to the development of technology infrastructure can also be seen from the Malaysian Industrial Master Plan from 2006-2020, coinciding with the country's vision for 2020 (MITI, 2007). For example, the government has implemented numerous policies and strategies under this plan which was formulated to enhance the growth of the industries through the entire value chain and to encourage cluster-based industrial development.

The "Malaysia, Policies, Incentives and Facilities for Malaysian Firms" issued by Ministry of International Trade and Industry (MITI) indicated that the Malaysian government provided a financial assistance scheme as "Grant for ICT Application" for the local business firms (MITI, 2007). The scheme provided assistance for local business firms to purchase ERP software to improve their productivity and competencies in a globalized environment.

However various studies have revealed that not all ERP implementations are successful in improving the productivity and competencies of a company. According to Gattiker and Goodhue (2005), ERP implementation failure rate is from 40%, yet companies try to implement these systems because they are absolutely essential to responsive planning and communication. The competitive pressure unleashed by the process of globalization is driving implementation of ERP projects in increasingly large numbers, so a methodological framework for dealing with complex problem of evaluating ERP projects is required. It has been found that, unique risks in ERP implementation arises due to tightly linked interdependencies of business processes, relational databases, and process reengineering (Wright and Wright, 2002). According to Gordon (2006), three main factors that can be held responsible for failure of ERP system are: poor planning or poor management; change in business goals during project; and lack of business management support. In another study, it has been found that companies spent large money in developing ERP systems that are not utilized. From a software perspective ERP systems is complete. But from the business perspective it is found that software and business processes needs to be aligned, which involves a mixture of business process design and software configurations (Mabert et., 2003). So a purely technical approach to ERP system design is insufficient.

According to Gordon (2006), a careful use of communication and change management procedures is required to handle the often business process reengineering impact of ERP systems which can alleviate some of the problems, but a more fundamental issue of concern is the cost feasibility of system integration, training and user licenses, system utilization, etc. needs to be checked. A design interface with a process plan is an essential part of the system integration process in ERP.

The primary objective of this research is to examine the critical success factors of ERP implementation to minimize the ERP implementation failure rate among the local companies. The research was focused in different sectors of the economy. Apart from that the study also aimed to identify the ERP usage contribution to the business performance of the organizations.

2. LITERATURE REVIEW

The term "Enterprise Resource Planning" was initiated in the early 1990s as a software solution that integrates information and business processes to enable information sharing among the departments in an organization. The range of functionality and use of ERP systems has further expanded in recent years to include business intelligence, customer

relationship management (CRM) and electronic commerce. Common examples of ERP systems available include SAP ERP, Oracle, Baan and PeopleSoft.

An ERP system typically comprises a central, state-of-the-art, comprehensive database that collects, stores, and disseminates data across all business functions and activities in an enterprise. By integrating all business functions, economies of scale are obtained and the business gains a significant operating cost reduction, in addition to improved capabilities and information transparency. The increased business trends of globalization, mergers, and acquisitions demand that companies must have the ability to control and coordinate increasingly remote operating units. An ERP system can help to achieve this by enabling the sharing of real-time information across departments, currencies, languages, and national borders. According to Masson et.al., (2006), it is not possible to think of an ERP system without a sophisticated Information Technology (IT) infrastructure. He also emphasized that ERP is a system with inseparability of business and IT.

The dream of creating an enterprise wide system began in the 1970's, but was then unrealized due to the technological barriers at that time. Instead, most companies created what Razmi et. al., (2009) termed "islands of automation", which naturally evolved as new IT applications were introduced to fill the constantly emerging business needs. This gave rise to a plethora of different systems that were loosely interfaced. As a result, information was scattered throughout an organization, and detailed analyses of an organization's performance across its business functions were not possible. Such information was impossible to obtain unless manual record- sifting or specialized programming requirements were carried out. In time, the organizational costs to maintain these "legacy" systems began to exceed the funds available for building new systems (Tsamantanis and Kojetsidis, 2006). Enterprise systems provide a backbone of information, communication, and control for a company (Shehab et al., 2004), and embody the current best business practices for organizational processes (Esteves and Pastor, 2000). Numerous benefits include improvements in cooperation between managers and employees, consolidation of business processes, real-time management information system, availability of information and improved lead-times and delivery times.

An ERP system is a set of customizable and highly-integrative real-time business application software modules sharing a common database and supporting core business, production, and administrative functions such as logistics, manufacturing, sales, distribution, finance, and accounting. Companies that are structurally complex, geographically dispersed, and culturally vibrant tend to present unique challenges to ERP implementation (Markus et al., 2000).

