CUSTOMIZING ERP SYSTEM MODULES FOR MANUFACTURING SMES IN MALAYSIA

YOUSEF KAMAL YOUSEF KHALEEL

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MENYESUAIKAN MODUL SISTEM ERP UNTUK PEMBUATAN SME DI MALAYSIA

YOUSEF KAMAL YOUSEF KHALEEL

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DECLARATION

I hereby declare that the work in this thesis is my own except for quotations and summaries which have been duly acknowledged.

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ABSTRACT

Small and Medium Enterprises (SMEs) are required to utilize their local resources and provide integrations with their suppliers and trading partners to sustain their competitiveness and survive in global markets. ICT applications could be utilized to fully capitalize SMEs resources, thus allows SMEs to expand their boundaries and better collaborate with their stakeholders. Enterprise Resource Planning (ERP) system, as an ICT application, is an efficient tool to help enterprises to enhance their performance and service. Based on literature reviews, it is found that Malaysian SMEs are still at minimal level of utilizing ICT applications generally, and ERP system in particular. In fact only 10% of Malaysian SMEs have adopted ERP system within their borders. Investigations reveal that there are two types of ERP systems used in Malaysian SMEs namely, Off-the-shelf and In-house ERP systems. Firstly, preliminary study phase was conducted to evaluate the impacts of these issues. The procedure of this evaluation obtained through a quantitative survey. Results show that the complexity and non-compatibility of the off-the-shelf ERP system in addition to the high cost of In-house ERP development, those have the highest impact that leads to the reluctance of manufacturing SMEs from adopting ERP system. Based on these findings, the objectives of this study was formulated, first of which is to investigate the appropriate sub-sector to apply ERP within, then to identify the requirements of ERP for the selected appropriate manufacturing SMEs sub-sector in Malaysia. Therefore, according to Small and Medium Industries Development Corporation (SMIDEC) in Malaysia, three major enterprises activities in manufacturing SME known as the Office, Accounting, and Computing Machinery sub-sector is selected as it most fit ERP readiness criteria. Analyses conducted on the business processes of this sub-sector leads to generate new ERP functions and To-Be business processes. This contributes to pursue in designing the ERP system, a new web-based system design in which the issues identified were addressed. The web-based form has been selected to exploit the features that are available in web application such as providing free licence ERP system that can be used by multi enterprises through internet business area and reducing the cost of the hardware required for implementation. In order to validate the new web-based ERP system, the design is transformed into a computer system that consists of different capabilities, which allow users to customize and select ERP functions based on the needs of the enterprises. Finally, the usability questionnaire was used to evaluate the developed ERP system based on five ERP usability criteria. The result shows that the usability criteria have been achieved. In addition the results have illustrated a common agreement among the participants in terms of the efficiency and effectiveness of the system. Furthermore, the results also indicate the applicability and ability of the developed system to integrate the processes within Office, Accounting and Computing Machinery sub-sector, in a way that will fulfil their requirements.

ABSTRAK

Industri Kecil dan Sederhana (SME) perlu memanfaatkan sumber tempatan mereka dan menyediakan proses yang menyepadukan dengan pihak pembekal serta rakan kongsi perusahaan untuk mengekalkan daya saing dan daya tahan dalam pasaran global. Aplikasi ICT boleh dimanfaatkan untuk memodalkan sumber SME sepenuhnya, sekali gus membolehkan SME memperluaskan sempadan dan mewujudkan kerjasama yang lebih baik dengan pemegang saham mereka. Sistem Perancangan Sumber Perusahaan (ERP) adalah satu aplikasi ICT dalam industri pembuatan, yang berupaya meningkatkan prestasi dan perkhidmatan perusahaan. Berdasarkan kajian literatur, didapati bahawa penggunaan aplikasi ICT di SME di Malaysia masih lagi ditahap minimum, khususnya, Sistem ERP. Malah, hanya 10% SME di Malaysia yang menggunakan Sistem ERP dalam perusahaan mereka. Melalui penyelidikan ini, didapati bahawa terdapat dua jenis sistem ERP yang diguna di SME di Malaysia iaitu, sistem stok-sedia-ada dan sistem ERP"In-house". Pada permulaan kajian fasa awal dijalankan, sebuah soal selidik telah dilaksanakan untuk menilai impak kepada isu-isu ini dan mendapati bahawa kerumitan dan ketakserasian sistem stok-sedia-ada di samping kos yang tinggi untuk pembangunan sistem ERP "In-house" memberi impak yang tinggi dan menyebabkan SME enggan menggunakan sistem ERP. Berdasarkan penemuan ini, objektif kajian ini telah dirangka untuk mengenalpasti keperluan sistem ERP untuk SME di Malaysia dan untuk mengenalpasti subsektor yang sesuai menggunakan ERP. Oleh itu, berdasarkan kajian ke atas Perbadanan Pembangunan Industri Kecil dan Sederhana (SMIDEC) di Malaysia, tiga aktiviti perusahaan utama dalam pembuatan SME dikenali sebagai subsektor pejabat, perakaunan, dan perkomputeran mesin kecil telas dipilih kerana sub sektor ini yang paling sesuai patut kriteria "ERP readiness" ataupun ketersediaan ERP. Analisis yang dijalankan ke atas proses bisnes sub sektor ini menghasilkan fungsi baru ERP serta proses niaga yang. Penyelidikan ini menyumbang kepada proses mereka bentuk sistem ERP, sebuah reka bentuk sistem baru berasaskan web dengan isu-isu yang telah dikenalpasti ditangani. Bagi mengesahkan sistem ERP baru yang berasaskan web, reka bentuk sistem diubah menjadi sistem maju dengan keupayaan berbeza yang membolehkan penyesuaian dan pemilihan fungsi ERP berdasarkan keperluan perusahaan. Akhir sekali, kaedah soal selidik ujian kebolehgunaan digunakan untuk menilai sistem ERP yang telah dibangunkan berdasarkan lima kriteria kebolehgunaan ERP. Hasil kajian menunjukkan bahawa kriteria kebolehgunaan telah dicapai. Di samping itu, keputusan juga menggambarkan terdapat persamaan dari segi kecekapan dan keberkesanan sistem. Tambahan pula, keputusan juga menunjukkan terdapat kesesuaian dan keupayaan untuk mengintegrasikan sistem yang dibangunkan dengan proses perniagaan dalam sektor kecil Pejabat, Perakaunan dan Pengkomputeran Mesin Kecil di Malaysia yang memenuhi keperluan dan ciri-ciri perusahaan meraka.

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CHAPTER I

INTRODUCTION

1.1 STUDY OVERVIEW

The vast development of Information and Communication Technology (ICT) in the last decades is a result of the growth occurs in various industries such as electronic, computer, telecommunication, and others that have had dramatic effects on different aspects of organizations' functions. An optimal introduction and integration of a primary technology that effectively utilizes an ICT system in the organization and workforce, specifically an ERP system, will have an enormous positive long-term effect on large, medium or small enterprises (Ravarini 2010). One of the key business applications that help enterprises to manage their resources is Enterprise Resource Planning (ERP), which is a multi-module application software package system that integrates key business and management processes across an enterprise (McGaughey and Gunasekaran 2008).

A successful implementationof the ERP system helps enterprises to manage and integrate all the business functions within their borders. The ERP typically contains a set of mature business application and tools for financial and cost accounting, sales and distribution, materials management, human resource, production planning and computer integrated manufacturing, supply chain, and customer information (Boykin 2001; McGaughey and Gunasekaran 2008). Furthermore, an ERP system can be used as a tool to help in improving the performance level of a supply chain network by helping to reduce cycle times (Gardiner et al. 2002; Wisner et al. 2008).

This research targets the Manufacturing small and medium sized enterprises (SMEs) whose headcount or turnover falls below certain limits. According to the Small and Medium Industries Development Corporation (SMIDEC) in Malaysia; Manufacturing SMEs are enterprises with full-time employees not exceeding 150 or with annual sales turnover not exceeding RM25million.

With the opening up and opportunity of the global economy the Manufacturing SMEs have found difficulties to sustain, since they do not have the strength to compete with large enterprises (Singh et al. 2008). Manufacturing SMEs in Malaysia have to tap the power of IT and integrated information systems to stay competitive and customer oriented (Ghobakhloo et al. 2011). As stated earlier, ERP is often considered the answer for enterprises survival (Rao 2000; Shehab et al. 2004; McGaughey and Gunasekaran 2008). Since ERP software market has become one of today's largest IT investments worldwide (Shehab et al. 2004; Moon 2007), as enterprises, and SMEs in particular, realized the abilities and promises of ERP.

