Segments and Elements Influenced on ERP System Implementation

[1]Feybi Ariani Goni, [2]Abdoulmohammad Gholamzadeh Chofreh, [3]Muriati Mukhtar, [4]Shahnorbanun Sahran, [5]Syaimak Abdul Shukor

[1,3,4,5]School of Information Technology, Faculty of Information Science and Technology, Universiti Kebangsaan Malaysia, 43600, Bangi, Selangor, Malaysia
[2]Faculty of Mechanical Engineering, Universiti Teknologi Malaysia, 81310, Skudai, Johor, Malaysia

Abstract: The purpose of this paper is to discuss the segments and elements that influence on Enterprise Resource Planning (ERP) system implementation. The authors categorize the elements into four segmentations: functional capability, managerial capability, implementation capability and technology capability. The authors use the iterative triangulation methodology to establish this study. The proposed concept is then applied into a number of Malaysian SMEs to analyze their capability in ERP system adoption. By proposing these segments and elements influenced on ERP system implementation, the researcher expects that this concept will be valuable for giving the supplement in academic researches and also assist the practitioners in industry to implement ERP system successfully.

Key words: ERP System, Conceptual Framework, ERP Implementation, Small and Medium Enterprise.

INTRODUCTION

Small- to medium sized enterprises (SMEs) are crucial to the economic growth process and play an important role in the overall production network in development countries SMIDEC 2009. Malaysian SMEs comprise over 98% of total establishments and contributing to over 65% of employment as well as over 50% of the gross domestic product Malaysia 2006. SMEs become the backbone of economic growth and innovation in driving industrial development Mohd Aris 2007.

SMEs adopt information and communication technology (ICT) in their business management and operation to enhance their competitiveness, efficiency, and productivity. Effective usage of ICT in entire supply chains of manufacturing sectors can give the benefits of ICT for SMEs. SMEs in manufacturing sector are more likely to adopt ICT if their peers, suppliers, and clients are adopting ICT as well. This can help SMEs to increase the competitiveness of the industry as a whole. However, it must be noted at the outset that not all SMEs need to adopt ICT tools to the same degree of sophistication. The most basic ICT tool is having communication capabilities through fixed lines or mobile phones, whichever is more cost effective. SMEs may then use a personal computer with basic software for simple information processing needs such as producing text or keeping track of accounting items. Internet access enables SMEs to have advanced communication capabilities such as email, web browsing and launching a website. SMEs in manufacturing can benefit from more advanced ICT tools such as Enterprise Resource Planning (ERP) system Kotelnikov 2007.

While ICT can benefit SMEs in multiple ways, SMEs in developing countries have been slow to adopt ICT as they face major constraints, such as poor telecommunications infrastructure, high costs of ICT equipment, limited ICT literacy, incomplete government regulations for e-commerce, a poor understanding of the dynamics of the knowledge economy, and inability to integrate ICT into business processes. SMEs need help in translating the benefits of ICT to their core business. The willingness of SMEs to integrate ERP system as an advanced ICT depends on how much it can directly improve their core business and how much the potential benefits outweigh the definite costs. But then implement ERP system is not easy for SMEs. It needs integration in all aspects such as support from the top level management, change management, project management, human resource and infrastructure as well known as critical success factors of ERP system implementation. The goal of this study is to discuss the segments and elements that influence on ERP system implementation. The segmentation is determined by considering the integrated aspects in ERP system.

In the following sections, the authors describe the conceptual context of ERP system adoption for Malaysian SMEs and its acquired benefits. It goes on to present the research methodology for data gathering and analysing, followed by discussion of concept, case study and conclusion.

Erp System And Benefits:

ERP system is one of advanced ICT tools that can be implemented by Malaysian SMEs to build strong capabilities, improve performance, undertake better decision making and achieve a competitive advantage. The

ERP system aims are to integrate all key business activities through improved relationships at all levels in an organisation and to streamline organisational processes Davenport 2000. However, the benefits of an ERP system cannot be easily acquired Hayes *et al*. 2001 as a technology solution for SMEs, because an ERP system implementation is not just a technological challenge. It is the integration between social and technological endeavors which mandate existing applications' modification and business process re-design to facilitate ERP implementation Jha & Joshi 2007.

An ERP system implementation needs huge commitment from the organisation, causing the expensive cost of implementation and can take up to several years to complete Davenport 2000. However, when it is integrated successfully, the benefits can be enormous. The authors categorise the benefits of ERP system based on the integrated functional units in organisation, such as financial, sales and marketing, human resources, operations and logistics, suppliers and customers. Each of these functional units has a group of benefits, which are derived from multiple literatures in SME manufacturing sector. The categorisation of the benefits of ERP system is shown in Fig. 1.

Factors Affecting Erp System Adoption In Smes:

ERP system is an advanced ICT application that requires basic level of understanding in ICT as infrastructure to support business activities. SMEs need to have ICT support tools and techniques before they are ready to adopt ERP system. In recent years, ERP system has been used by many SMEs. It has been successful in some and in some others it has failed Noudoostbeni 2009. ICT infrastructure is one of the critical factors of successful ERP system implementation. Sometimes the use of an ERP system is not compatible for SMEs that do not have ICT infrastructure. Organisations with low basic ICT adoption will be unable to utilise more advanced ICT optimally. This issue will cause high cost of ERP system implementation. In this case, SMEs are most likely to avoid extra expenses rather than take the plunge Shahawai & Idrus 2010.

Based on previous studies, technical complexity was one of the significant issues in ERP system implementation. Related to this issue, organisational culture is also highlighted as one of the critical success factors of ERP system implementation. SMEs that lack personnel with understanding of ICT, however will find that adopting an ERP system would be highly unlikely to change their original ways Mohd Aris 2007. Some of SMEs still have an idea of using ERP without involvement from technology department. This case leads to a negative culture shock in the working environment and causes of failure in ERP system implementation among SMEs.

Numerous studies have attempted to explain the factors that influence ERP system adoption in SMEs. Shahawai and Idrus 2010 suggested four factors in their major study that affecting the adoption of ERP system in SMEs. The four pre-considered factors are business level, ICT Usage Level, Technological Level and External Classification. These factors need to be first considered in order to better understand the ERP system adoption in SMEs. The summarisation of each factors is described in Table 1.

Table 1: The Summarisation of Factors Affecting ERP System Adoption in SMEs Shahawai & Idrus 2010.