2.1 ERP System Evolution and Growth

Enterprise Resource Planning (ERP) has evolved from inventory management systems in the 1960s, to Materials Requirements Planning (MRP) in the 1970s and Manufacturing Resource Planning (MRPII) in the 1980s. In 1990s, Gartner Group, a famous US based consultancy firm, re-christened MRPII as ERP (Nah et al., 2001). The initial meaning of ERP indicated integrated software applications that govern different departmental functions such as finance and human resource. Today, the term ERP implies widespread integrated information systems applicable to any organization regardless of size and geographic locations (Huang et al., 2003). The evolution of ERP system is diagrammatically shown in Table 1.

Table 1: Evolution of ERP System

Period	Evolution
2000s	Extended ERP system (ERP II)
1990s	Enterprise Resource Planning (ERP)
1980s	Manufacturing Resources Planning (MRP II)
1970s	Material Requirements Planning (MRP)
1960s	Inventory Control Packages

Source: Adapted from Huang et al. (2003)

The first generation ERP system (introduced by vendors such as SAP and Baan) was used by large manufacturing companies such as Boeing, Mercedes-Benz and BMW (Kumar and Hillegersberg, 2000). Over time, various other industries such as retail, wholesale and service also began using ERP system (Markus, 2000). In recent years, ERP II – a second generation system with additional features such as supply chain management and customer relationship management was introduced in the market. The improved ERP system integrates back and front end office operations seamlessly (Beath, 2000). The primary backbone of ERP system is information technology (IT) which helps in the integration of numerous applications and processes owned by different departments in a firm. It is not just about enabling efficient communication between networks and protocols but is also about integration of different business processes, company policies and organizational structures (Kumar and Hillegersberg, 2000).

Since mid 1990s, the number of ERP using firms has been growing significantly. Verma (2007) reported that ERP system has become a part and parcel of firms with over $1 billion annual turnover in the year 1998. Six years later, Markus et al. (2000) highlighted that nearly 70% of Fortune 1000 firms are users of ERP system. Apart from penetration quantum, reports are also abundant with success stories from ERP vendors' perspective, although most of them seem to be estimation figure per se.

The massive investment and growth figures depict business organizations preference for ERP system. Such importance is further exacerbated by claims made by leading ERP vendors such as SAP AG and Oracle, on the benefits provided by their ERP architecture to business performance. For example, Oracle claimed that their E-business Suite assist customers to make effective informed decisions by improving their business operations and reducing operation expenditures while SAP AG promises 'faster return on investment' via their *SAP* ERP solution.

The growth in ERP users across the globe implies successful adoption to the system. The literature however has showed evidence of ERP system adoption failures, regardless of whether in developed or developing countries. In lieu of the failure cases, empirical and non-empirical studies have shown various critical success factors that can assist in avoiding adoption failure. Some of the key related studies are discussed in the next subsection.

2.2 Critical Success Factors for ERP Adoption

Nah et al. (2001) investigated critical success factors for ERP implementation by conducting a literature review. They found that key organizational issues were teamwork, change, management, top management support, plan and vision, business process management and development, project management, monitoring, effective communication, software development and testing, the role of the project champion and appropriate business and IT legacy systems. Their study shows that the complex organizational change issues must be comprehensively addressed and that they cannot be overcome by using technical solutions alone. Similarly, Huang et al. (2003) suggest that in addition to developing the technical aspects of ERP, more effort is required in understanding the more complex organizational

issues involved. Although the ERP systems have been progressively developed over at least a decade, the continual pace of change in organizations and their environments has resulted in complex technical organizational, cultural and political issues that have made the integration process a very challenging task (Huang et al., 2003).

Unique issues of change management are particularly important for multinational companies where their parent sites are geographically separate. This complexity involves several dimensions including business strategy, software configuration, technical platform, and management execution. Of these four, management execution contributes toward ERP implementation success to the greatest degree (Nah et al., 2001). Different managerial reporting lines, languages, and national cultures also make managing a multi-site ERP implementation project challenging (Markus et al., 2000). Local management must therefore be prepared to deal with the issues of enterprise-wide implementation on a site level. In particular, companies in Asia confront issues substantially different from those faced by companies in the developed world (Tarafdar and Gordon, 2007) due to the differences in sophistication of IT use and cultural influences.