Despite local and international ERP vendors have come up with various solutions or packages to cater the needs of SMEs, it is inadequate to raise awareness for the targeted markets to embrace the system (Olson 2003; Johansson and Sudzina 2008). Most SMEs in Malaysia are proving to be laggards of the ERP system (Shahawai and Idrus 2011). SMEs could not afford the risk of investing time, money and effort for a system that could ultimately fail (Haddara and Zach 2011). The current trend in handling the SME market for Malaysian ERP vendors is still a huge grey area (Supramaniam and Kuppusamy 2010). The adopted ERP solutions within SMEs in Malaysia found to be either, of-the-shelf ERP system, in which enterprises purchase the ERP system offered by the vendors from the IT products markets. The other form, In-house ERP system, where enterprises utilize their own IT departments to develop a specific system functions(Shahawai and Idrus 2010). The provided ERP solutions have not met the mark with the majority of Malaysian SMEs that it was targeting (Noudoostbeni et al. 2009; Shahawai and Idrus 2010). To sum up of the foregoing, there is weakness in the adoption of the ERP system in Malaysian SMEs, in both manufacturing and services sector.

Accordingly, the relevant research issues are: What are the reasons that affect the adoption of ERP in manufacturing SMEs in Malaysia? How it can be overcome? This research aims to address these issues. Firstly, a review of current literature on ERP implementation is presented, and gaps are identified in the literature investigating the issues in ERP adoption. Secondly,identify the Manufacturing of SMEs in Malaysia those are capable and prepared to adopt ERP system. Thirdly, the current business processes of Manufacturing SMEs are analyzed to determine the required improvement. Finally customized ERP system modules are developed for Manufacturing SMEs in Malaysia where by avoiding the issues that prevent the expansion of the ERP adoption within manufacturing SMEs in Malaysia.

1.2 STUDY BACKGROUND

According to the United Nation Economic Commission for Europe (UNECE), the economic globalization has a dual impact on SMEs. It may provide new opportunities to SMEs in terms of expansion and growth. This is can be achieved by improving quality, competitiveness and management practices that leads to international marketing possibilities.

Moreover, communication facilities are required for any enterprise to get the benefits of entering the globalization world. In this regard, SMEs are asked to allow exchange real time information (Moekotte and Freye 2008). This need is emerged widely, especially after the growth of e-commerce technology adoption in SMEs (Themistocleous and Chen 2004).

While on the other hand, inspecting the globalization influence on SMEs revealed endangers of SMEs existence in the long run (Moekotte and Freye 2008). Further investigations showed various barriers for SMEs to enter international trading represented by the lack of quality information, techniques, standards and conformity available (Hashim and Hassan 2008).

However, such barriers should be removed in order for SMEs to be internationalized and globalized. One way of addressing this demand is adopting ERP practice as a discipline that allows enterprises to integrate their different resources and

information technology infrastructures to stay competitive in the global markets (McGaughey and Gunasekaran 2008).

In particular, ERP system is one of the key ICT applications that help enterprises to manage their resources through a multi-module software package that integrates key business and management processes across the enterprise (De Souza et al. 2008; McGaughey and Gunasekaran 2008). The utilisation of ERP system helps SMEs to improve their competitiveness via establishing integration among their systems and their suppliers or trading partners (Militaru and Serbanica 2008).

The integration provided by ERP system is a sore point for enterprises in general, even for the large high-technology companies integration to meet global competition is not easy task to achieve (Mohr et al. 2009). However, for SMEs, integration is a significant problem due to high costs and technology requirements(Themistocleous and Chen 2004; Matejun 2008).

According to the International Data Corporation (IDC), even though most of the SMEs are conscious of the impending benefits of ICT, they are uncertain of selecting the correct solution.

Based on examining Malaysian SMEs in terms of ERP practices, it is discovered that Malaysia has put a lot of efforts to influence the SMEs to use ICT applications including ERP systems. The Malaysian Industrial Development Finance provides 75 percent financing at the rate of 3 percent interest over a period of five years for SMEs to purchase ICT applications. The loan amounts ranges from MYR 20,000 and MYR 250,000. Unfortunately, the efforts have not yielded positive results; despite the government's efforts only about 10 percent of SMEs have used ERP (Kotelnikov 2007).

Therefore, it is vital to identify the issues that prevent the use of ERP system in Malaysian SMEs. Based on studies presented byPoba-Nzaou et al. (2008) and Noudoostbeni et al. (2009), Shahawai & Idrus(2011)there are various issues affecting ERP adoption in SMEs environment. Specifically, eight issues were identified affecting ERP adoption in Malaysian SMEs; the issues are divided into three

categories as follows: (1) organizational issue, (2) technological issue, and (3) awareness towards ERP system (See Figure 1.1). As the study main focus is the manufacturing sector of SMEs inside Malaysia. The motive was formulated to examine the sector's poor deployment of ERP system. For this purpose, a survey questionnaire was carried out. This questionnaire is aimed at investigating the current status of ERP systems availability in the Manufacturing SMEs in Malaysia. This sector includes 21 sub-sectors has been covered in this questionnaire. The questionnaire results had classified the eight identified issues that affecting ERP system adoption based on their impact in ERP adoption. In particular, analysing the questionnaire results reveals specific issues that have a high impacts related to technological issue. In addition to other issues that are related to organizational issue and awareness towards ERP system issues, their impact are less severe.

As illustrated in Figure 1.1, off-the-shelf ERP system suffers a complex functions that found unable to fit the size of the SMEs business processes, as well an inadequate functions provided. Meanwhile, the In-house ERP system suffers a high cost of development and need longer time for implementation. These issues act as barrier for enterprises to develop ERP system, since In-house ERP system need to be customized in order to be compatible with the enterprises business processes thus it is essential to fulfil their needs and requirements.

Based on an extensive analysis of each of the issues above, it was found that the high cost and long implementation time of In-house ERP system development is resulted from the customization and alignment needs. However, this high cost could be reduced by providing a customized based on sub-sector rather on enterprise. In other words, based on the literature reviews conducted it is discovered that enterprises in the same sub-sector that have similar output products (activities) are implicitly sharing similar business processes (Raymond and Uwizeyemungu 2007; Poba-Nzaou et al. 2008). Therefore, it can be deduced that those enterprises are qualified to share same ERP system.

On the other hand, the issues related with off-the-shelf ERP systems found to fall under usability issues, in which possible solutions can be presented based on different development techniques and tools to ensure achieving the usability measure.

Figure 1.1 shows the current issues of ERP system adoption within manufacturing SMEs in Malaysia. During this research the technical issues will be addressed on the grounds that the technical issues have the highest impact among other ERP issues that lead to poor adoption of the ERP system within manufacturing SMEs in Malaysia.

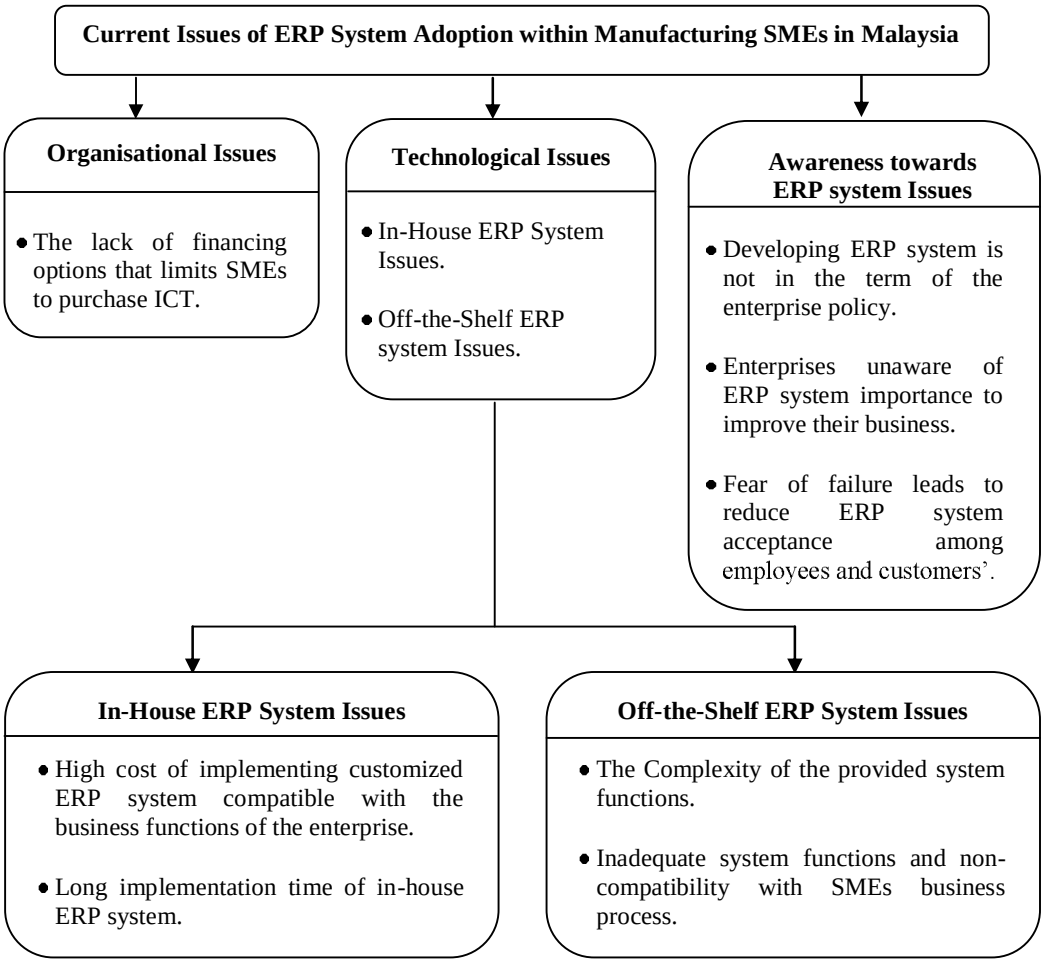

Figure1.1 Forms of ERP systems and interrelated issues

Source: Van Everdingen et al. 2000; Poba-Nzaou et al. 2008; Noudoostbeni et al. 2009; Shahawai and Idrus 2011

