USING ENTERPRISE RESOURCE PLANNING (ERP) FOR ENHANCING BUSINESS PROCESSES IN SMALL AND MEDIUM ENTERPRISES (SMEs)

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Abstract

Increasing number of small medium enterprises (SMEs) is using enterprise resource planning (ERP) as they start to recognize the benefits provided to the organisations. The benefits include tangible and intangible benefits. They can be identified in the operational, managerial, strategic, organizational, as well as in IT infrastructure dimension. To successfully implement ERP, organizations should recognize the barriers in attaining expected benefits, especially people-related issues which are more dominant than the technical-related. A combination of IT factors and business factors motivate SMEs to adopt ERP. However, several factors characterized in SMEs should be considered in analyzing their need for ERP. SMEs must prepare themselves in both technical aspects and human aspects. It is also very important for SMEs to recognize critical success factors (CSFs) that contribute to a successful ERP implementation. CSFs can be used to measure the success at different points in the ERP life cycle.

Keywords: Enterprise Resource Planning (ERP), small and medium enterprises (SMEs), critical success factors (CSFs), ERP benefits, and ERP adoption

INTRODUCTION

When your company deals with the daily business complexity, such as what products to be delivered, how much capacity will be needed, when and where the activities should be carried out and other related activities then it is time to call for the Enterprise Resource Planning (ERP). ERP helps companies to plan forward their planning and controlling decisions. It also provides the understanding of the implications brought by any changes made in plan.

Since 1990, ERP has been widely implemented by many large companies around the world. Many of them have found that ERP played important role in operating their businesses. In recent time, growing number of small and medium enterprises (SMEs) start to recognize the potential benefits of ERP to their businesses. From the vendors' perspectives, SMEs market is an interesting market for its large number of midsize companies and its average annual IT budget. For example, in the mid of 1998, there were more than 100,000 SMEs in Europe and the total budget for IT products and services in the market exceeded $50 billion per year (Van Everdingen et al, 2000).

The growing of mid-market ERP adoption has lead to an increasing interest on the investigation of ERP implementation success. It is considered as a radical move which requires extensive efforts for transforming the business process. To understand the effective use of ERP, particularly for SMEs, this article is going to discuss the facts of ERP software, the benefits and limitations of ERP software, reasons to adopt and not to adopt ERP, ERP's success stories, and ERP's critical success factors (CSFs).

ABOUT ERP

ERP represents the latest and the most significant development of production planning and control systems for manufacturing companies; it was evolved from Material Requirement Planning (MRP) in 1975 and Material Resources Planning II (MRP II) in 1980 (Muscatelo et al., 2003; Slack et al., 2010). ERP was firstly used in the early of 1988 as Dow Chemical Company purchased its first ERP module from SAP AG of Germany, but it was in 1994 where SAP R/3 was marked as a distinctive evident of ERP system (Muscatelo et al., 2003). In the following years, some software vendors such as Oracle, PeopleSoft, Baan, and JD Edwards were joining SAP to compete in the ERP consulting and system integration market.