In response to ERP systems implementation issues, there are some academic journals which have revealed specific metrics for ERP implementation success. Somers and Nelson (2004) are well-known as one of the top 'guru' of ERP implementation who came up with the unified critical success factor model for the industries in United States as described in Table 2. Their research work has received high number of citation in the literature and can be validated from the social science citation index (SSCI) platform. Apart from that, from research perspective, usage of a validated study that has been published by Somers and Nelson has been used to form the structure of this study. The idea is to test the model/factors proposed by these authors and see if it is applicable in the context of a developing country.

According to Youngberg (2009), the implementation process consists of six phases: initiation, adoption, adaptation, acceptance, routinization, and infusion. A number of factors that may affect the ERP implementation process and the probability of conversion success have been identified in the IT implementation, IT failures, and business process reengineering literatures (Laukkanen et al., 2007). Among the more important factors are top management support and involvement (Jarvenpaa and Ives, 2003), the need for a project champion (Beath, 2000), user training (Nelson and Cheney, 2005), technological competence, process delineation, project planning, change management, and project management (Elbertsen et al., 2006). A comprehensive study was done by Nah and Delgado (2006) to identify the factors related to successful ERP implementation. At the end of the study they came up with seven broad categories as the main factor of successful implementation as shown in Table 3. Somer and Nelson (2004) has further grouped the factors into three main categories such as knowledge management, business process and requirement study as well as project communication and management.

2.2.1 Knowledge Management

Knowledge management is about developing systems or processes to identify, capture, disseminate and use that knowledge to achieve the business objectives (Somer and Nelson, 2003). Furthermore in the context of knowledge management, Woo, H.S. (2007) has indicated that ERP software training and interdepartmental cooperation were crucial in his study towards Chinese manufacturing firms. In addition, the same study presents the lack of ICT strategy and skills as a key reason for SMEs not being able to adopt and invest in ICT. Although studies so far have shown that SMEs are more flexible, more adaptable to change and more receptive to new ideas and techniques, they do however face limitations in purchasing and implementing new systems due to a lack of human resources (Kostas, 2009; Bozbura. F, 2007; Motwani, J. and Subramanian, R, 2005; Zhang et al., 2003). Bozbura

(2007) has further indicated in her study that post ERP implementation training such as business process reengineering and software training is crucial for a successful ERP implementation.

2.2.2 Business Process and Requirement Study

Business process and requirements study is the process of understanding the organizational needs and business functions for a specific purposes such as business process reengineering. However, as pointed out by Willis and Willis-Brown (2002), even if the ERP system is successfully implemented, the "go-live" point of the system is not the end of the successful ERP implementation. An in-depth study of business process and requirement analysis will determine the successful adoption in the long term to ensure it is flexible and meets the ROI (Willis and Willis-Brown, 2002). A clear business objectives, ERP module selection, resources and alignment in between legacy system and the newly implemented system is crucial for a successful ERP implementation (Themistocleus and Irani, 2001; Shehab et al., 2004; McAdam and Galloway, 2005; Chung and Snyder 2000).

2.2.3 Project and Communication Management

This category describes exactly which piece of information needs to be communicated and what vehicles, channels or methods project team members will use to carry out the necessary project implementation (Yu, C.S, 2005). According to McAdam and Galloway (2005), ERP implementation is a long term endeavor, involves inevitable interaction between top management, project group and vendors. This was further supported by other studies which were focusing on the ERP project management and implementations (Woo H.S., 2007; Worley, J.H., 2005; Yusuf, Y., 2004)

2.3 ERP Adoption in Developing Countries

ERP system adoption has been rather predominant in developed countries for many years. The past few years however saw penetration of ERP system in firms in developing countries. There are a growing number of literatures on ERP usage in developing countries lately, especially in the context of Asian countries. Since there is a lack of study on ERP implementation and adoption in Malaysia, the review will be based on the experiences from other developing nations which are similar to Malaysian context.