1.3 PROBLEM STATEMENT

ERP system is a promising discipline that enables enterprises in general and SMEs in particular to enhance their internal activities leading to better outcomes. However, investigations performed on Malaysian SMEs reveals two forms of ERP systems implemented, the off-the-shelf and In-house ERP systems(Poba-Nzaou et al. 2008; Noudoostbeni et al. 2009). Examining the Malaysian SMEs in terms of ERP practice indicates a poor ERP adoption(Kotelnikov 2007). Analysis conducted to SMEs who have not adopted ERP within showed various issues leads to the poor ERP adoption. For instance, complex functions provided in off-the-shelf ERP systems in addition to inadequate functions embedded within those ERP systems. This affects negatively on the system usage rates. On the other hand, SMEs who have developed their ERP system In-house suffers high cost of implementation, due to the efforts needed to achieve customized and aligned system functions with enterprise business processes. Therefore, this study will address the issues identified and propose a customized design of ERP system when it is implemented different capabilities and features are able to over com the abovementioned issues.

1.4 RESEARCH QUESTIONS

The motivation of the research can be formulated into research questions as detailed below:

RQ 1 What is the appropriate manufacturing SMEs sub-sector in Malaysia for ERP implementation?

RQ 2 What are the main criteria and prerequisites of the Malaysian manufacturing SMEs are associated with the implementation of ERP System?

RQ 3 How can the defined requirements be aligned to fit the ERP modules inmanufacturing SMEs sub-sector in Malaysia?

RQ 4 How manufacturing SMEs sub-sector in Malaysia will embellish their performance by employing the ERP functions in their business operation process?

1.5 RESEARCH OBJECTIVES

This study embarks on the following objectives:

1. To investigate the sub-sectors of Malaysian manufacturing SMEs based on readiness measure for ERP adoption.

2. To identify the requirements of manufacturing SMEs sub-sector in Malaysia for ERP practice.

3. To design ERP system for Malaysian manufacturing SMEsthat achieves usability aspects.

4. To develop and evaluate ERP system modules for Malaysian manufacturing SMEs.

Summary of research questions, objectives and tasks have been listed in Table 1.1, which is describes the objectives that answer each of research question, as well the tasks that carried out to achieve the research objectives.

Table 1.1 Summary of research questions, objectives and tasks

N	Research Questions	Research Objectives	Tasks
1.	What is the appropriate manufacturing SMEs sub-sector in Malaysia for ERP implementation?	To investigate the sub-sectors of Malaysian manufacturing SMEs based on readiness measure for ERP adoption.	• Conduct a quantitative survey.
2.	What are the main criteria and prerequisites of the Malaysian manufacturing SMEs are associated with the implementation of ERP System?	To identify the requirements of manufacturing SMEs sub-sector in Malaysia for ERP practice.	• Aggregation the requirements components. • Collect and analyze the current business processes using document-based research. • Improve To-Be business requirements. • Generate new ERP system functions.
3.	How can the defined requirements be aligned to fit the ERP modules in manufacturing SMEs sub-sector in Malaysia?	To design ERP system for Malaysian manufacturing SMEs that achieves usability aspects.	• Create new design for a desired future system functions using UML.
4.	How manufacturing SMEs sub-sector in Malaysia will embellish their performance by employing the ERP functions in their business operation process?	To develop and evaluate ERP system modules for Malaysian manufacturing SMEs.	• Create database structure. • Construct and write the program source code. • Evaluate the developed system based on usability criteria.

1.6 SCOPE OF THE RESEARCH

In order to achieve the study objectives, new ERP system functions have been customized to fit the business processes of manufacturing SMEs in Malaysia and be able to over come the identified ERP issues. Customizing compatible ERP system functions required an understanding of the current business processes, which has been gained through the following practices: (1) aggregation the requirements components, (2)collect and analyse the current business processes using document-based research. Based on the current situation and business processes of the enterprises the To-Be system functions were generated and designed by adopted three techniques such as: customization, configuration and business process reengineering, these techniques have been used to match the unique business processes of the enterprises with standard ERP system functions. The new design of ERP system functions were taken

from the designed processes to create the tangible operational processes based on web application architecture.

Manufacturing SMEs sector in Malaysia has been selected to be the targeted enterprises of this research due the need of this sector to integrate their resources to stay competitive and customer oriented in the era of globalization(Ghobakhloo et al. 2011). Nevertheless only 10 percent of Malaysian SMEs have used ERP system (Kotelnikov 2007). In addition the poor research directed to Manufacturing SMEs sector in Malaysia in the field of integration practices despite the importance of this sector in supporting Gross Domestic Product(GDP) in Malaysia has ignited the need to provide ERP solutions for this sector.

1.7 ORGANIZATION OF THE THESIS

This thesis organized into seven chapters as shown in Figure 1.2. Chapter I serve as an essential introduction to the research. Chapter II provides the background information on the issues of ERP adoption in Malaysian SMEs that leads to the formulation of the thesis. Chapter III describes the result of conducted preliminary study which is includes two quantitative surveys. Chapter IV propose the research methodology followed to achieve the desired objectives of research. Chapter V addresses the analysis of the current business process of the manufacturing SMEs in Malaysia and identify the new ERP system requirements. In addition the design of the new customized ERP system has been described in this chapter. Chapter VI deals with the representative of the system development to determine new tangible functions that make up the customized ERP system modules. Chapter VII concludes the thesis with an overall discussion of research findings, research contributions and suggestion for future work.

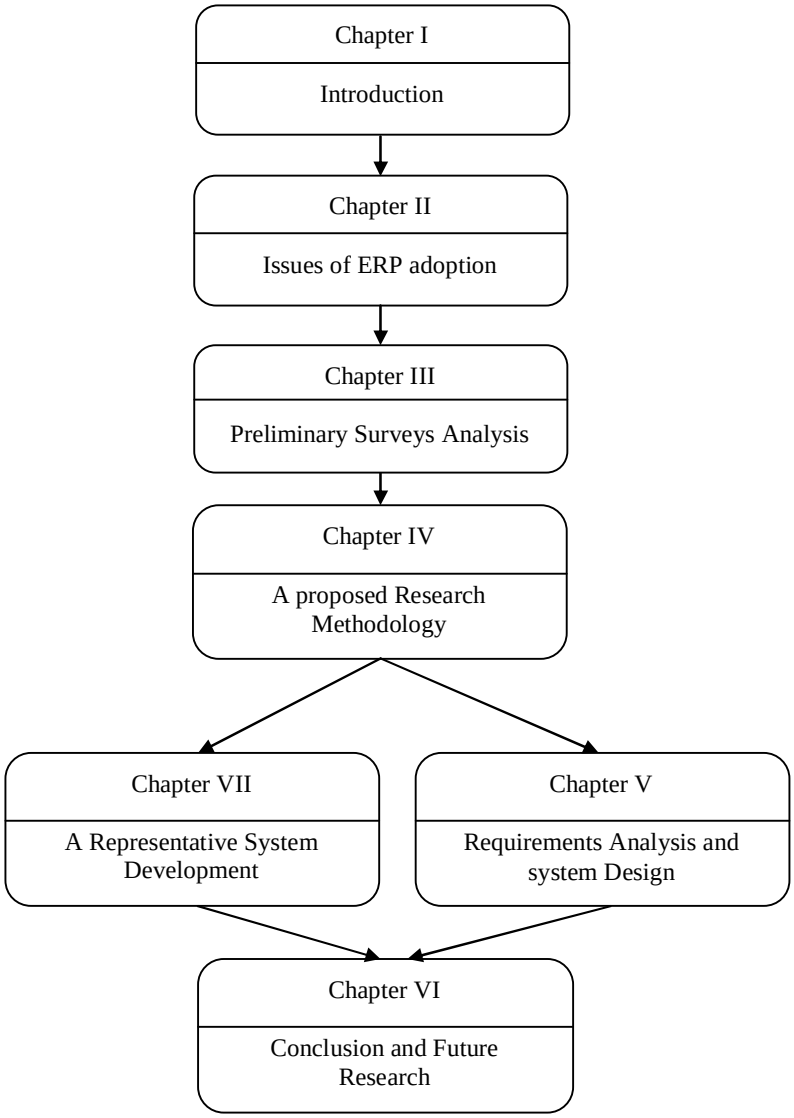

Figure1.2 Organization of the thesis

CHAPTER II

LITERATURE REVIEW

2.1 INTRODUCTION

It is necessary for the Small and Medium Enterprises (SMEs) to employ the In-house resources to get incorporated with their suppliers and trading, essentially to stay competitive in market. Moreover, it is essential to use ICT applications to entirely exploit the resources of SMEs, in order to expand their limits and enhance the collaboration with their stakeholders. ERP system, is a form of ICT application and it efficiently helps organizations to improve their performance and services (McGaughey and Gunasekaran 2008).