ERP is a software package which integrates all the information through a company such as financial and accounting information, human resources information, supply chain information and customer information (Davenport, 1998). ERP is also viewed as "an ideology of planning and managing the resources of an entire organization in an efficient, productive, and profitable manner, and is manifested in the form of configurable information system packages" (Laukkanen et al., 2007). ERP integrates all parts of the organization like a "central nervous system" in which it senses the current information of different parts of the business and relays information to other parts of the business in real time manner (Slack et al., 2010).
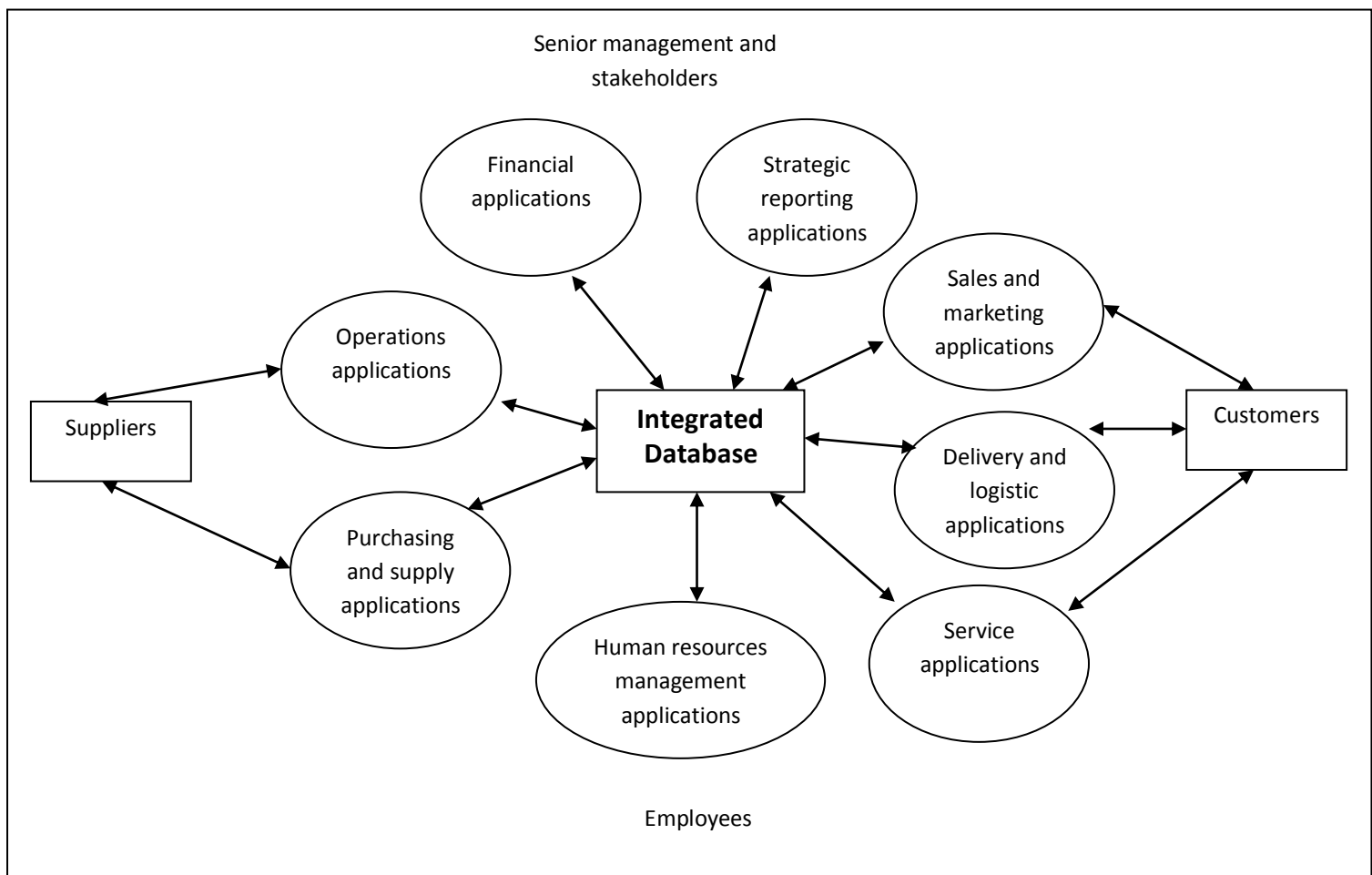

Figure 1: Organisational Integration within ERP
Source: Slack et al., 2010

ERP's major vendors were mainly marketed their ERP software to large companies (companies with more than 1,000 employees). However, the necessity to upgrade information systems to improve the strategic and operational competitiveness has resulted in the increasing numbers of small and medium enterprises (SMEs) to implement ERP in their businesses. With $50 billion per year for IT products and services involving more than 100,000 European midsize companies, SMEs appear to be very attractive for major vendors for their potential market (Van Everdingen et al., 2000). Meanwhile, Adam and O'Doherty (2000) report that SMEs in Ireland already involved in ERP implementation to a large extent and have successfully implemented ERP. SMEs have become a primary target on the software market. They suggested that the perception of most vendors and consultants for stronger arguments on ERP implementation in large companies than in SMEs has become the main reason for the ignorance as shown by previous researches. The facts lead to a reasonable base for extending ERP market to smaller-size organisations.