Some studies examined the cultural differences between countries as the major driver for successful ERP adoption. Literature on the ERP implementation comparison between developed and developing countries indicates that developing countries are more focused towards building an integrated knowledge management framework to ensure a sustainable and more culturally accepted information system (Nah and Degaldo, 2006). The same author has also indicated that the firms from the developed countries are more focused towards project management issues and business process management. In their study, Huang and Palvia (2001) reviewed ERP implementation differences in developed and developing countries and concluded that economic status, government regulations, low IT maturity, firm size and lack of business process management experience as the major hindrance for firms in developing countries to reap the benefits from ERP investment. Karimi (2008) has indicated that the firms in Bahrain were more concerned about sustaining the ERP implementation through continuous training and exposure from the external consultants and vendors to their employees. This will ensure their local expertise are equipped with the knowledge and ultimately lowering the cost of maintaining the ERP system. Nah and Degaldo (2006) on the other hand compared success factor differences between North American and Hong Kong firms. The author found that firms in Hong Kong reap lower tangible and intangible benefits

from ERP usage as they have lower information access capability and weak reengineering and empowerment being the key success factors.

Huang et al. (2004) conducted a survey on various Taiwanese firms with the aim of identifying the critical factors for ERP adoption failure. The findings indicate that time, project management capability, employee training and change management practice as the primary factors for ERP adoption failure.

Table 2: Critical Factors for ERP

Critical Factors	
1. Top management support	12. Dedicated resources
2. Project team competence	13. Use of steering committee
3. Interdepartmental cooperation	14. User training on software
4. Clear goals and objectives	15. Education on new business processes
5. Project management	16. Business process reengineering
6. Interdepartmental communication	17. Minimal customization
7. Management of expectations	18. Architecture choices
8. Project champion	19. Change management
9. Vendor support	20. Partnership with vendor
10. Careful package selection	21. Use of vendors' tools
11. Data analysis and conversion	22. Use of consultants

Table 3: Seven Broad Categories for Successful ERP Implementation

Factors
1. Business Plan and Vision
2. Change Management
3. Communication
4. ERP Team Composition
5. Project Completion
6. Project Champions
7. System Analysis, Selection and Technical Implementation

3. RESEARCH METHODOLOGY

The research focus of this study is firms operating in retail, banking and finance, manufacturing, professional services and utilities. A total of 488 sample of small and medium enterprises (SMEs) details were collected. The lists of SMEs were obtained from several sources including Small and Medium Industries Development Corporation (SMIDEC), Federation of Malaysian Manufacturers (FMM), Institute of Bankers Malaysia (IBBM) and Multimedia Development Corporation Malaysia (MDeC).

The questionnaire was pilot tested with fifty firms for content validity and instrument reliability. Based upon the modification the final questionnaire was sent to key informants within each firm. Data were secured by a mail questionnaire. Huber and Powere noted that "if only one informant per organization is to be questioned, attempt to identify the person most knowledgeable about the issue of interest". Therefore, having decided to use a single informant from each company, we examined the suitability of various possible informants. The senior managerial positions were considered to be the most suitable informant, especially if this executive was also at a senior level in the overall organizational hierarchy (Johnston and Carrico, 1988).

The survey questions consist of 3 sections. The survey questionnaire structure was adapted from Somer and Nelson (2004). The questionnaire was distributed through post on

January 2009. A total of one-hundred and fifty one respondents or thirty one percent has responded to the questionnaires.

3.1 Measurement

In order to identify the critical success factors, a total of twenty two questions were used which was adopted from Somer and Nelson (2004). The respondents were asked to indicate their extent on each factor which was important in their ERP implementation stages. It was measured based on a five point likert scale. The rating scale ranged from: '1-strong disagree (SD)', '2-disagree (D)', '3-Uncertain (U)', '4 Agree (A)' and '5-strongly agree (SA). The target respondent in each firm was the chief information officer (CIO), the director of MIS, IT Manager or any person responsible for ERP System since they are directly involved in ERP system.

Section A involved in identifying key constructs to examine demographic characteristics of the owner-manager, business information, information about ERP system and modules used, perceived benefits from using the ERP system and perceived barriers in adopting ERP system in the organization. Demographics characteristics were gender, age, formal education level, experience in role and time spent using the ERP for work purposes. Items of business information were synthesized from the findings from Somer and Nelson (2004). The ordinal scale of measurement will be used for the demographic questions such as establishment period, size of business, type of business, location and ownership structure.

Questions in section B were designed to examine the important factors needed to look into during ERP adoption process. The questionnaires were designed based on the findings of Somer and Nelson (2004) as shown in Table 4:

Table 4: Categories and Subcategories

Categories	Subcategories
Knowledge Management	Interdepartmental cooperation User training on software Education on new business process
Business Process and Requirement study	Clear goals and objective Careful package selection Data analysis and conversion Dedicated resources Business process reengineering Minimal customization Architecture choices Change management Use of vendors' tool
Project and Communication Management	Top management support Project team competence Project management Interdepartmental communication Management of expectation Project champion Vendor support Use of steering committee Partnership with vendor Use of consultants

Section C of the survey questionnaire addresses the expected business outcome of an organization. These questions were adapted from Karimi (2008). The final stage was the collation and analysis of the response data. Data were entered into an Excel spreadsheet for cleaning and transferred to SPSS for testing the hypotheses. Three types of analysis were undertaken with missing respondent data omitted from the analysis.