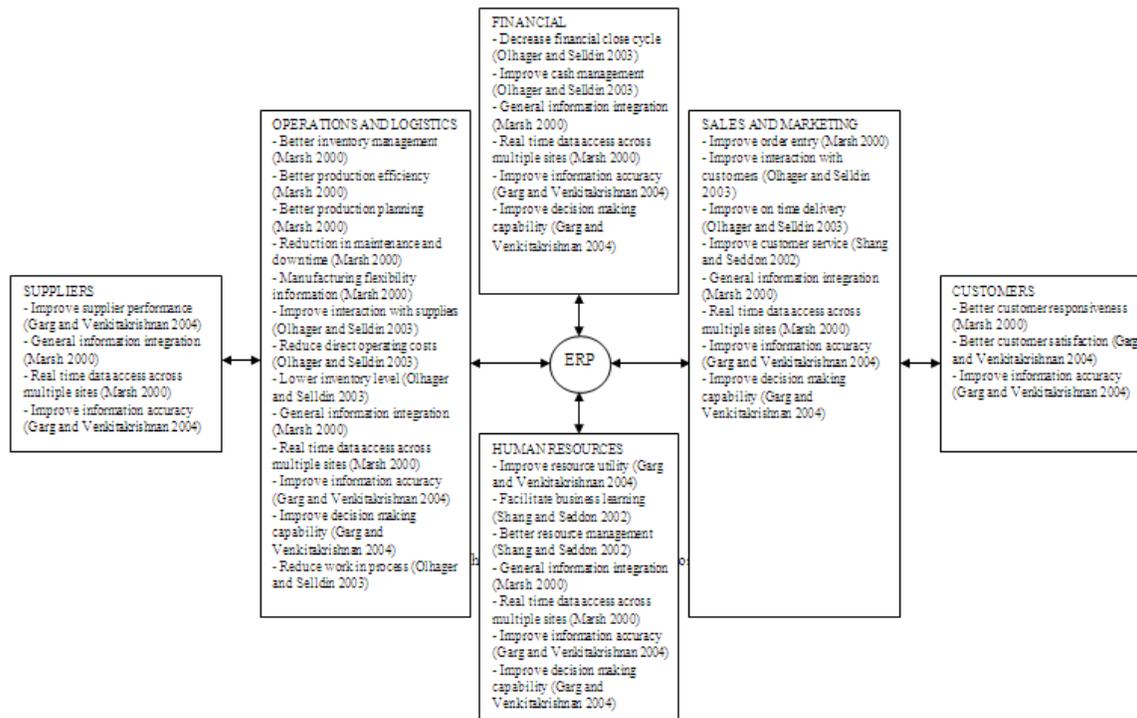| Main factor	Sub-factors	
Business level	• Micro enterprise	
	• Small enterprise	
	• Medium	enterprise
ICT usage level	• Infrastructure	
	• Budg*et al*location	
	• The barriers of ICT investment injection among SMEs	
Technological level	• Related to the need of SMEs in adopting an ERP system	
External classification	• Financial aid provided by the government	
	• ICT tools	

The business level of SMEs is categorized in many sections depending on the worker's annual income and other factors. Generally SMEs with a larger business hierarchy should be more willing to adopt ERP. While SMEs with lower business level may not have the investment needed to adopt ERP they do not find it a loss that they are unable to it. ICT usage level is the key decision factor for SMEs to adopt ERP. The implementation of ERP software requires at least some basic level of understanding in ICT. Sometimes the use of an ERP software are not compatible and appropriate for certain SMEs that do not even have an ICT support tool such as computer. The technological level factor looks into the organisation's long-term plan of re-evaluating the effects on SMEs, and whether the organisations are ready to reach a higher automated level of operational efficiency provided by the newly adopted system. Other pre-considered factor which influences SMEs in ERP system adoption is external classification. The external classification consists of financial-aid from government, awareness of information technology and suitability of ERP software to the business process in SMEs Shahawai & Idrus 2010.

According to Buonanno, *et al*. 2005, the factors affecting ERP system adoption are business factors and organisational change. In their research, Buonanno, *et al*. 2005 focused on the identification of taxonomy of business and organisational factors influencing ERP adoption. The deriving research model was incorporated in a questionnaire that was preliminarily tested and finally provided to a sample of 366 companies of any size. The summarisation of the factors affecting ERP system adoption is shown in Table 2.

Table 2: The Summarisation of Factors Affecting ERP System Adoption in SMEs Buonanno *et al*. 2005

Main factor	Sub-factors
Business factors	• Company size (H1) • Market area (H2) • The membership an industrial group (H3) • The presence of branch offices (H4) • The level of diversification in terms of products, markets, technologies (H5) • The degree of functional extension (H6)
Organisational change	• Organisational change (H7)

These seven factors were the main hypothesis in their research. The data analysis supports the existence of a strong correlation between company sizes (H1) (evaluated as a composed measure of number of employees and turnover) and ERP adoption. All the other hypotheses regarding possible business complexity measures have been rejected. The findings on the relationship between ERP adoption and organizational change (H7) show that companies making use of an ERP system expect a wider extent of business transformation (business process reengineering and business network redesign) with respect to companies making use of other software applications. SMEs always scheduled a limited organizational change in the case of ERP adoption, thus they seem not to consider ERP systems as a keystone for organisational innovation. Therefore, the rate of ERP system adoption is quite low among SMEs.

FINANCIAL
- Decrease financial close cycle (Olhager and Selldin 2003)
- Improve cash management (Olhager and Selldin 2003)
- General information integration (Marsh 2000)
- Real time data access across multiple sites (Marsh 2000)
- Improve information accuracy (Garg and Venkitakrishnan 2004)
- Improve decision making capability (Garg and Venkitakrishnan 2004)

OPERATIONS AND LOGISTICS
- Better inventory management (Marsh 2000)
- Better production efficiency (Marsh 2000)
- Better production planning (Marsh 2000)
- Reduction in maintenance and downtime (Marsh 2000)
- Manufacturing flexibility information (Marsh 2000)
- Improve interaction with supplies (Olhager and Selldin 2003)
- Reduce direct operating costs (Olhager and Selldin 2003)
- Lower inventory level (Olhager and Selldin 2003)
- General information integration (Marsh 2000)
- Real time data access across multiple sites (Marsh 2000)
- Improve information accuracy (Garg and Venkitakrishnan 2004)
- Improve decision making capability (Garg and Venkitakrishnan 2004)
- Reduce work in process (Olhager and Selldin 2003)

SALES AND MARKETING
- Improve order entry (Marsh 2000)
- Improve interaction with customers (Olhager and Selldin 2003)
- Improve on time delivery (Olhager and Selldin 2003)
- Improve customer service (Shang and Seddon 2002)
- General information integration (Marsh 2000)
- Real time data access across multiple sites (Marsh 2000)
- Improve information accuracy (Garg and Venkitakrishnan 2004)
- Improve decision making capability (Garg and Venkitakrishnan 2004)