To serve this potential market, the vendors provide solutions targeted on midsize company. For example, SAP offers two solution categories, Business Management software (e.g. SAP Business One, SAP Business ByDesign and SAP Business All-in-One) and Business Intelligence Software (e.g. Crystal Report Offering, Xcelsius and SAP Business Objects Edge) while Oracle moves with more variety of products such as Oracle CRM on Demand, Oracle Essbase, Oracle Hyperion Planning, Oracle Solaris Operating System, etc. Generally, after acquiring ERP software available in the market, the companies will ask the assistance of local implementer (such as consulting firm and software distributor) in dealing with the complexity of preparing migration from business processes and systems to the ERP solution selected (Adam and O'Doherty, 2000).

ERP'S BENEFITS AND LIMITATIONS

In general, ERP is expected to improve company's performance by enhancing its integration in many different business sectors. From an overall business stand point, ERP mainly provides cost reduction, inventory reduction, and improved operating performance (Sumner, 2004). Deloitte Consulting (in O'Leary, 2004) describes the benefits of ERP into tangible and intangible benefits. Inventory reduction, personnel reduction, and productivity improvement are the main tangible benefits of implementing ERP while information/visibility, new/improved processes, and customer responsiveness are the main intangible benefits. Information/visibility dominates the intangible benefits of nearly 55%. It indicates that ERP improves the transparency of business information, an important key to enhance business performance.

Mabert et al. (2003) report that integration of business operations/processes, availability of information and quality of information are the main perceived benefits of ERP implementation. However, more large companies report benefits in financial management and personal management than small companies. On the other hand, inventory management and procurements are the area where small companies reports higher benefits than the large one. The survey also indicated that most improvements for companies are in the increased interaction across the enterprise and in the quicker response times for information. However, larger companies have more improvements in decreased financial close cycle whereas smaller companies report better improvements in order management, on-time deliveries, and customer interactions. Table 1 and table 2 provide the details of areas benefiting from ERP and performance measures in ERP implementation respectfully.

Table 1: Areas benefiting from ERP

Benefit Areas	Firms Size			
	All (%)	Small (%)	Medium (%)	Large (%)
Integration of business operations/processes	80.4	76.7	82.4	84.0
Availability of information	82.8	86.8	71.1	92.0
Quality of information	75.5	80.4	62.9	84.0
Customer responsiveness/flexibility	36.5	41.0	37.0	26.3
Financial management	59.8	55.6	48.0	81.0
Personnel management	15.4	8.9	18.4	23.8
Decreased information technology costs	12.8	12.8	8.8	20.8
Inventory management	62.6	71.4	59.4	50.0
Supplier management/procurement	62.6	52.3	54.2	35.3

Source: Mabert, et al. (2003)

Table 2: Performance Measures

Outcomes	Firms Size			
	All (%)	Small (%)	Medium (%)	Large (%)
Reduced direct operating costs	20.8	23.1	18.8	20.0
Quicker response times for information	75.5	76.9	70.6	79.2
Improved order management/order cycle	66.3	75.0	57.6	61.9
Lowered inventory levels	35.8	35.7	34.4	38.1
Increased interaction across the enterprise	79.0	75.0	77.4	87.0
Decreased financial close cycle	59.6	47.7	60.6	77.8
Improved on-time delivery	50.5	60.0	48.4	31.6
Improved cash management	26.5	26.3	23.1	31.6
Improved interaction with suppliers	44.8	40.0	55.2	38.9
Improved interaction with customers	53.6	59.0	56.7	33.3

Source: Mabert, et al. (2003)

Based on longitudinal case studies of four medium-sized Australian companies, Shang and Seddon (2002) suggest that benefit realization is an ongoing process; the benefits are likely to be realized at different rates in different core processes in each of the five dimensions (i.e. operational, managerial, strategic, infrastructure, and organizational dimension). They argue that business managers should adopt a holistic view of the benefit realization and manage the different effects in different dimensions. Table 3 describes the five dimensions of enterprise system's benefits.