1. A descriptive analysis was carried out in order to understand the distribution of the responses obtained from the survey.
2. A chi-square test was conducted to ensure the results are independent of gender, age, education, sales and implementation stage
3. A one-sample t-test was conducted on the means of the skill and channel variables to identify the statistically significant constructs (if any). The test was used to identify the skills with means significantly different from 3.0 (the midpoint of the scale); variable with a mean significantly larger than 3.0 were regarded as important (Karimi, 2008). In addition, the p-values and 95% Confidence Interval (CI) values were observed to determine the significance of these variables to the respondents. The p-values need to be significant at 5% level while the CI values would normally need to be closer to 0, and any negative values were considered unimportant.

4. FINDINGS AND ANALYSIS

A wide variety of industries were represented in the responses. The companies were classified by industry type as shown in Tables 5. The descriptive statistics suggests that a wide variety of industries were represented and the information was provided by top level IS executives. Table 5 shows a higher representation from manufacturing as manufacturing industry is the largest user of ERP in Malaysia

Table 5: Companies by industry

Industry	Number of Companies
Retail	36
Banking Institutions	10
Manufacturing	75
Professional services	18
Utilities	12

Table 6 shows the summary of frequency analysis for demographic profiles of micro-sized small business respondents.

Table 6: Demographic Profiles of Respondents and their companies

Demographics	Profiles	Percentage
Gender	Male	54.8
	Female	44.1
Year born	Before 1964	48
	1965 – 1980	42.9
	1981 – 1994	6.2
Education qualification	Certificate/Diploma	51.9
	Bachelor's degree	31.6
	Post-graduate degree	14.7
Total Employees	More than 300	55.9
	Between 150 – 300	20.3
	Less than 150	18.1
Age of business	More than 10 years	48.0
	Between 5 – 10 years	15.3
	Less than 5 years	30.5
Sales turnover	Under 100k	57.6
	Between 100 – 500k	27.1
	Above 500k	11.3
Location	Klang Valley	55.9
	Southern Peninsular	23.2
	Northern Peninsular	15.8

As can be observed from Table 7, half of the organizations reported their ERP implementation was completed last year or over one year ago, 10% were near completion, and 10% were early to mid implementation.

Table 7: Organizations' Current Stage of ERP Installation

Implementation Stage	%
Early implementation	10
Late implementation / near completion	10
Implementation completed a year ago	20
Implementation completed over a year ago	50

Table 8 presents the means and standard deviations for the 3 CSFs in descending order of importance (5=critical, 4=very high, 3=high, 2=moderate and 1=low) for the category of Knowledge Management. User training on software was viewed as most important by the respondents based on the mean value of 3.43 and further supported by positive Confidence Intervals (CI) regions. It is followed by education on new business process with a mean value of 3.35 and interdepartmental cooperation with a mean value of 3.33.

Table 8: Knowledge Management

	Mean	Std Deviation	p-value @ 0.01	Confidence Intervals @ 95%	
				Lower	Upper
User training on software	3.43	0.62	0.000	1.22	1.42
Education on new business processes	3.35	1.38	0.000	0.99	1.21
Interdepartmental cooperation	3.33	0.91	0.000	0.84	1.08

Table 9 represents CSFs related to the business process and requirements category in descending order of importance. It also shows that six out of nine factors have a mean value of more than 3.00 as well as a positive CI region. The use of vendor tools has the lowest mean value of 2.33 and further supported by negative CI region.

Table 9: Business Process and Requirement study

	Mean	Std Deviation	p-value @ 0.01	Confidence Intervals @ 95%	
				Lower	Upper
Clear goals and objective	4.02	1.19	0.000	0.66	0.91
Business process reengineering	3.75	1.14	0.000	0.69	0.94
Careful package selection	3.63	0.94	0.000	0.68	0.91
Dedicated resources	3.44	0.99	0.000	0.63	0.87
Architecture choices	3.21	1.78	0.000	0.48	0.74
Minimal customization	3.11	0.91	0.000	0.40	0.65
Change management	2.90	0.96	0.000	-0.36	-0.65
Data analysis and conversion	2.62	1.10	0.000	-0.32	-0.60
Use of vendor tools	2.33	0.89	0.000	-0.27	-0.54

Table 10 represents the means and standard deviation for the ten CSFs in descending order of importance for the category of Project communication and management. The top three CSFs are top management support with a mean value of 3.48, use of consultant with a mean value of 3.44 and followed by project management. There are three factors which are considered non-important as it has a mean value less than 3.00 with a negative CI region as shown in Table 10.