SUPPLIERS
- Improve supplier performance (Garg and Venkitakrishnan 2004)
- General information integration (Marsh 2000)
- Real time data access across multiple sites (Marsh 2000)
- Improve information accuracy (Garg and Venkitakrishnan 2004)

ERP

CUSTOMERS
- Better customer responsiveness (Marsh 2000)
- Better customer satisfaction (Garg and Venkitakrishnan 2004)
- Improve information accuracy (Garg and Venkitakrishnan 2004)

HUMAN RESOURCES
- Improve resource utility (Garg and Venkitakrishnan 2004)
- Facilitate business learning (Shang and Seddon 2002)
- Better resource management (Shang and Seddon 2002)
- General information integration (Marsh 2000)
- Real time data access across multiple sites (Marsh 2000)
- Improve information accuracy (Garg and Venkitakrishnan 2004)
- Improve decision making capability (Garg and Venkitakrishnan 2004)

In another major study, Raymond and Uwizeyemungu 2007 found that environmental context, organisational context and technological context are the three main factors that are affecting ERP system adoption in SMEs. The summarisation of each factor is shown in Table 3.

Table 3: The Summarization of Factors Affecting ERP System Adoption in SMEs Raymond & Uwizeyemungu 2007.

Main factor	Sub-factors
Environmental context	• SMEs operating in a price-sensitive market will be more predisposed to adopt an ERP system. • SMEs operating in a very dynamic sector or in a high-growth market will be more predisposed to adopt an ERP system. • Close logistical links between SMEs and their business partners (partnership-network) would necessitate the integration of information in the value chain, thus increasing their motivation to adopt an ERP system. • Membership or affiliation of SMEs in a network of business partners will motivate them to adopt an ERP system.
Organisational context	• SMEs having very idiosyncratic production processes will be less predisposed to adopt an ERP system. • SMEs in a situation of (human, technical, and financial) resource scarcity will be less predisposed to adopt an ERP system. • SMEs with greater flexibility will be less predisposed to adopt an ERP system. • Larger, more decentralized SMEs will be more predisposed to adopt of an ERP system. • Greater formalization will predispose SMEs to adopt an ERP system.
Technological context	• SMEs confronted with the obsolescence (inefficiency, inflexibility, disintegration) of their "legacy" manufacturing information systems will be more predisposed to adopt an ERP system. • SMEs that have implemented and assimilated more advanced and integrated manufacturing technologies and applications such as CAD/CAM, FMS, and MRP-II will be more predisposed to adopt an ERP system.

MATERIALS AND METHOD

The study was carried out in 56 SMEs in Malaysia during 2008-2011. The researchers use iterative triangulation as a methodology to establish the study. This methodology can be an efficient and effective means of theory development. Analysing existing case studies taps an often abundant source of field-based information, while conserving valuable resources that would have been needed to conduct multiple, original case studies. Ideally, cases can provide thorough description of constructs, construct interrelationships, organizational contexts, and processes from multiple stakeholder perspectives, data collection methods, and levels of analysis Yin 1984. Iterative triangulation unfolds in four phases: groundwork, induction, iteration and conclusion (see Fig. 2).

The literature review serves to illuminate the dominant constructs, relationships, and theoretical perspectives and the strengths, gaps, and needs of existing literatures. This understanding helps specify the problems and constructs of interest which provide the boundaries of the theoretical domain. The authors gather a number of conceptual context in ERP system implementation and search for the gaps between the existing concepts and propose a new concept. A number of SMEs in Malaysia have been chosen as a case study. These SMEs can represent others SMEs in Malaysia, because they are selected from the various business levels. The determination of preliminary conceptual framework is then analyzed in a number of SMEs in Malaysia. The survey results will be mapped into the preliminary conceptual framework to produce a new conceptual framework in ERP system implementation. The authors also iterate different case study to be mapped into the new concept. This phase can increase the quantity and variety of conjectures raises the chance of breakthroughs and potentially improves the quality.

Results:

The proposed conceptual framework consists of four main segments: functional capability, managerial capability, implementation capability and technology capability. Fig. 3 illustrates the new conceptual framework and the detail of each main segment and its elements are explained.

Functional Capability:

This capability is related to the organizational context. Stewart *et al*. 2000 stated that the introduction of an information system can be seen as the diffusion of technology in a social system. It is important that there be adequate alignment between the technological and organizational requirements. Functional capability consists of two sub factors, which are explained in the list below.
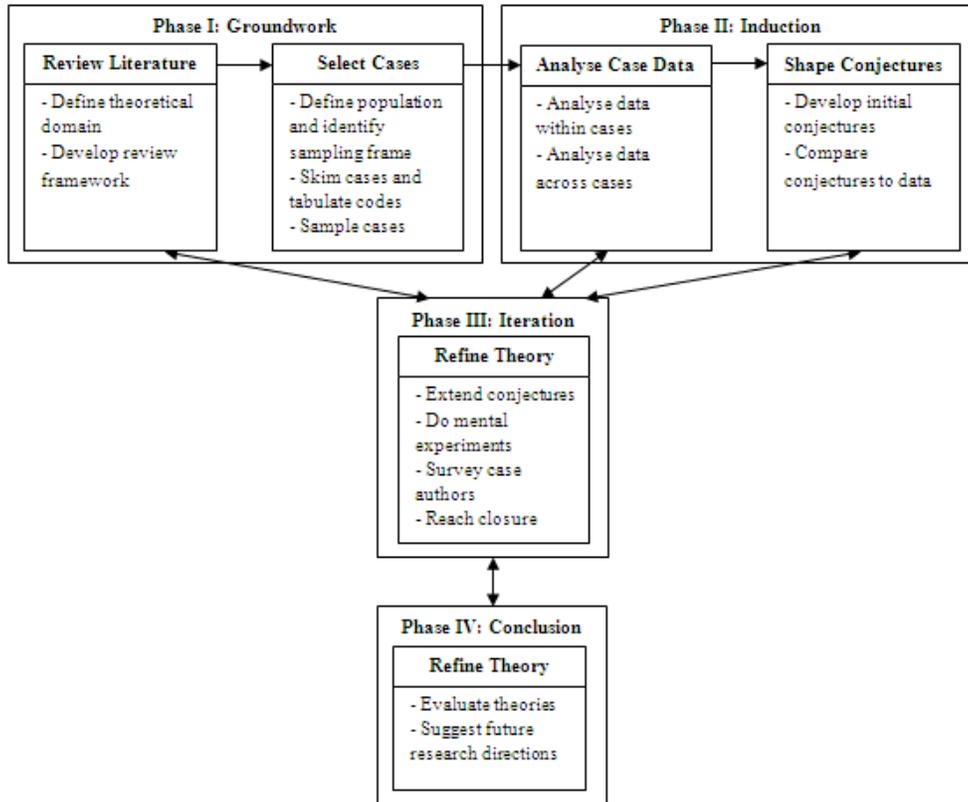
Fig. 2: The Research Approach Lewis 1998