In spite of the significance of the advantages of an ERP system, a lot of studies have stated that the SMEsin Malaysia are in very early stages of employing ICT applications especially the ERP systems (Noudoostbeni et al. 2009; Shahawai and Idrus 2011).

This chapter is organised into five sections as follows: section 2.2 illustrates the ERP both, as a concept and as a system and its respective activities; section 2.3 explains the perspective of ERP adoption in Malaysian SMEs; section 2.4 reviews the background of implementing ERP in SMEs and section 2.5 explains the ERP development methodologies for SMEs environment. Finally, section 2.6 concludes of the chapter.

2.2 ENTERPRISE RESOURCE PLANNING (ERP) BACKGROUND

Enterprise Resource Planning (ERP) systems are in existence for over a decade, therefore a substantial body of knowledge exists in terms of their implementation and management. Researches about ERP systems have revealed various concepts of ERP. The available abundant knowledge has helped us to better define and understand the ERP modules.

The following sub-section defines ERP as a concept and as a system, followed by the elucidation of its background and benefits. The second subsection investigates the ERP functional modules.

2.2.1 ERP System Definition

It is critical to make a clear distinction between the ERP concept and ERP system. Mabert et al.(2000)have defined the concept of ERP as "seamless integration of processes across functional areas with improved workflow, standardization of various business practices, improved order management, accurate accounting of inventory and better supply chain management". ERP system would be merely the vehicles through which this could be accomplished. Correspondingly,Jacobs& Bendoly(2003)have described that the term "concept research" focuses on the potential impact of ERP on the performance of various business functions, while the "system research" focuses on the intricacies of package and process design to meet such conceptual objective. This study is concerned with the system research, which considers ERP as a technology and searches the technical side of ERP.

Due to the larger scope of ERP system, it is not easy to get a clear definition, however, the most succinct definition is given byNah et al.(2001), stating that ERP system is:

"*A packaged business software system that enables a company to manage the efficient and effective use of resources (materials, human resources, finance, etc.) by providing a total, integrated solution for the organization's information-processing needs*".

Other definitions can be broader, as defined by Kumar & van Hillegersberg(2000), who have defined ERP system as:

"*A configurable information systems packages that integrate information and information-based processes within and across functional areas in an organization, the current generation of ERP systems also provides reference models or process templates that claim to embody the current best business practices*".

Al-Mashari et al. (2003)have stated that the basic architecture of an ERP system constitutes a database, application and a unified interface for the entire enterprise. Few scholars have defined ERP in terms of its implication.Bingi et al. (1999) have stated that ERP system is not mere software system, instead they very much influence the business processes and create "organization revolution", rather than just being a technological exercise. According to Jacobs & Bendoly(2003)the representation of ERP system in a corporation's infrastructure, is similar to the physical highway system. They have also suggested that IT concepts in business such as, B2B (Business to Business), B2C (Business to Consumer), and CRM (Customer Relationship Management) are actually the extensions of a company's core ERP system.

Regardless of the definition of ERP system it is evident that, once a company implements an ERP system, it becomes critical to the competitiveness and survival of the business.

2.2.2 Benefits of ERP System

A number of researchers have identified the benefits of ERP systems towards the success of organizations. According to O'Leary(2000)an ERP system integrates the majority of the business processes and allows access to the data in real time. Furthermore, ERP improves the performance level of a supply chain by helping to reduce the cycle times (Gardiner et al. 2002; Esteves 2009). There are also some intangible benefits that an organization may enjoy by implementing an ERP system including, better customer satisfaction, improved vendor performance, increased

flexibility, reduced quality costs, improved resource utility, improved information accuracy and improved decision-making capability (Siriginidi 2000).

Yi(2002)has stated that, ERP is capable of: reorganizing and modifying business processes; providing real-time information regarding the performance of an organization from various perspectives; improving services to customers and enhancing internal operations. Companies also use ERP software to facilitate the exchange of information throughout an organization (Mabert et al. 2003; Esteves 2009). In addition an ERP system is beneficial because it integrates the stand-alone systems of various departments as a whole system (Al-Mashari et al. 2003).

2.2.3 Functional Modules of ERP System

ERP software is made up of many software modules, which differ from one vendor to the other, however, ultimately they serve the same purpose; each ERP software module mimics a major functional area of an organization. Eventually the different modules integrate the organization functions. A typical system integrates all these functions by allowing its modules to freely exchange and transfer information through a single central database (Chen 2001; Glenn 2008).

a) ERP Production Planning Module

In the process of developing the manufacturing requirements planning (MRP II) into ERP, the vendors have focused more on software for planning the production, whereas, the consultation agencies have acquired solid knowledge of production planning module. The production planning improves the utilization of manufacturing capacity and usage of historical production data and sales forecasting by components and material resources (Glenn 2008).

b) ERP Purchasing Module

The purchase module restructures the process of purchasing essential raw materials. It also computerizes the processes of recognizing impending dealers, price negotiations, sending purchase order to the dealers and billing. This module is closely integrated with the inventory control and production planning modules and with supply chain management software (Shehab et al. 2004; Glenn 2008).

c) ERP Inventory Control Module

Inventory module helps processes of maintaining the proper degree of stockpile in a depot. The inventory control module involves in the following processes: (i) identify inventory needs, (ii) set targets, (iii) provide replacement techniques and options, (iv) investigate usage of items, (v) resolve inventory balances and (vi) inventory status report. Incorporation of inventory control module with sales, purchase, finance modules allows ERP systems to create observant managerial level reports(Leon 2007; Shtub and Karni 2009).

d) ERP Sales and Marketing Module

Income earned from sales is very essential for any organization to stay healthy. The sales module involves in processes such as: placement and scheduling of orders and delivery and dispatch notes. Sales module is directly incorporated with ecommerce websites of organizations. Numerous ERP vendors provide online interface as part of the sales module (Shtub and Karni 2009). The ERP marketing module supports lead generation, direct mailing campaign and more.

e) ERP Financial Module

Commercial and non-commercial organizations get the advantages from financial module of ERP systems. The financial module is the nucleus of a lot of ERP software systems. It is capable of collecting financial data from a lot of departments, and creates valuable reports such as, balance sheets, general ledgers, trail balances, and periodical financial statements (Shehab et al. 2004).

f) ERP HR Module

HR module is also significant aspect in ERP system. It enhances the administration of human resources and human capitals. Furthermore, it consistently maintains employee database, which comprises: contact address, wages, attendance, performance appraisal and promotion of all employees. Advanced HR module is incorporated with knowledge management systems to completely exploit the proficiency of all employees (Shehab et al. 2004; Shtub and Karni 2009).

2.2.4 ERP Background Literature Summary

As mentioned earlier, this study is focused on "system research", which examines the intricacies of package and design to meet such conceptual objective, therefore, this study has identified both, intangible and tangible benefits of ERP system. The benefit provided by the ERP system for all business parties (owners, employees and customers) is the motivation, which makes the adoption of ERP system as an essential requirement to stay competitive and customer oriented. Finally, the ERP system modules have been reviewed, as ERP system is made up of many modules vary from one vendor to another, but ultimately serve the same functions, each ERP software module mimics a major functional area of an enterprises.

2.3 ERP SYSTEM ADOPTION IN THE MALAYSIAN SMALL AND MEDIUM ENTERPRISES (SMES) ENVIRONMENT

In line with the growing global needs, the Malaysian SMEs in now are involved in severe competition, these SMEs are aimed at moving forward and upgrading their business operation to the most favourable level (Muhammad et al. 2009). The ERP system is considered as one of the best ICT tools that facilitates the SMEs to efficiently deal their business processes and augment competence in decision making(Shahawai and Idrus 2009).