Table 10: Project Communication and Management

	Mean	Std Deviation	p-value @ 0.01	Confidence Intervals @ 95%	
				Lower	Upper
Top management support	3.48	0.64	0.000	0.44	0.69
Use of consultant	3.44	1.04	0.000	0.27	0.59
Project management	3.38	1.157	0.000	0.32	0.58
Project champion	3.24	0.91	0.000	0.28	0.56
Project team competence	3.23	0.88	0.000	0.20	0.50
Interdepartmental communication	3.11	1.13	0.000	0.15	0.49
Vendor support	3.01	0.81	0.023	0.02	0.32
Management of expectation	2.98	0.95	0.000	-0.21	-0.49
Partnership with vendor	2.45	0.88	0.000	-0.16	-0.42
Use of steering committee	2.11	1.00	0.000	-0.16	-0.45

Table 11, 12 and 13 represents the business performance outcome of the organizations. The business performance outcome has been measured based on operational efficiency, operational effectiveness and operational flexibility (Karimi, 2008).

Table 11 presents the means and standard deviations for the three business outcomes in descending order of importance for the category of operational efficiency. The data shows that the most important business outcome was lowering the cost of operation with mean value of 3.44 followed by the improved efficiency of operations with a mean value of 3.16 while reduced redundancy was considered less important due to mean value of 2.85 and a negative CI region.

Table 11: Business Performance Outcome: Operational Efficiency

	Mean	Std Deviation	p-value @ 0.01	Confidence Intervals @ 95%	
				Lower	Upper
Lowered the cost of operations	3.44	0.58	0.000	0.71	0.97
Improved the efficiency of operations	3.16	1.12	0.000	0.33	0.63
Reduced redundancy	2.85	1.04	0.000	-0.18	-0.49

Table 12 presents the means and standard deviation for the operational effectiveness. Four out of five items under the operational effectiveness has a mean value more than three with a

positive CI region. The list of business outcome based on descending order were add value to operation, high level of integration, improved quality of operations and improved timely access to corporate data.

Table 12: Business Performance Outcome: Operational Effectiveness

	Mean	Std Deviation	p- value @ 0.01	Confidence Intervals @ 95%	
				Lower	Upper
Add value to operation	3.76	1.11	0.000	0.18	0.45
High level integration	3.34	1.38	0.004	0.07	0.37
Improved quality of Operations	3.29	0.91	0.000	0.08	0.34
Improved timely access To corporate data	3.23	0.99	0.000	0.94	1.17
ERP functionalities met the requirements of job	2.93	0.80	0.000	-0.43	-0.73

Table 13 presents the means and standard deviations for the four business outcomes in descending order of importance for the category of operational flexibility. Three out four factors have a mean value of more than 3.00 with a positive CI region.

Table 13: Business Performance Outcome: Operational Flexibility

	Mean	Std Deviation	p- value @ 0.01	Confidence Intervals @ 95%	
				Upper	Lower
Adaptive to changing business environment	3.47	0.64	0.000	0.14	0.40
Improved operational flexibility	3.15	1.12	0.009	0.05	0.34
More ways to customize the process	3.07	1.15	0.000	0.15	0.38
Made the company more agile	2.85	1.04	0.000	-0.13	-0.50

5. DISCUSSION AND RESULTS

The research findings are presented and discussed in two categories. The first category discussed about the critical success factors in ERP implementation. The second category presents the benefits achieved from the ERP implementation. A study of this nature is perceived as important as the analysis could assist ERP adopting firms to identify and allocate strategic resources for successful system implementation. Such identification could also increase success across different phases of system implementation. In this study, the CSFs have been grouped under knowledge management, business process and requirement study and project and communication factors.

The result indicates that all the factors had an important role in successful ERP rollouts. Table 14 provides an understanding of the most critical factors and their importance

throughout the ERP implementation in the Malaysian business firms with the mean value of more than 3.00 and a positive CI region. The factors with a mean value of less than 3.00 are considered less important for the ERP implementation and are not shown in the final table below.