Top management commitment and support

Implementation of ERP system in an organisation needs a big support from the top management, especially in the early steps of such a project Bingi *et al*. 1999; Slevin & Pinto 1986. The roles of top management in IT implementations include developing an understanding of the capabilities and limitations of IT, establishing reasonable goals for IT systems, exhibiting strong commitment to the successful introduction of IT, and communicating the corporate IT strategy to all employees Walton & Mckersie 1991. Research on project failures shows that project cancellations occur when senior management delegates progress monitoring and decisions at critical junctures of the project to technical experts Ewusi & Przanyski 1991. The importance of top management support was instrumental in the successful implementation of a large customized system Ginzberg 1981, was the second most important critical success factors in a study of MRP implementations in Singapore Ang *et al*. 1997, and appeared to be the driving force behind a successful ERP implementation at a manufacturing firm in the southern Midwest Clemons 1998.

a. Strategic Goals and Objectives

Set the strategic goals and objectives are important before even seeking top management support. Clear strategic goals and objectives are essential to guide an ongoing organizational effort for ERP system implementation. SMEs must define why the ERP system is being implemented and how they successfully implement ERP system. There are five primarily considered as the objectives of ERP system implementation.

- To achieve the potential growth rate.
- Increase the return on investment.
- Availability of the relevant information on regular basis.
- Better decision support system.
- Scalability of the business operations.

Most of the organizations may not be working up to their potential just because of the non availability of the relevant information and poor coordination between inter-departments. All departments work individually and get the work done and this eventually results in taking much time to complete the given task. With implementation of ERP system, the information flow across departments is easier. All the departments can be able to access the data of each and every department so they can take immediate actions Slevin & Pinto 1986.

b. Cultures

Most organizations have developed unique and describable cultures, which are reflected in their shared values, norms, beliefs, and expectations; in their policies and procedures; in their view of authority relationships; and in numerous other factors. Organizational cultures often have a direct influence on the project. For example:

1. A team proposing an unusual or high-risk approach is more likely to secure approval in an aggressive or entrepreneurial organization.

2. A project manager with a highly participative style is apt to encounter problems in a rigidly hierarchical organization, while a project manager with an authoritarian style will be equally challenged in a participative organization Duncan 1996.

The success of ERP system implementation depends on users' acceptance and their willingness to work with the new system. The role of top management in providing the appropriate and effective leadership and support creating a culture that is conducive to effective ERP system implementation Goni *et al*. 2011. Enterprise wide culture and structure change should be managed, which include people, organisation and culture change. A culture with shared values and common aims is conducive to success. SMEs should have a strong corporate identity that is open to change. An emphasis on quality, a strong computing ability, and a strong willingness to accept new technology would aid in implementation efforts Goni 2011.

    c. Educational level

Another decisive element of ERP system implementation success or failure is related to the knowledge, skills, abilities and experience of the project manager as well as selection of the right team members, which should not only be technologically competent but also understand the company and its business requirements Kapp 1998. An organisation may use consultants to provide expertise in areas where the team members are lack of knowledge Barki *et al*. 1993; Cameron & Meyer 1998; Clemons 1998.
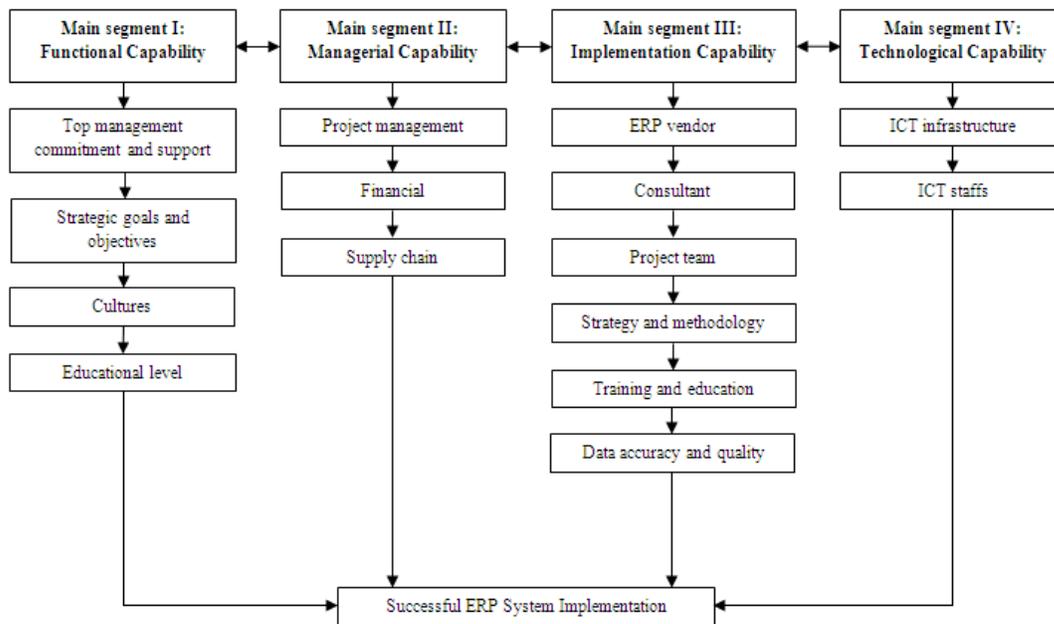

Fig. 3: The New Conceptual Model

Managerial capability:

ERP system integrates business activities across functional departments, from product planning, parts purchasing, inventory control, product distribution, general ledger, accounting to shop floor control Shah & Trivedi 2009. This means that SMEs have to have explicit business processes in all of the functional departments. The congruence or fit between an ERP system and the business processes heads the list of criteria in the selection of an ERP system for SMEs Everdingen *et al*. 2000. This congruence allows the SMEs to avoid the shock of an in-depth process re-engineering. If business processes are very idiosyncratic, there is much less of finding ERP software on the market whose design fits the organization Raymond & Uwizeyemungu 2007. The authors divide the managerial capability into four sub factors, which are mentioned as follows.

    a. Project management

ERP implementation is very complex. It needs vast combination of hardware, software, and organisational issues Ryan 1999. In order to overcome this complexity, the needs for project management as a methodological planning and calculated management are stressed Soliman & Youssef 1998. Project management needs

improvisation that becomes a part of the skill set of ERP project managers Macredie & Sandom 1999. Project management activities span the life of the project from initiating the project to closing it Hoffer *et al.* 1998.

b. Financial

Staying on budget is more than having a good budget in place. ERP project team must have a strong dose of financial management skill to keep the project on the budget. In the ongoing management of ERP budget, the best way to avoid unwanted costs and stay within budget is to follow the five principles: keep the project on the schedule, managing the project scope, limit software modifications, manage vendor hours, and frequently publish a budget expenditures dashboard Cornelius III 2006.

c. Supply chain

The need to optimize the supply chain is one of the factors that lead to the adoption of an ERP system: large manufacturing companies exert pressure on their suppliers, mainly SMEs, so that they will meet world standards in terms of cost, efficiency, and quality; this very often obliges these SMEs to restructure their processes, and in so doing they generally need an ERP system capable of real-time sharing of detailed information with their partners in the value chain Chalmers 1999. It is in fact the existence of very close logistical links between an SME and its business partners that creates an urgent need for integration Dolmetsch *et al.* 1998.