Table 3: Enterprise System's Benefits

Dimensions	Benefit definitions (all consequences of ES use)
Operational benefits	Operational benefits are usually reflected in cost reduction, cycle time reduction, productivity improvement, quality improvement, and improved customer service.
Managerial benefits	Improved management decision-making, e.g., improved allocation and control of organization's resources, monitoring of operations, performance improvement and support for strategic decisions.
Strategic benefits	Support for strategic action such as business growth, alliance, globalization, innovation, product differentiation, and external linkages.

IT Infrastructure benefits	Reduced IT costs, increased capability for quick and economic implementation of new applications, and enablement of greater organizational flexibility.
Organizational benefits	Consequences of ES use that make an organization more focused and cohesive, better at learning, and better at executing its chosen strategies. Evidence of organizational benefits includes increased employee morale and satisfaction, greater employee accountability, and the transformation of users from doers to planners with broadened skills.

Source: Shang and Seddon, 2002

Despite the multi-dimensional benefits which are offered by ERP, we should be aware that not all companies which have implemented ERP were successful and satisfied with their investments. Some of them were failed and many others needed costly improvement before finally got the ERP properly installed. Examples of ERP's failure include FoxMeyer Drug which claimed that its ERP implementation in 1996 had drive it into bankruptcy and Hershey Food Corp which had spent $112 million for ERP and ended into a loss of $19 million sales and $23 million of profits (Sumner, 2004).

Investigating the ERP benefit realisation in Australian companies, Hawking et al. (2004) report that IT cost reduction had the greatest disparity between expected and actual benefits. The study also reveals that people-related issues (e.g. lack of discipline, lack of change management, and inadequate training) dominated the barriers to attaining expected benefits. Despite the length of ERP implementation in the organisations, change management seems to be a major issue. On the other hand, technical based barriers rated lower which indicate that technical issues (e.g. poor software functionality, inadequate ongoing support, and poor management application) are not insurmountable.

PREPARING SMEs FOR ERP

Both SMEs and larger companies can benefit from ERP adoption although the needs and opportunities of SMEs are subset to those of larger companies (Markus et al., 2000). ERP is critical, particularly to the SMEs, given their different operations from large companies (Montazemi, 2006). Compared to larger scale organizations, small companies are benefited from their simple structures which allow enhancing communication among their members but the simplistic choice of information system might lead into high cost operation in the long run (Montazemi, 1988).

SMEs are facing increasing pressure to employ information system and technology. A mixture of IT factors and business factors motivates SMEs to adopt ERP; the main factors include replacing legacy system, simplifying and standardizing the system, improving interaction and communication with suppliers and customers, and gaining strategic advantage (Mabert et al., 2003). Other technical factors are added as the reasons for adopting new enterprise system, e.g. to solve Y2K and similar problems, to reduce software maintenance burden through outsourcing, eliminate redundant data entry and errors in filling customers' orders for merged business, and to decrease computer operating costs (Markus et al., 2000).

Despite the increasing interest in deploying ERP, there are several reasons of why we should be careful in analysing the need for ERP for the SMEs. First, SMEs' centralized structure often results in a lack of IT/IS knowledge and skills for its tendency to employ generalists rather than specialist (Montazemi, 2006). SMEs usually experience problems related to users' competency and inadequacy of information; thus resource poverty regarding knowledge requirements of ERP adoption emerged for the SMEs (Laukkanen et al., 2007). Second, SMEs lack of financial resources for investing in IT infrastructure and for providing adequate training for the employees as well as their vulnerability in dealing with the risks of

IT investment failure (Montazemi, 2006). Third, despite the increasing focus toward strategic business development by medium-size companies, small-sized companies are less strategic-oriented than the medium-sized due to the difference of needs or lack of vision by small-sized enterprises. Lack of strategies, expertise, capital, and time to upgrade their manufacturing operation are commonly found in SMEs (Marri et al., 1998).