Table 14: Mean Rankings of CSFs by Degree of Importance in ERP Implementation

Critical Success Factors	Mean	p-value @ 0.01	Confidence Intervals @ 95%	
			Lower	Upper
Knowledge Management				
1.User training on software	3.43	0.000	1.22	1.42
2.Education on new business processes	3.35	0.000	0.99	1.21
3.Interdepartmental cooperation	3.33	0.000	0.84	1.08
Business Process and Requirement Study				
4.Clear goals and objective	4.02	0.000	0.66	0.91
5.Business process reengineering	3.75	0.000	0.69	0.94
6.Careful package selection	3.63	0.000	0.68	0.91
7.Dedicated Resources	3.44	0.000	0.63	0.87
8.Architecture choices	3.21	0.000	0.48	0.74
9.Minimal customization	3.11	0.000	0.40	0.65
Project and Communication Management				
10.Top management support	3.48	0.000	0.44	0.69
11.Use of consultant	3.44	0.000	0.27	0.59
12.Project management	3.38	0.000	0.32	0.58
13.Project champion	3.24	0.000	0.28	0.56
14.Project team competence	3.23	0.000	0.20	0.50
15.Interdepartmental communication	3.11	0.000	0.15	0.49
16.Vendor support	3.00	0.023	0.02	0.32

5.1 Knowledge Management

The survey analysis has shown that when considering ERP implementation, it is imperative for the employees to be trained on using the ERP software. Such finding is in line with Zhang et al's (2003) argument on the importance training for smooth knowledge transfer between supplier and user of technology systems as in the literature review.

5.2 Business Process and Requirement Study

It has been observed that clear goals and objectives are important for a successful ERP implementation among Malaysian business firms. This factor could be related to the project goals clarification and their congruence with the organizational mission and strategic goals.

The second most important factor is business process reengineering. The dimensions concerning the business process reengineering could be related to the company's willingness to reengineer, readiness for change and capability of reengineering (Zhang et al., 2003; Themistocleus and Irani, 2001; Shehab et al., 2004; McAdam and Galloway, 2005; Chung and Snyder 2000). There is no single ERP solution that can prove to be a panacea and fulfill all the business requirements. Integrating differing software packages from various vendors always poses a challenge to the organization and requires a good business process engineering. Table 13 presents that careful package selection, dedicated resources, architecture choices and minimal customization are the other most important factors.

5.3 Project and Communication Management

The most frequently discussed CSF, identified through the survey analysis was that a successful ERP implementation required top management support, because an implementation involves significant change to existing business processes as well as a significant amount of capital investment therefore gaining the required amount of support from senior management becomes paramount. The other frequently cited factors are issues related to the use of ERP consultants, this has been deemed vital to ERP projects because an ERP implementation typically requires a person with a sound knowledge of underlying business processes and the required technical skills to map new technologies and functionalities onto processes. Good consultants are however in short supply due to the lack of requisite skills and experience. The skills and competence of the project team are also a key factor influencing the success of ERP implementations because the more experienced and skilled the team the less time and money is spent on ensuring smooth rollouts with minimal errors; experienced teams also have good contingency and risk management plans for successful ERP rollouts.

Project management is also one of the CSF that is most focused under this category. This CSF is closely related to other CSFs such as project champion, change management culture and, program and user training and education. Hence, project management plays an important role in planning the whole project direction and to ensure that the undertaken ERP project can be implemented on time, on budget and meet the requirements of the company. An organizational culture where the employees share common values and goals and are receptive to change is most likely to succeed in ERP implementation because change agents play a major role in the implementation by facilitating change and communication, and to leverage the corporate culture.

It has been observed that the project management is the most important factor under this category. A formal implementation plan and realistic time frame should be the most important factor under the ERP implementation. To accomplish these CFSs, significant effort is required that must be supported by top management involvement to ensure that the implementation receives the resources, time and priority that is necessary.

In short**,** with a better understanding of the issues involved in ERP implementations and the CSFs, management will be able to make critical decisions and allocate resources that are required to make ERP implementations a success. The following section will continue with the proposal for future research topic as a result of the issue that we discovered in this section.