To recognize the relationship between SMEs in Malaysia and ERP system, this section is organized into four subsections such as: (i) overview of SMEs in Malaysia, definition, categories and sectors, (ii) review of ERP market in Malaysian SMEs, (iii) the current status of ERP adoption in Malaysian SMEs and (iv) the issues that affect the adoption ERP system in Malaysian SMEs.

2.3.1 Malaysian SMEs Overview

Small and medium enterprises (SMEs) are also called as small and medium-sized enterprises or small and medium-sized businesses or small and medium businesses (SMBs) and their headcount or turnover falls below certain limits.

According to the Small and Medium Industries Development Corporation (SMIDEC) Malaysia, the SMEs can be defined into two broad categories such as:

i. Manufacturing, Manufacturing-related Services and Agro-based industries.
ii. Services, Primary Agriculture and Information and Communication Technology (ICT).

The Manufacturing, Manufacturing-related Services and Agro-based industries generally have not more than 150 full-time employees or with annual turnover not exceeding RM25 million.

Whereas the services, Primary Agriculture and Information and Communication Technology (lCT) sectors generally have not more than 50 full-time employees or with annual sales turnover not exceeding RM50million.

The SMEs in Malaysia are an imperative constituent of the nation's financial development. According toSMIDEC(2008), SMEs constitute 93.8% of the companies in the manufacturing sector. Furthermore, they occupy a large percentage of businesses in various sectors, and share a considerable amount in terms of GDP(Shahawai and Idrus 2010). Like many other countries, Malaysian SMEs are involved in a various industries. However, the manufacturing sector it is the target of this research.

According to the list given by SMIDEC, the manufacturing sector in Malaysia is being promoted in at least 21 different manufacturing activities. Table 2.1 indicates the different types of SMEs manufacturing activities, as each manufacturing activity is called sub-sector.

Table 2.1 List of manufacturing SMEs sub-sectors in Malaysia

N	Sub-sectors	N	Sub-sectors
1.	Chemical Petrochemical	12.	RB(MRS)-Packaging
2.	Products Electronic and Electronics	13.	Distribute trade INC. wholesale & retail
3.	Food Beverage	14.	Wood &Wood Products
4.	Machinery &Engendering	15.	Transport Equipments
5.	Manufacturing Related Service	16.	Textiles & Apparel & Leather
6.	Non-Metallic Mineral Products	17.	Rubber Products
7.	Palm Oil Based Products	18.	MFG of Professional, Medical, Scientific
8.	Paper &Printing	19.	Construction
9.	Metal Product	20.	Office , Accounting & Computing Machinery
10	Healthcare	21.	Plastic products
11.	Pharmaceutical		

Source: SMIDEC 2008

2.3.2 ERP Market Value in Malaysian SMEs

Many companies employ ERP for many reasons such as: the ERP is capable of escalating the manufacturing processes by computerized processes and workflows, and consequently it also minimizes the requirement to have inventories. This is due to the integration of information in ERP. For example the customer order information and financial data are integrated, simplified and organized accurately, which enhances the business processes (Aris 2007). If implemented appropriately the ERP becomes a promising end product as it offers competitive edge despite the huge implementation costs (Shahawai and Idrus 2009).

Graham-Cumming(2006)has stated that ERP is a notion or visualization of strategic ICT tool, which can enhance the processes of business organizations, in terms of the association between clients and retailers, however these values of ERP are not prioritized by SMEs market.

According to the report from the International Data Corporation (IDC) the consciousness of ERP in SMEs was less than 35% as against the 80% of large scale organization. Consequently, ERP has a buoyant prospective to be introduced to SMEs market with a well-resourced strategy. The Figure 2.1 below depicts the approximate ERP applications revenue between 2006 - 2011(Jacobson et al. 2007). For example Malaysia has accounted 349,617 SMEs as indicated in 2005 and the number of SMEs has proportionally increased over the years. In 2008, Malaysia has accounted for

548,267 SMEs representing the growth of 56.819% from year 2005 and it is anticipated to augment due to backing of government, financial support and growth of global market (Shahawai and Idrus 2009).

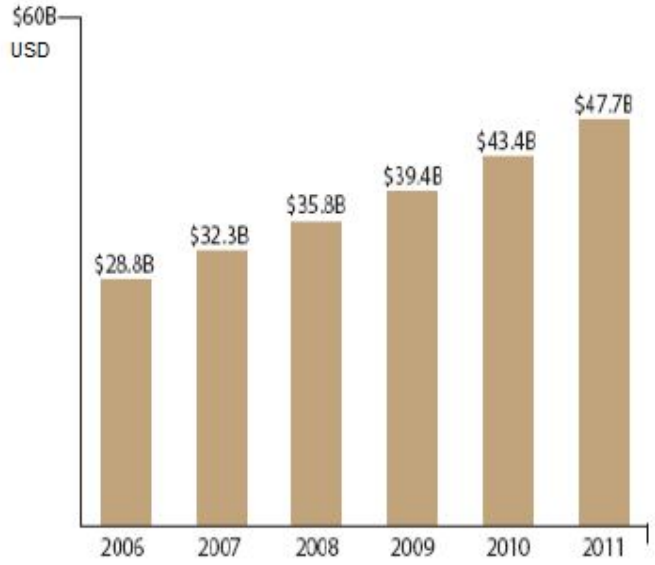

Figure 2.1 ERP revenue estimate for 2006-2011
Source: Jacobson et al. 2007

According to the International Data Corporation (IDC), though most of the SMEs are conscious of the impending benefits of ICT, they are uncertain of selecting the correct solution. However, Malaysia has put a lot of efforts to influence the SMEs to use ICT. The Malaysian Industrial Development Finance provides 75% financing at the rate of 3% interest over a period of five years for SMEs to purchase ICT applications. The loan amounts range from MYR 20,000 and MYR 250,000. However, the efforts have not yielded positive results; despite the government's efforts only about 10 percent of SMEs have used ERP (Kotelnikov 2007).

2.3.3 Current Status of ERP in Malaysian SMEs

Even though, the implementation of ERP system involves some risks, the ERP systems have become very important aspect in business operations among large organizations (McGaughey and Gunasekaran 2008). These systems have a lot of

advantageous features and values, which have driven a lot of Malaysian large organizations in such as Malaysia Airlines (MAS), to endow time, endeavour and millions of Ringgits in ERP system (Shahawai and Idrus 2011).

Nevertheless, the acceptance of ERP system in Malaysian SMEs is still low as against the large organizations(Shahawai and Idrus 2010). The reasons for the low level acceptance is the complication of the system, huge cost incurred from the pre-implementation until the post-implementation, irrelevancy of business operation and the low level consciousness towards ERP system or ICT (Shahawai and Idrus 2010).Based on the previous studies of pre-determined factors towards the adoption of ERP system in Malaysian SMEs, a lot of SMEs in Malaysia are slow in employing the ERP system(Shahawai and Idrus 2010).

With respect to the manufacturing SMEs in Malaysia, which have implemented ERP system, all the sub-sectors of manufacturing SMEs and their industries chose one of the forms of adopting ERP. A number of industries require a different kind of ERP modules for their business operations, based on the type of industry; hence the ERP system has to be customized. While other industries have implemented generic ERP system(Shahawai and Idrus 2010). Both forms seem to have own risk of implementation, where the complexity and high cost are the major concerns.

2.3.4 Malaysian SMEs Perspective on Issues Affecting ERP System Adoption

The implementation of ERP systems in large scale industries and SMEs cannot be treated similarly (Noudoostbeni et al. 2009). As discussed earlier, large scale industries and SMEs differ in a lot of aspects, especially in terms of size and their business operations (Snider et al. 2009). A lot of issues have been identified by scholars in terms of adopting ERP system (Olson 2003; Sun et al. 2005; Osman et al. 2006; Ngai et al. 2008; Poba-Nzaou et al. 2008; Snider et al. 2009). These factors offer a common measurement and hence can be used as a guideline in this study. Especially, the issues influencing the adoption of ERP system in Malaysian SMEs have been identified by many researchers (Van Everdingen et al. 2000; Shahawai and Idrus 2011). The researchers have identified the following three major categories that

affect the ERP adoption: (a) Organizational Issue, (b) Technological Issue, and (c) Awareness towards ERP system. Each category constitutes a group of issues that affecting the adoption of ERP in Malaysian SMEs.

The issues that impact the adoption of ERP in Malaysian SMEs and SMEs in other countries are illustrated in Table 2.2.