Implementation Capability:

Managerial capability, which consists of ERP vendor, consultant, project team, strategy and methodology, and training and education, is related to the ERP implementation process in organizations. These sub factors can be considered by SMEs before they start the implementation process. The explanation of each sub factor is mentioned below.

a. ERP vendor

An organization commonly does not have all the technical and transformational skills readily for managing the ERP implementation on its own. Therefore, the collaboration with IT vendors can actualize the successful project Ang *et al.* 1997; Janson & Subramanian 1996; Willcocks & Stykes 2000. The relationship between the software buyer and vendor should be strategic in nature with the ERP provider enhancing the organization's competitiveness and efficiency. Willcocks and Stykes 2000 identified ERP vendor collaborating as an enabling critical factor necessary for ERP success.

b. Consultant

Previous researches have advocated the need to include an ERP consultant as a part of the implementation team Al-Mudimigh *et al.* 2001; Bajwa *et al.* 2004; Bingi *et al.* 1999; Kalling 2003; Kraemmergaard & Rose 2002; Motwani *et al.* 2002; Skok & Legge 2002; Trimmer *et al.* 2002; Willcocks & Stykes 2000. Many organisations use consultants to facilitate the implementation process. Consultants may have experience in specific industries, comprehensive knowledge about certain modules, and able to determine which suite will work best for a given company Piturro 1999. Consultants may be involved in various stages of the implementation: performing requirements analysis, recommending a suitable solution, and managing the implementation Thong *et al.* 1994. While opinions vary with respect to what third parties should be able to control, the company should keep control and accept full responsibility for all phases of the project Cooke & Peterson 1998. Therefore, it is imperative to arrange for knowledge transfer from the consultant to the organisation Al-Mashari *et al.* 2003 to decrease the dependency on the consultant Skok & Legge 2002.

c. Project team

User involvement is important throughout ERP system implementation process, because end-users will be the potential users who use ERP system for handling their daily jobs. User involvement refers to participation of the user in the process of ERP implementation. The functions of the ERP system rely on the user to use the system after going live, but the user is also a significant factor in the implementation stage. Resistance to new ERP system may be involving the user early on while the project is still being defined, since the user has then also contributed to this decision. The experienced users who take part in implementation can also communicate with the newcomers. Another benefit of involving some users early on is that it facilitates in-house expert training. In the long-run the company may not be willing or able to rely on consultants or vendors because of the expensive consulting cost. However, this depends on the organisational culture in an organisation. There are organisations that do not involve users' participation in the project implementation stage.

d. Strategy and methodology

ERP implementation ideas and strategies can help to overcome the employees' resistance to ERP system. Previous researches classified the ideas and strategies into organisational, technical and people Aladwani 2001. The company has to do feasibility study to define what are the ideas and strategies from previous successful ERP implementation system. Based on previous research that has been conducted by the authors, there are three main strategies that must be considered in implementing ERP system: pre-implementation, implementation and post-implementation. These strategies are plans of action designed to achieve successful implementation. There are several ways for handling the project. The big bang, modular implementation and process-oriented implementation are methodologies that are commonly used for implementing ERP system. Each methodology

has a different method of system installation. This depends on the ability of SME to handle the implementation issues. The ERP implementation methodology includes extensive services from the ERP vendor. It is important for the companies to analyse each ERP implementation method, since the risk of failure in ERP implementation is existent and can be a highly expensive ordeal.

e. Training and education

Training and education on new business processes are necessary to consider the impact of the change on the nature of work and the specific job descriptions Finney & Corbett 2007. Some researchers in their previous research have specifically mentioned the need for project team training and education Kumar *et al.* 2002, while others have focused on user training Bingi *et al.* 1999; Kumar *et al.* 2002; Mandal & Gunasekaran 2003; Robey *et al.* 2002; Trimmer *et al.* 2002. The training and education should encompass the development of IT skills Stratman & Roth 2002; Tarafdar & Roy 2003; Voordijk *et al.* 2003. The management of company needs to take into account how many staff needs to be restructured Mandal & Gunasekaran 2003; Motwani *et al.* 2002 and how compensation plans may need to be evaluated and modified Cliffe 1999.

f. Data accuracy and quality

Huang *et al.* 1999 defined data quality as data that is fit for use by data consumers. Ballou *et al.* 1993 identified four common data quality dimensions: accuracy, timeliness, completeness and consistency. Data quality issues have become increasingly prevalent in practice with most organizations Redman 1998; Wand & Wang 1996. Data accuracy and quality during the conversion is much of the success of the ERP system implementation. This stage of the implementation might also involve the cleaning up of suspect and unnecessary data Yusuf *et al.* 2004. However, not many of them have taken action to deal with these issues. DQ issues have become more important for organisations to perform well, obtain competitive advantage, and/or survive in today's global economy. In particular, when organisations are implementing an ERP, it is imperative that DQ issues are a high priority Xu *et al.* 2002.