5.4 Key Benefits of ERP Implementatio*n*

This research found that the key benefits can be evaluated from three perspectives which are operational efficiency, operational effectiveness and operational flexibility (Karimi, 2008). As in the case of operational efficiency, this research found that organizations implementing ERP incur lowered cost of operation. This is indicated by the variable mean value of 3.44 in

Table 11. This factor is indirectly related to the return on investment (ROI). This is a clear indication that most of the organizations in this survey could be achieving or achieved their ROI. This is a very encouraging result. It indicates that, companies in the sample are experiencing good ERP-driven change and a positive ERP efficiency. It also indicated that companies are adhering to goals and objective of ERP implementation.

Table 12 summarizes that in terms of operational effectiveness, ERP has added value towards the operations of the companies. This is indicated by the mean value of 3.76 as in Table 12. The results clearly indicated that firms that implemented ERP systems more successfully concentrated on waste and its elimination leads to the distinction between value added operations and non-value added operations. The second key benefit under the operational effectiveness was high level of integration. Since the implementation of ERP systems requires changes from different functional areas, breaking functional boundaries, the very process by which these systems are put in place requires coordination across the enterprise in order to have a high integration level in a very short period of time.

Table 13 summarizes that ERP-driven companies are able to adapt towards the changing business environment. This is indicated with a mean value of 3.47 for adapting to changing business environment as in Table 13 The ability of the companies to effectively adapt to the changing business environment through ERP was found to be either as a result of focused business process reengineering or the preferred style or the direction taken by the top management in realizing their goals and objective through information system (Huang et al., 2003). ERP could create a competitive advantage in terms of new product development and delivery performance by holistically managing underlying causes of uncertainties that significantly affect new product development.

6. CONCLUSIONS

The implementation of ERP systems in organizations is an enormously complex undertaking. It is a high-risk project that needs to be managed and planned properly because it can affect nearly every aspect of organizational performance and functioning. In this paper, a comprehensive list of CSFs and key benefits has been identified and has been broadly analyzed based on Malaysian context in implementing an ERP system. To ensure success implementation, organizations must learn how to identify the critical issues that affect the implementation process and know when in the process to address them effectively to ensure that the promised benefits can be realized and potential failures can be avoided.

6.1 Implications

The results of this study have important practical and research implications. The key findings of this study would be of value to the management of the Malaysian business firms when taking decisions regarding the adoption of ERP. Moreover, it provides information systems researchers and ERP consultants with better understanding about the adoption of ERP systems in the context of developing countries such as Malaysia to ensure successful implementation of ERP. It, however, should be acknowledged that since this research emerges from an in-depth single-case study, the ability to generalize the findings is limited. The findings of the study are expected to be more transferable within the context of Malaysian SMEs in general. Furthermore it also provides a benchmark to further enhance the research scope of Malaysian ERP implementation among academicians and researchers

6.2 Limitations

One of the limitations of this study is its generalizability. The findings of this study were limited to Malaysian companies. Further analysis and research need to be done on corporations from other developing nations. Furthermore each of the firms being analyzed

were in a different phase of ERP implementation and since ERP system demands time to fulfill all the expectations derived from its implementation, it could affect the identified CSFs. Another limitation is that a wider range of critical success factors was not included due to practical constraints such as time and cost. The survey questions have also been shortened to ensure the respondents are not discouraged by the number of questions in the survey form. Apart from that, the study involves interviewing of a single IT executive in each firm which could be biased based on their job scope.

6.3 Future Research

ERP systems have become vital strategic tools in today's competitive business environment. This research attempts to investigate the critical success factors in implementing ERP systems in Malaysian business firms. In order to further enhance the research capability in this field, several in-depth interviews with the Malaysian business firm's managers and the Information Technology Centre senior staff will be conducted to get insight about their experience in managing risk with ERP implementations. Furthermore, most of the researchers seem to have neglected the important aspect of risk management in ERP implementation as most of the research work does not consider risk management as part of a successful ERP implementation. Therefore the development of techniques and approaches for the risk management of ERP implementation projects is an area to be improved.

Though it has been stated previously that some CFSs are more significant than others a proper analytical study of interrelationships of CSF dependency is yet to be made. In addition, it can be seen that factors such as top management support and project management are not substantially different from factors that are critical to the success of most IT projects and to organizational change of other kinds. It is not clear how these studies contribute to a specific understanding of factors critical to the success of ERP projects, as distinguished from other types of projects.

Furthermore, most of the identified CSFs are non-industry specific and there is a confusion about whether the identified CFSs vary across industry sectors. More research need to be focused in more industry specify CSFs. Therefore more effort in these areas should be a focus for future research.

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