Table 2.2 Issues affecting ERP system adoption in SMEs

Themes/Category	Issue
Technological Issues	• The Complexity of the off-the-shelf ERP system functions. • Inadequate off-the-shelf ERP system functions and non-compatibility with SMEs business process. • Long implementation time of In-house ERP system. • High cost of implementing customized ERP (In-House) system compatible with the business functions of the enterprise.
Organisational Issues	• The lack of financing options that limits SMEs to purchase ICT.
Awareness towards ERP system Issues	• Developing ERP system is not in the term of the enterprise policy. • Enterprises unaware of ERP system importance to improve their business. • Fear of failure leads to reduce ERP system acceptance among employees and customers'

Source: Van Everdingen et al. 2000;Poba-Nzaou et al. 2008; Noudoostbeni et al. 2009; Shahawai and Idrus 2011

a. Technological issue

Technological issue is considered a problem associated with internal and external technologies that are pertinent to the organization. There are four types of technological issues, the first and second issues related to the off-the-shelf ERP systems, such as (1) the complexity of outsource (of-the-shelf) ERP system functions, and (2)inadequate off-the-shelf ERP system functions provided and

non-compatibility with SMEs business process. While the third and fourth issues related to customized (In-house) ERP systems, which are (3) long implementation time (4) high cost of implementing customized ERP system.

Two terms is necessary to be understood, which are off-the-shelf ERP system and In-house ERP system. Off-the-shelf ERP system it is also called outsource system is a ready-made commercial ERP system provided by vendors for use by a number of enterprises. While In-house ERP system is a customized ERP system provided by vendors for one enterprise to fit their business processes and cater their specific matters.

It is vital to understand the difference between the off-the-shelf ERP system and In-house ERP system. The former which is also called outsource ERP system is a readymade system that comprises generic module, which will be suitable most of the general business operations; the later actually is the tailor made version of ERP, the advantage of this kind of ERP is that it will be much suitable to fit the enterprise's business processes and cater their specific matters.

b. Organizational issue

The organizational issues is considered as one of the key issues that impacts the employment of ERP systems in Malaysian SMEs (Shahawai and Idrus 2011). The readiness of enterprises based on the financial health is a significant aspect of this issue.

c. Awareness of ERP system

Awareness of ERP system is a perception of understanding, adopting and using ERP system in enterprise. This type addresses the following issues: (1) Developing ERP system is not in the term of the enterprise policy. (2) Enterprises unaware of ERP system importance to improve their business and manufacturing performance. (3) Fear of failure leads to minimize ERP system acceptance among staff and customers.

Precisely, these issues compile the issues that influence the adoption of ERP systems in Malaysian SMEs. Additionally, these issues facilitate researchers to surface with strategies to comprehend and decide the precise specification in successfully adopting an ERP system, particularly in Malaysian SMEs. However, these issues have to be evaluated in terms of the potency of the impacts in hindering ERP adoption. Consequently, recognizing the impact of each issue will facilitate to conclude the issues that have prioritized in suggest fitting solutions to solve it.

2.3.5 ERP Adoption in Malaysian SMEs Environment Literature Summary

This section had reviewed the definition of SMEs, based on the two main categories such manufacturing and services (SMIDEC).This study is concerned about the adoption ERP in Malaysian manufacturing sector. Consequently, the manufacturing sub-sectors fall under Malaysian SMEs had been explained. The current status of ERP adoption within Malaysian SMEs had been discussed, it had been identified that there are weakness in the adoption of the ERP system in Malaysian SMEs. Finally the issues influencing the adoption ERP system in global SMEs and particularly in Malaysian SMEs had been reviewed. Precisely the issues affecting the adoption ERP in Malaysian SMEs are divided into three categories as follows: (1) Organizational issue, (2) Technological issue, and (3) Awareness towards ERP system.

2.4 ERP IMPLEMENTATION IN SMEs

With ERP system being implemented more and more at SMEs there are several themes that must be considered when developing an ERP system for small businesses.These themes emerged from the previous experiments and studies. This section is organized into four themes. First, ERP adoption and business process alignment has existed for a while. Second, ERP adoption readiness in SMEs has been reviewed. Third, Web-based ERP system is briefly highlighted. Finally, ERP system forms discussed and circuits.

2.4.1 ERP System Adoption and Business Processes Alignments

As discussed earlier the ERP systems have a lot of benefits, which helps the enterprises to successfully achieve their business goals, by facilitating efficient executive planning, interaction and partnership to develop the business process across the enterprise. However, the challenge here is choosing the appropriate ERP for any particular enterprise. The enterprises have to focus on the link between the business processes and the functionalities of the ERP. According toŠtemberger & Kovacic(2008), it is very imperativeto compare the business processeswith the capabilities of an ERP system in order to find differences. Fundamentally, the requirements of business are better depicted with the startegies and intended business processes of an enterprise. Processes inside an enterprise have to be compared with reference to an ERP system functions. Figure 2.2 shows alternative possibilities after the comparing.

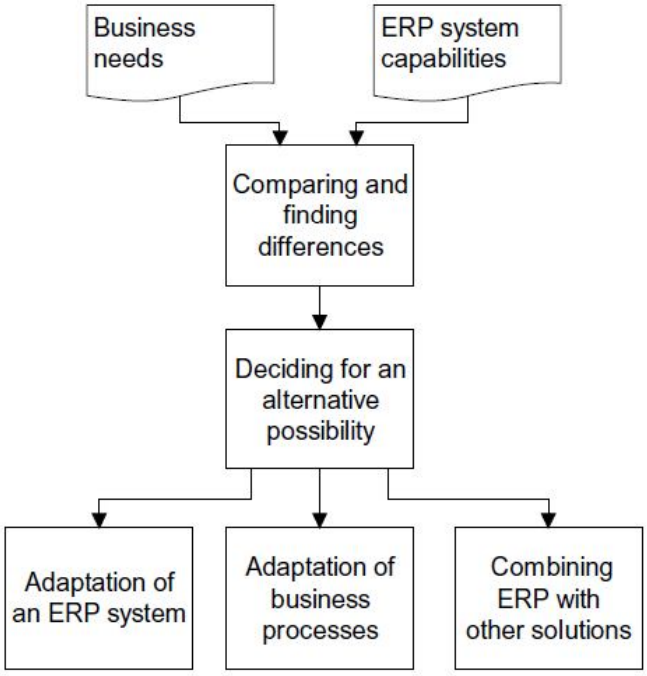

Figure 2.2 The alternatives for adopting an ERP system to the business processes

Source: Štemberger and Kovacic 2008

After comparison, the enterprise has three alternatives as follows:

(1) Adapting ERP system to the business processes of enterprise:

This means that the best business practices must be adapted to the ERP systems. If the ERP system does not match with the current business process of an enterprise, then the following approaches have to be followed to address the unmatched business processes: (i) assess the existing business processes and identify the necessary improvements to be made in line with the ERP best practices (Štemberger and Kovacic 2008), this is called as business processes reengineering (BPR). However, Žabjek et al. (2009)have stated that BPR increase the implementation time and cost, (ii) adopting new processes design and ignoring the current business processes, this approach minimizes the time consumed for implementing but involves the risk of changing the business management and the success of new process (Karim et al. 2007). (iii) The final approach called "to do no" or "no significant adjustment". This approach surely leads to "living with problems" and continue to run the business without taking efforts to modify the ERP according to their business needs (Štemberger and Kovacic 2008).

(2) Adaption the business processes to the functions of an ERP system.

This option is suitable for the enterprises that have unique business process and these processes form their competitive edge. Such enterprises do not necessarily wish to standardize all their processes due to ERP implementation. However, it becomes necessary to customize the ERP systemin order to preserve the unique business processes. Nevertheless, the enterprises have to take risks of investing long implementation time and high costs for maintenance and upgrading in the future (Soffer et al. 2003).

(3) Combining ERP with other solution.

This approach recommends the merging of ERP with other solutions such as. Integrated (best-of-breed) and engineered (adapted or built) applications. A lot of studies have revealed about the lack of incorporation among the combined systems.

In the case of SMEs, the enterprises within same sub-sector have almost identical business processes, however, the enterprisers that fall into different sub-sectors operate in dissimilar processes where each sub-sector has their own specific requirement that sometimes do not match with the standard ERP system offered by vendors(Raymond and Uwizeyemungu 2007; Poba-Nzaou et al. 2008). An generic off-shelf ERP package comprise features that are not really well-suited with the need of the business processes(Raymond and Uwizeyemungu 2007).

Precisely it is difficult to find an ERP system that is suitable for all the business process of an enterprise in different sub-sectors. Therefore the customization of ERP becomes necessary to suit the business processes or the business process should be changed to fit the characteristics of the software. However, both these options are associated with risk of implementation, where complexity is the foremost challenge.