Technological Capability:

The need to improve the performance of ongoing operations is important for ERP systems adoption Oliver & Romm 2000. Therefore, SMEs are required to have technology capability to facilitate them for implementing ERP systems. The authors divide this capability into two sub factors: ICT infrastructures and ICT staffs.

a. ICT infrastructures

ERP system implementation requires at least basic IT infrastructure. Sometimes the use of ERP software is not compatible and appropriate for certain SMEs that do not have IT infrastructure, such as computer. SMEs with low IT infrastructure prior to an ERP system implementation will most probably unable to utilize the equipments for the new system optimally Shahawai 2010. Due to the lack of professional expertise and experience on developing in-house ERP systems, many companies prefer to buy off-the-shelf systems to shorten the ERP implementation cycle. ERP packages provide generic off-the-shelf business and software solutions to customers Zhang *et al.* 2002. More or less, they cannot fully meet the company's needs, especially when the business processes of the company are unique. Thus, to increase the chance of success, management must choose software that most closely fits its requirements. ERP vendors use different hardware platforms, databases, and operation systems and certain ERP packages are only compatible with some companies' databases and operation systems. Thus, companies should conduct requirements analysis first to make sure what problems need to be solved, and select the ERP systems that most fit their requirements. The hardware then is selected according to the specific ERP systems' requirements Zhang *et al.* 2002.

b. ICT staffs

ICT staff support is one of the critical factors for successful ERP system implementation Goni *et al.* 2011. ERP system implementation would not appeal to SMEs that do not have a technology department and will lead to a negative culture shock in the working environment Shahawai & Idrus 2010. SMEs that lack of personnel that clearly understanding technology will find that adopting ERP system would have a rough time and will be highly unlikely change their old ways of work.

Discussion:

SMEs in Malaysia are involved in various industries. One of them is SME in manufacturing sector that involves in activities, such as the processing and production of raw materials, and manufacturing of electrical and electronics appliances and components Saleh & Ndubisi 2006, and service sector that focus on service to customers. The main mode of the manufactures is labour intensive products and technology intensive products. Based on survey conducted by authors, ICT adoption is the highest values regarding the criteria that could be achievable as a best practice in Malaysian SMEs. This reflects the high willingness of Malaysian SMEs to adopt advanced ICT such as ERP system, which supports their operational activities and improves business and manufacturing performance. Another survey's results, which are mapped into the segments and elements in the proposed conceptual framework, are explained in Table 4.

Table 3: The Result of Case Studies' Analysis

Segments	Elements	Case studies	Documentation
Functional capability	Top management commitment and support	Most of the top managements in Malaysian SMEs support the ERP system implementation in their plants.	Questionnaires, document analysis and actual operations.
	Strategic goals and objectives	The strategic goals and objectives to implement ERP system are carefully defined.	Questionnaires, document analysis and actual operations.
	Cultures	Malaysian SMEs get problem with cultures.	Questionnaires and actual operations.
	Educational level	The educational level of employees in SMEs is still low.	Questionnaires, document analysis and actual operations.
Managerial capability	Project management	Integration: the elements of the project are not properly coordinated. Scope: Malaysian SMEs concern with defining and controlling what is or is not included in the project. Time: The time accomplishment of the project is out of the schedule. Cost: The cost estimation is not appropriate. Quality: The ERP system is not utterly satisfy the needs of users. Human Resource: The user involvement is not effective. Communications: The critical links and information among people are organized, but sometimes the key users' ideas have been ignored by the project manager. Risk management: SMEs do not identify, analyze and respond to project risk. Procurement management: The project procurement is well managed.	Questionnaires, document analysis and actual operations.
	Financial	SMEs in Malaysia have enough budgets to implement ERP system.	Questionnaires, document analysis and actual operations.
	Supply chain	Only a number of SMEs in Malaysia have supply chain management, and the rest do not have.	Questionnaires, document analysis and actual operations.
Implementation capability	ERP vendor	SMEs in Malaysia prefer to do outsource for implementing ERP system.	Questionnaires, document analysis and actual operations.
	Consultant	Malaysian SMEs do not engage business consultant to analyze their business operations.	Questionnaires, document analysis and actual operations.
	Project team	The key users in every department.	Questionnaires, document analysis and actual operations.
	Strategy and methodology	The strategic plans, which must be design in every stage of ERP system implementation, are not effective. The methodology, which is often be adopted by Malaysian SMEs, is process-oriented implementation.	Questionnaires, document analysis and actual operations.
	Training and education	Training and education are still not sufficient for users in Malaysian SMEs.	Questionnaires, document analysis and actual operations.
	Data accuracy and quality	The data that SMEs have is still not accurate and it needs much modification.	Actual operations.
Technological capability	ICT infrastructure	Malaysian SMEs have sufficient ICT infrastructures, which can support ERP system	Questionnaires, document analysis and actual operations.

		implementation.
ICT staffs		Malaysian SMEs often have a small number of ICT staff, or even do not have.	Questionnaires, document analysis and actual operations.

Functional Capability:

The management in a company is responsible for providing direct oversight direction for the ERP project and to sponsor its implementation. Top managements in Malaysian SMEs support the ERP system implementation in their plants, but it is only limited to the financial support. Most of them do not get involved into project implementation process, because they do not know the importance of their roles and responsibilities. Before deciding to implement ERP system, top management must define the strategic goals and objectives of business. Clear strategic goals and objectives are important to guide an ongoing organizational effort for ERP system implementation.

Organizational cultures become a primary issue in most of Malaysian SMEs. This particular issue is categorized into two areas: internal issues and external issues. Table 4 shows the related aspects in every issue.

Table 4: The Categorization of Issues in Organizational Cultures

Primary issue	Area of issue	Issue
Internal	Staff	Low level of education and high of staff's turnover.
	Supervisor	No willingness to change the way they work in organization, because they consider the experience rather than knowledge.
	Top manager	The difficulty to persuade the top managers for changing their decisions.
External	Supplier	Low level of education and expectation for no any system changing in customer's side.
	Customer	Low level of education.

Managerial capability:

Project management knowledge areas describe project management knowledge and practice in terms of its component processes. These processes have been organized into nine areas, which include integration, scope, time, cost, quality, human resource, communications, risk, and procurement. Considering the complexity of ERP system implementation, the needs of project management as a methodological planning and calculated management are stressed in order to meet or exceed stakeholder needs and expectations from a project.

In overall, SMEs in Malaysia still do not have effective project management to implement ERP system. They only focus on time and cost estimation, without considering the other knowledge areas. This phenomenon is caused by the project manager, who does not have integrated knowledge and skills in managerial and technical parts. Therefore, top management in an organization must select a leader, who is able to establish and use appropriate measures of success.

Consider to the high cost of ERP system implementation, financial also plays an important role in the project. Organizations will have two possibilities when they want to implement ERP; firstly restructuring/reengineering their supply chain, and secondly customization. Both of these possibilities may consume many efforts, especially cost and schedule. Malaysian SMEs have to face these particular issues, because they cannot manage the process very well. The best way to avoid this matter is effectively applying the project management concept and software. The integration of nine knowledge areas in project management will help the project manager to organize the implementation processes.

Implementation Capability:

SMEs in Malaysia collaborate with vendor to implement ERP system, because they do not have technical skill readily for managing the project implementation. Oppositely, SMEs do not consider business consultant in the project implementation, because of cost efficiency. They will define their own business processes and determine the modules. The roles of ERP vendors are not only sale the products, they also have to guide an organization to implement this system and understand the business concepts. The way to transform the knowledge is through training and education to the top management, project team and key users in system pre-implementation and post-implementation in order to consider the impact of the change on the previous work, roles and responsibilities. The users' involvement is also needed during implementation, because ERP system will not be effectively implemented without this.

Based on research conducted in a group of SMEs, modular implementation and process-oriented implementation are the most common methodology adopted by SMEs to install ERP software package. These methodologies reduce the risk of installation and operation of ERP system by reducing the scope of implementation. SMEs might not be ready for adopting the big bang approach because it needs a solid ERP project team which has enough experience to implement this. Data transformation will also take a part of ERP implementation. This transformation needs high accuracy and quality of data. In this case, SMEs still have less

data accuracy and quality, therefore they need much modification before they convert the data into centralized database.

Technological Capability:

Malaysian SMEs have sufficient ICT infrastructures, which can support ERP system implementation. ERP vendor will recommend hardware and software from minimum to maximum requirements to implement ERP system. The decision for choosing these requirements and installing the software and hardware must be considered by project manager, because it has effect to the cost and schedule.

Based on this survey, most of SMEs have small number of ICT staff, or even do not have. This brings human resource problem in SMEs and lead them to face the culture shocks. The idea of implementing ERP system will not be achieved by SMEs that do not have ICT staffs. Their existence is essential in ERP system implementation, because they have technical capability as a part that is needed in the system implementation.

Conclusion:

Based on the case study, the success or failure in implementing an ERP system is not only in terms of software installation. There are still functional, managerial, implementation and technological capabilities that are critical to support the successful implementation of ERP system. SMEs as a backbone of the economic growth in industry must consider these capabilities and their elements for implementing this system. All of these capabilities must be integrated to solve the issues those appear during implementation. The conceptual framework as a contribution in this research is effectively beneficial in ERP system implementation environment. This can give significant for SMEs as guidance to implement this integrated information system.

REFERENCES

Al-Mashari, M., A. Al-Mudimigh, & M. Zairi, 2003. Enterprise resource planning: A taxonomy of critical factors. European Journal of Operational Research, pp: 352-364.

Al-Mudimigh, Zairi, A.M. & M. Al-Mashari, 2001. ERP software implementation: an integrative framework. European Journal of Information Systems, pp: 216-226.

Aladwani, A., 2001. Change management strategies for successful ERP implementation. Business Process Management Journal, pp: 266-275.

Ang, K.T., J.Y. Thong, & C.S. Yap, 1997. IT implementation through the lens of organizational learning: a case study of insuror. *ICIS*, hlm. pp: 331-348.

Bajwa, D., J. Garcia, & T. Mooney, 2004. An integrative framework for the assimilation of enterprise resource planning systems: phases, antecedents, and outcomes. Journal of Computer Information Systems, pp: 81-90.

Ballou, D.P., R.Y. Wang, H.L. Pazer, & K.G. Tayi, 1993. Modelling data manufacturing systems to determine data product quality. Total Data Quality Management Research Program. MIT Sloan School of Management.

Barki, H., S. Rivard, & J. Talbot, 1993. Toward an assessment of software development risk. Journal of Management Information Systems, pp: 203-225.

Bingi, P., M. Sharma, & J. Godla, 1999. Critical Issues Affecting an ERP Implementation. Information Systems Management, pp: 7-14.

Buonanno, G., P. Faverio, F. Pigni, A. Ravarini, D. Sciuto, & M. Tagliavini, 2005. Factors affecting ERP system adoption: A comparative analysis between SMEs and large companies. Journal of Enterprise Information Management, pp: 384-426.

Buonanno, G.P.F.F.P.A.R.D.S.M.T., 2005. Factors affecting ERP system adoption: A comparative analysis between SMEs and large companies. Journal of Enterprise Information Management, pp: 384-426.

Cameron, D.P. & L.S. Meyer, 1998. Rapid ERP Implementation - A Contradiction. Management Accounting, pp: 58-60.

Chalmers, R.E., 1999. Small manufacturers seek best ERP fit. Manufacturing Engineering, 123(4): 42-46.

Clemons, C., 1998. Successful Implementation of an Enterprise System: A Case Study. *Proceedings of the Americas Conference on Information Systems*, hlm. 109-110.

Cliffe, S., 1999. ERP Implementation. Harvard Business Review., pp: 16.

Cooke, D. & W. Peterson, 1998. *SAP Implementation: Strategies and Results*. New York, USA: The Conference Board.

Cornelius III, E.T., 2006. ERP Budget 101: Part II Constructing the Managing-Level Budget.*www.collegiateproject.com.*
http://www.collegiateproject.com/articles/ERP%20Budget%20101%20Part%202.pdf

Davenport, T., 2000. Mission Critical: Realizing the Promise of Enterprise Systems.

Dolmetsch, R., T. Huber, E. Fleisch, & H. Osterle, 1998. *R/3 implementation in small and midsize companies*. St Gallen: Institute for Information Management, Universitat St Gallen.

Duncan, W.R., 1996. *A Guide to the Project Management Body of Knowledge*. Upper Darby, PA, USA: Project Management Institute.

Everdingen, Y.V., Hillegersberg, J. V. & Waarts, E. 2000. ERP adoption by European midsize companies. *Communication of the ACM* 43(4): 27-31.

Ewusi, M. & Z. Przanyski, 1991. On information systems project abandonment: an exploratory study of organizational practices. MIS Quarterly, pp: 67-85.

Finney, S. & M. Corbett, 2007. ERP Implementation: a compilation and analysis of critical success factors. Business Process Management Journal, pp: 329-347.

Ginzberg, M.J., 1981. Early Diagnosis of MIS Implementation Failure: Promising Results and Unanswered Questions. Management Science, 27(4): 459-478.

Goni, F.A., 2011. Framework for Enterprise Resource Planning (ERP) System Implementation in Small and Medium Enterprise in Malaysia. Universiti Kebangsaan Malaysia.

Goni, F.A., A. Gholamzadeh Chofreh, & S. Sahran, 2011. Critical Success Factors for Enterprise Resource Planning System Implementation: A Case Study in Malaysian SME. *International Conference on Advanced Science, Engineering and Information Technology (ICASEIT) 2011*, hlm. 200-205.

Hayes, D., H. Hunton, & J. Reck, 2001. Market reaction to ERP implementation announcements. Journal of Information Systems, pp: 3-18.

Hoffer, J.A., J.F. George, & J.S. Valacich, 1998. *Modern Systems Analysis and Design* MA: Addison-Wesley.

Huang, H.-T., Y.W. Lee, & R.Y. Wang, 1999. *Quality Information and Knowledge*. Prentice Hall PTR.