2.4.2 ERP Adoption Readiness in SMEs

Of late, due to need of globalization, ERP systems are getting popular, therefore the ERP system developers and the SMEs are showing great interest in developing and implementing ERP respectively (Gable and Stewart 1999; Muscatello et al. 2003). Based on the literature, it is evident that, just having Information Technology (IT) systems implemented in organizations, it does not mean that they are competent enough to stay active in the market. IT or ERP systems has to fulfil a lot of factors to be successfully implemented; many researchers have claimed that implementation of ERP in a lot of large scale organizations have ended in futile , they could not get the real or total benefit of such systems(Chen et al. 2009). Consequently, it has become important for any organization to evaluate their readiness when adopting new technologies such as ERP.Gargeya & Brady (2005)have identified that the lack of proper cultural and organizational readiness is the most critical factor contributing towards the failure of an ERP projects.

ERP providers and developers should understand the level of readiness in the organization (Shahawai and Idrus 2009). Evaluation of the readiness factors may help ERP providers and developers to understand the potential of SMEs, which can lead

them to plan and fulfil the needs of SMEs before developing an ERP system(Raymond et al. 2004). By understanding the level of readiness the ERP providers and developers make a better decision and to better target their products or services.

To gauge the level of readiness the following questions have to be addressed: (i) what constitutes the readiness for ERP adoption in manufacturing SMEs? And (ii) how enterprises are characterized in terms of their readiness to adopt an ERP?

2.4.3 ERP System Based on Web Architecture

Most of the companies around the world have given red carpet welcome to E-commerce due to its impact in terms of globalization. An ERP system will be considered wholesome only when it meets the needs of client-server architecture. With the increasing recognition of Internet, the scalability of the conventional ERP software has become a foremost issue(Yu and Sun 2011). Furthermore, Precisely Internet has brought a new colour to the field of ERP development (Tarantilis et al. 2008). Of late the contemporary ERP systems are directly related with the Internet and e-commerce. A lot of these systems, such as SAP (Systems Applications and Products in Data Processing), Oracle, PeopleSoft, JD Edwards, are developed with complete Internet capabilities.

The ERP systems are recognized as the significant aspect of e-commerce solutions, as the e-commerce applications will be futile without proper support of a influential back-end computer system(Yu and Sun 2011). Employing computers for managing enterprises has become a very popular scene nowadays, due to the development of computer technology, distributed systems and communication technology. The development of enterprise management information system has also evolved a lot of phases, from early-click system, file server system, to client / server system, and even Web-based browser / server system (Yu and Sun 2011).

The advent of Internet has totally changed our way of life, especially in the business world and particularly in the manufacturing industry; hitherto it is still believed that this revolution is still in its early stage in this sector. The manufacturing

enterprises have to redesign their working model in order to stay competitive in the aggressive global market. An Internet-enabled ERP is vital to the incessant development of a manufacturing enterprise (Ng and Ip 2003).

A lot of studies have stated that developing ERP system using web-based technology will facilitate the ERP system to take advantage of the features by web environment such as: (i) utilising the functions of the system and services with less time and without location constraints, (ii) lesser hardware and network resources consumption ,(iii) less investments in hardware, (iv) can be used by multiple clients, (v) inexpensive maintenance and (vi) on line technical support(Ng and Ip 2003; Yu and Sun 2011).

2.4.4 The ERP Application Forms for SMEs

Based on the characteristics of SMEs and problems occurred during the ERP implementation, the SMEs can choose the following implementation forms:

a. Outsourcing form (off-the-shelf)

The SMEs with sound financial strength and technological power can utilize outsourcing model, which is also known as off-the-shelf systems. The SMEs can acquire ERP solutions from specialized local or international software vendors and implement in their enterprises. However, the SMEs have to pay a few million dollars in order to get a powerful ERP system, which encompasses financial management of the enterprise, procurement management, production management, etc (Glenn 2008). In the contemporary ERP software marketplace, the conventional ERP solutions include: SAP 28 Business One of SAP Company; E. Business Suite Special Edition of Oracle Corporation; U860 of UF soft Company; K3 system of Kingdee Company, etc.

However, the drawbacks of outsourcing are, the off-the-shelf ERP systems are so generic, so that they do not meet the specific needs of a particular enterprise. As each and every enterprise have different business objectives one cannot expect a generic ERP system to cater all their distinct needs. Moreover this form of ERP

system provides complicated ERP functions towards the SMEs business processes and procedure. Table 2.3 illustrates the advantages and disadvantage of outsourcing form.

b. Customization form (in-house)

It is very much impossible to find a common ERP system that will meet the needs of all kind of enterprisers. Hence some SMEs that have unique business processes, certain financial strength and technological support can customize the ERP system, and take risks while implementing the customized system. Generally the associated risks are huge implementation costs; extensive time consumption and expensive maintenance and upgrading processes (Soffer et al. 2003; Olson 2007). Customization means employing authorized professional software vendors to develop ERP systems to fulfil the specific needs of enterprises (Yang 2010).

The process of customization involves the adaptation of an ERP software package to match the current business processes of enterprise (Luo and Strong 2004). On the other hand modifications of business process entails amending the business processes to get along with the ERP package (Scheer and Habermann 2000). Enterprises that implement ERP systems have a lot of choices to enable them to handle the business processes.Brehm et al. (2001) andKholeif et al. (2007)have discussed a typology of such ERP customization approaches. An enterprise might constitute a system to its requirements by selecting a suitable system mechanism and by setting features, which enable the enterprise to amend the system within the limits set by the developers of ERP system. However, these factors might address several customization needs but might not house all existing business processes.

The configuration technique is recognized as a customization typology or as adistinct ERP application model. On the other hand, enterprises can apply third-party packages (or bolt-ons) that are intended to work with the ERP package and complement the functionalities of ERP. Therefore, the enterprises have the option of adding custom features on their ERP platforms by using the ERP system language or standard programming languages, in order to address unique modification needs. This needs additional program code development, however there is no need to alter the existing system code(Rothenberger and Srite 2009).

As a result, during the process of upgrading, the functionality can be kept intact if the developers of the new component sticks to the interface norms and naming principles of the ERP vendor (Olson 2007). However, in terms of releasing new systems the ERP vendors will make sure not to change some basic principles that denote the process of connecting to other applications.Rothenberger & Srite (2009)have stated that, at times vendors will get rid of the guarantee for some interface standards by giving few years advance notice. Such bolt-on integrates into the ERP system without any modifications to the ERP system source code.

Precisely, the ERP system code can be modified to fit the needs an enterprise; this requires substantial development effort and specialized expertise. Customization can help the SMEs to fit their business process. Based on the aforementioned discussions, to fulfil the requirements of SMEs and to fit the different biasness process of SMEs, customization is most appropriate solution, if the developers could minimize the implementationperiod and high cost. Figure 2.3 summarizes the various ERP system modification options.

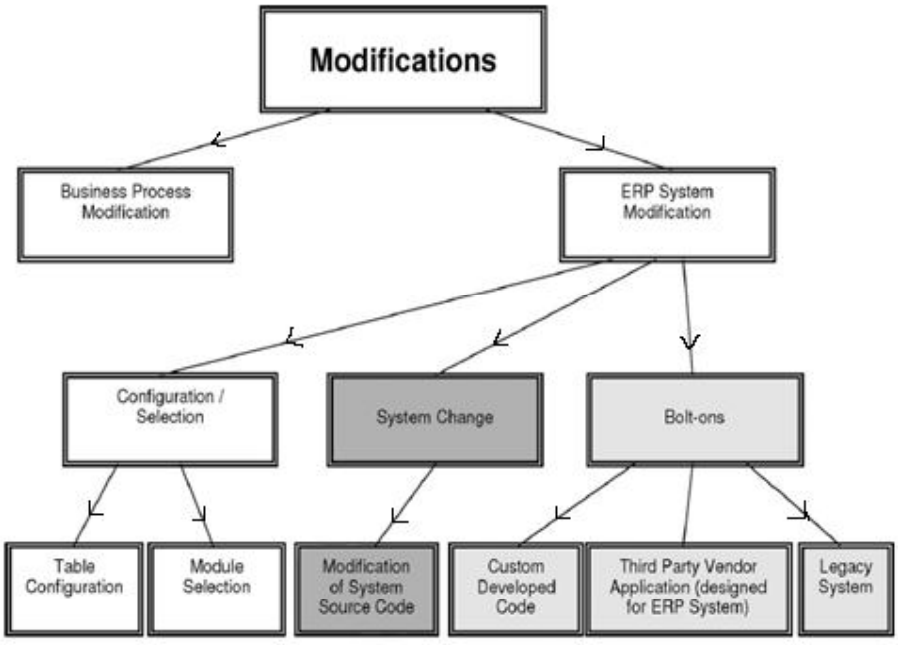

Figure 2.3 ERP modification options

Source: Rothenberger and Srite 2009

Ultimately, the customization model provides several futures and advantages for ERP adoption within SMEs, at the same time it has some constraints, as illustrated in Table 2.3. The advantages and disadvantages of customization model are explained below:

a) The advantages of customization

   Customization of ERP for an industry, satisfies the specific needs of enterprises; therefore, it constitutes, expedient, superior service, methodical organization and so on(Rothenberger and Srite 2009). Furthermore, customization develops only the essential modules that are vital for SMEs and makes the ERP systems more business-specific (Olson 2007). Nevertheless, customization can be merged with the optimization and restructuring of the business process, which makes ERP system more suitable to use (Yang 2010).