Janson, M. & A. Subramanian, 1996. Packaged Software: Selection and Implementation Policies. INFOR.

Jha, V.S. & H. Joshi, 2007. Relevance of Total Quality Management (TQM) or Business Excellence Strategy Implementation for Enterprise Resource Planning (ERP): A Conceptual Study.

Kalling, T., 2003. ERP systems and the strategic management processes that lead to competitive advantage. Information Resources Management Journal., pp: 46.

Kapp, K. M., 1998. Avoiding the HAL syndrome of ERP implementations. *APICS Magazine Online Edition*

Kotelnikov, V., 2007. Small and Medium Enterprises and ICT. United Nations Development Programme.

Kraemmergaard, P. & Rose, J. 2002. Managerial Competences for ERP Journeys. Information System Frontiers., pp: 199-211.

Kumar, V., B. Maheshwari, & U. Kumar, 2002. An investigation of critical management issues in ERP implementation: emperical evidence from Canadian organizations. Elsevier Science Ltd.

Lewis, M.W., 1998. Iterative triangulation: a theory development process using existing case studies. Journal of Operations Management., 16(4): 455-469.

Macredie, R. & C. Sandom, 1999. IT-enabled change: evaluating an improvisational perspective. European Journal of Information Systems, pp: 247-259.

Malaysia, S.C. 2006. *Developing Malaysian SMEs.* http://www.smeinfo.com.my/index.php?ch=2&pg=2&lang=

Mandal, P. & A. Gunasekaran, 2003. Issues in implementing ERP: A case study. European Journal of Operational Research, 146: 274-283.

Mohd Aris, N., 2007. SMEs: Building Blocks for Economic. Journal of Department of Statistics:

Motwani, J., D. Mirchandani, M. Madan, & A. Gunasekaran, 2002. Successful implementation of ERP projects: evidence from two case studies. International Journal of Production Economics., pp: 83.

Noudoostbeni, A.N., Mohd Yasin, 2009. To investigate the Success and Failure Factors of ERP implementation within Malaysian Small and Medium Enterprises. *International Conference on Information Management and Engineering*, hlm.

Oliver, D. & C. Romm, 2000. ERP systems: the route to adoption. *Proceedings of Americas Conference on Information Systems (AMCIS)*, hlm. pp: 1039-1044.

Piturro, M., 1999. How Midsize Companies are Buying ERP. Journal of Accountancy*., pp: 41-48.

Raymond, L. & S. Uwizeyemungu, 2007. A Profile of ERP adoption in manufacturing SMEs. Journal of Enterprise Information Management., pp: 487-502.

Raymond, L.S., Uwizeyemungu, 2007. A Profile of ERP adoption in manufacturing SMEs. Journal of Enterprise Information Management: pp: 487-502.

Redman, T.C., 1998. The impact of poor data quality on the typical enterprise. *Communications of the ACM* 41(2): 79-82.

Robey, D., J. Ross, & M.C. Boudreau, 2002. Learning to implement enterprise systems: an exploratory study of the dialectics of change. Journal of Management Information Systems, pp: 17.

Ryan, H., 1999. Managing development in the era of large complex systems. Information Systems Management, pp: 89-91.

Saleh, A.S. & N.O. Ndubisi, 2006. An Evaluation of SME Development in Malaysia. International Review of Business Research, pp: 1-14.

Shah, H. & J. Trivedi, 2009. Application of Enterprise Resource Planning in Construction Industry (Pre Implementation Phase).

Shahawai, S.S. & R. Idrus, 2010. Pre-considered factors affecting ERP system adoption in Malaysian SMEs. *12th International Conference on Computer Modelling and Simulation*, hlm.

Shahawai, S.S.R.I., 2010. Pre-considered factors affecting ERP system adoption in Malaysian SMEs. 12th International Conference on Computer Modelling and Simulation, hlm.

Skok, W. & M. Legge, 2002. Evaluating enterprise resource planning (ERP) systems using an interpretive approach. Knowledge and Process Management, pp: 72.

Slevin, D. & J. Pinto, 1986. The project implementation profile: New tool for project managers. Project Management Journal., pp: 57-70.

SMIDEC. 2009. Definition of SMEs. www.smidec.gov.my.

Soliman, F. & M. Youssef, 1998. The role of SAP software in business process reengineering. International Journal of Production and Operations Management., pp: 886-895.

Stewart, G.M., T. Jewels, T. Hunter, B. Hunter, 2000. Organizational readiness for ERP implementation. Proceedings of the 6th Americas Conference on Information Systems, hlm. 966-971.

Stratman, J. & A. Roth, 2002. Enterprise resource planning (ERP) competence constructs: two-stage multi-item scale development and validation. Decision Sciences, pp: 601.

Tarafdar, M. & R. Roy, 2003. Analyzing the adoption of enterprise resource planning systems in Indian organizations: a process framework. Journal of Global Information Technology Management, pp: 31.

Thong, J.Y.L., C.S. Yap, & K.S. Raman, 1994. Engagement of external expertise in information systems implementation. Journal of Management Information Systems (JMIS) 11: 209-231.

Trimmer, K., L. Pumphrey, & C. Wiggins, 2002. ERP implementation in rural health care. Journal of Management in Medicine, pp: 113.

Voordijk, H., A. Leuven, & A. Laan, 2003. Enterprise resource planning in a large construction firm: implementation analysis. Construction Management and Economics, pp: 511.

Walton, R.E. & R.B. Mckersie, 1991. A Behavioral Theory of Labor Negotiations: An Analysis of a Social Interaction System.

Wand, Y. & R.Y. Wang, 1996. Anchoring data quality dimensions in ontological foundation. *Communications of the ACM* 39(11): 86-95.

Willcocks, L. & R. Stykes, 2000. The CIO, IT Function and ERP: Asleep at the Wheel? *Communications of the ACM*

Xu, H., J.H. Nord, N. Brown, & G.D. Nord, 2002. Data quality issues in implementing an ERP. Industrial Management & Data Systems, 102(1): 47-58.

Yin, R., 1984. *Case study research: Design and methods*. Beverly Hills, CA: Sage Publishing.

Yusuf, Y., A. Gunasekaran, & M.S. Abthorpe, 2004. Enterprise information systems project implementation: A case study of ERP in Rolls-Royce. International Journal of Production Economics., 87: 251-266.

Zhang, L., M.K.O. Lee, Z. Zhang, & P. Banerjee, 2002. Critical Success Factors of Enterprise Resource Planning Systems Implementation Success in China. *Proceedings of the 36th Hawaii International Conference on System Sciences (HICSS'03)*, hlm.