b) The disadvantages of customization

   As mentioned earlier, customization also has some drawbacks such as: extended development cycles, expensive and complicated ERP management concepts that are barely acknowledged by SMEs (Soffer et al. 2003; Olson 2007). Moreover, huge volume of workforce and resources are required to accomplish customization. Apart from this, due to the consumption of long period, the SMEs will not reap the benefits and rewards immediately. These disadvantageous factors create an element of doubt in the minds of business leaders during the process of implementation, which might negatively affect the financial, human and material investments(Yang 2010). In short, customized ERP software is extremely explicit but less flexible.

c. Open source software (OSS) form

Generally, Open-Source ERP Software (OSES) is an ERP software product that is developed under a licensing model. Unlike the traditional closed-source ERP software (CSES), OSES can be freely used, modified, and redistributed. Its source code is also freely accessible (Serrano and Sarriei 2006). However, the benefits of applying OSS are greater for ERPs than for other kinds of applications, for three main reasons (Serrano and Sarriei 2006; Cereola 2008):

- Maximized flexibility: the complete access to the ERP source code enables inevitable customization and matches the business processes with local directive.
- Minimized dependability on a specific vendor: organizations that get a proprietaryERP are extremely reliant on the owners of the source code, which may be a developer of distributor. If anyone, or both, of these agents disappear, the processes of upgrading and maintaining the ERP will be very difficult.
- Reduced costs: The cost of proprietary ERP licenses is very high. A guideline puts them between one-sixth and one-third of the project implementation costs. However, the OSS ERPs avoid this cost. Furthermore, they generally do not require expensive hardware.

Besides the abovementioned benefits, previous studies have indicated that the expansion of open source ERP software in SMEs environments, have posed a lot of problems as explained below (Leina et al. 2008):

- Maintenance costs of open source might surpass acquisition costs of commercial codes. Moreover, the additional labour involved with open source solutions makes the total cost of ownership (TCO) higher than commercial products.
- Generally the open source codes will be released to the market as soon as possible. Hence they might have a lot of bugs, which makes the IT managers to involve in regular updates and debugging processes; therefore they must be vigil in terms of updates and new releases.
- As the open sources are mostly free of cost, it becomes the responsibility of IT managers to handle the security issues, repairing crashes and maintain it forever. More over at times, the IT staff may experience permanent crashes.
- It is difficult to get technical support.
- Updates of the products will not as swift as commercial software.
- There is no guarantee that the open source products will remain open.
- The legal implications are ambiguous.

With the number of drawbacks that have emerged through the OSES implementation in SMEs, it has become futile and inefficient to adopt this form within SEMs environment, particularly enterprises that have low awareness towards ERP system.

d. Application service provider (ASP) form

The centralized management is employed by ASP to provide application employment, hire, hosting and outsourcing services to customers. A variety of applications are installed in the internet data centre (IDC) or server clusters by the ASP. Based on the needs of users the application software and services will be provided to them with some monthly fees. ASP is in charge of administration, maintenance and updating of these functions and services. Hence customers can endorse some or all their business processes to the application service provider, and provide appropriate business data. All of these service deliveries depends on the network and the customers can access these services through a remote network (Yang 2010).

ASP model has solved some problems of SMEs as follows:

1. Reduces the initial investment and helps in cost control.
2. Meets the needs of remote offices for distributed companies.
3. Reduces the burden on enterprises.

On the other hand implementation of ASP for SMEs has the following draw backs:

1. Inflexible in meeting SMEs customer needs.
   The client must generally accept the application as provided, since ASPs can afford customized solution only for the largest clients.

2. Security and reliability issues
   Security issues is biggest challenge of implementing ERP based on an ASP model. Therefore a lot of SMEs are worried about the vulnerability of the ASP data centre and fear that their important information and data will be leaked or lost. As all the valuable information is kept in ASP data centre for customers to

use at any time, enterprises worry about damage to sensitive information. Moreover, it is too difficult to identify the persons, who are responsible for the safety of ASP (Trimi et al. 2005).

3. Rely on the provider

   The client may rely on the provider to provide a critical business function, thus limiting their control of that function.

4. Quality of service and support

   Service quality accord signed by customers and ASP applications specify that the capability of application ought to be attained to offer the variety of services and performance standards. However, there will be always conflict between the scope of services and service flexibility (Trimi et al. 2005). Besides, modifications in the ASP market might consequently end up with changes in the type or level of service available to clients.

5. Integration issues with non-ASP systems

   Integrating with the non-ASP client systems may be problematic.

6. Infrastructure factors

   The authenticity of the domestic network infrastructure, such as, bandwidth, speed, constancy are still not considered perfect, therefore, enterprises might not assign their administration tasks to the network.

Based on the above mentioned it is clear that the ASP model is not recognized as an effectual tool to resolve ERP issues within SMEs environment. Because ASPs can afford a customized solution only for the largest clients and is unable to provide an ERP functions fit the small and medium size enterprises.

e. The Combination of Outsourcing and Customization Platform Pattern ERP

Few SMEs in China have implemented the combination of outsourcing and customization platform of ERP model(Yang 2010). Of late, there are two platforms: the first one depends on rapid development purposes, which offers corresponding development tools. The second one is management platform that depends on the technology platform. The core aim of this combination of outsourcing and customization platform-based ERP is "customer focus ". The design of the product is exceptionally flexible therefore users can modify the products effortlessly without affecting the main frame. Therefore, this platform facilitates the enterprises to efficiently accomplish their shifting business processes. Regrettably, the combinations-form was not successful as expected, due to the intricacy in the development, huge cost and slow phased implementation process (Olson 2007).

Table 2.3 Alternative ERP forms in SMEs

Model	Advantages	Disadvantages
Outsource (Off-the-shelf)	• Fast implementation. • Inexpensive. • Efficient functions.	• Inflexible. • Complex functions. • Incompatible functions with enterprises' business processes.
In-house (Customization)	• Fit enterprise business process. • Meets the individual needs of enterprises.	• Most difficult developing. Expensive. • Long implementation time. • High cost for maintenance and upgrade in future.
Application Service Provider (ASP)	• Least risk. • Least cost and burden. • Fast Implementation.	• Lack of security. • Instability of functions quality. • Problematic to integrate with non-ASP systems.
Open Source Software (OSS)	• Increased adaptability • Reduced costs. • Decreased reliance on a single supplier.	• High cost of Maintenance. • Complex IT management. • slower than outsource software • The legal ramifications are unclear.
Combination the In-house and Outsource	• Blend proven features with organizational fit	• Difficult to develop. • Expensive. • Long implementation time.

Source: Olson 2007; Yang 2010

2.4.5 ERP Implementation in SME Literature Summary and Recommendation

Several themes have to be taken into account when adopting ERP system in SMEs in general and in manufacturing SMEs particular. This section had reviewed these topics starting with business processes alignments, which is considered as one of the most important factors affecting the adoption of ERP approach. Furthermore, the importance of enterprises readiness for ERP adoption has also been explained. As such, the organizational readiness was found as significant issue, which influences the contributing to the failure of an ERP project. Besides, the conceptual framework to evaluate the readiness of ERP adoption in manufacturing SMEs has been reviewed in brief. The review also indicates that the ERP system based on web technology, which is currently considered as a new generation of ERP system and offers numerous features for new ERP market.

Finally, four alternative ERP forms were also reviewed such as: outsourcing, customization, ASP, and combination the customization and outsource forms. The adoption of ERP forms in the SMEs environments had also been discussed and criticized. As a result, the discussion had revealed that some functions of the outsourcing forms were unable to meet the special needs of SMEs. Additionally, the customized forms require a high cost of implementation. The OSS needs a high cost for maintenance and it is unstable. Moreover, ASP is associated with some risks in terms of stability and data security. Ultimately, the combination of customization and outsource forms are considered expensive and had faced difficulty in development within SMEs. In order to evade those problems, the customization is considered as a suitable solution for developing ERP in manufacturing SMEs in case of exceeding the high cost and implementation time, which enables the enterprise to cater their specific requirements and needs, as well as fit the enterprise business presses. The high cost of customization can be overcome by customizing ERP functions for a group of enterprises, which share same requirements and similar in most of their business processes. As such this leads to divide the cost of customization on a number of enterprises. In addition, web-based technology can be used to offer free licence customized ERP system to be used by multiple enterprises.