Based on a survey of 166 small businesses in Singapore, Thong (1999) reports that small businesses with certain CEO characteristics (innovativeness and level of IS knowledge), innovation characteristics (relative advantage, compatibility, complexity of IS), and organisational characteristics (business size and level of employees' IS knowledge) are more likely to adopt IS (information system). While CEO and innovation characteristics influence the decision to adopt IS, yet they do not affect the extent of IS adoption. Organisational characteristics is the main determinant of the extent of IS adoption. In the context of ERP adoption, it is very important for small businesses to have innovative and IS-knowledgeable CEOs. Understanding the benefit of ERP implementation to improve organisational efficiency and effectiveness, they are willing to invest scarce resources in the ERP system. Furthermore, small businesses should possess adequate financial resources and IS-knowledgeable employees. Greater financial resources would provide better chances of succeeding in the ERP adoption whereas lower barriers in understanding and using ERP would emerge from having IS-knowledgeable employees.

ADOPTING ERP

Before adopting a new ERP system, SMEs must carefully consider their capabilities. The adoption of ERP system should only be taken after requirement analysis because inadequate requirement might lead to misfit between ERP and organization (Muscatello et al, 2000). This view is also supported by a large survey involving 2,647 European SMEs which reports that fitness to the current business procedures is the most important criterion in the software selection (Van Everdingen et al., 2000). Other important selection criteria include flexibility, cost, and user friendliness while scalability and supplier support are considered in a somewhat lesser extent. In selecting software supplier, the functionality and quality of the products and services are more prioritized than suppliers' corporate image or their international orientation.

While the fit between ERP functionality and company business process is viewed to be important, SMEs commonly have limited resources and inadequate knowledge and experience of ERP system. These may create problems in software requirement specification process which is aimed at supporting the implementation process after software selection. Vilpola and Kouri (2005) propose a new method for SME's ERP requirement specification to provide a holistic and multidisciplinary approach in the process. It includes operational analysis, contextual, and risk analysis. Operational analysis' main goal is to define the future business process and to specify the requirements for new ERP system. It includes the discussion of business' strategy and vision by board of executives and group interview with key personnel in each business process. The deviation of current key processes and operational procedures are further examined in contextual analysis. It produces an in-depth description of the business' current organisation, its culture and interaction, and thus creates contextual requirements for ERP system and its implementation. Finally, the risk analysis completes the requirements analysis by highlighting the risks for ERP project as well as emphasizing the importance of planning preventive actions.

There some technical aspects which need to be considered in the adoption of ERP system, e.g. implementation strategies, ERP packages, configuration of system, degree of customization and implementation costs (Mabert, et al, 2003). Companies may choose a single go-live after date all modules (Bing-Bang), a single go-live date for subset of module

(Mini Big-Bang) or phasing in by module and/or site. Mabert et al. (2003) report that almost 70% of the US's SMEs have chosen Big-bang strategy which may need the shortest time for its implementation but the riskiest as well since any problems in one part of system can seriously impact the whole organization. Complexities of size, processes and operations may influence the choice of implementation strategy.

Each organisation may have unique experience regarding its ERP implementation; however, there are four ideal phases of enterprise system experience cycle as shown in figure 2. It should be noted that the organisation will recycle through the process when they run major upgrade or replace the system. The following section briefly describes the phases (Markus and Tanis, 2000).

- **Chartering phase**. It consists of the decisions leading up to system's funding including the activities such as building a business case for ERP, selecting software package (though it may be deferred until the project phase), identifying a project manager, and approving a budget and schedule. A decision of proceed or not to proceed the ERP system is the outcome of this phase.
- **Project phase**. It comprises activities such as software configuration, system integration, testing, data conversion, training, and rollout. The purpose is to get the system up and running in one or more organisational units. In this phase we should be able to recognize whether the business conditions identified in the chartering phase have changed or not.
- **Shakedown phase**. It includes activities such as bug fixing and rework, system performance tuning, retraining, and staffing up to handle temporary inefficiencies. As the outcome, the organization may achieve "normal operations" in which the system fits its goals or alternatively it gives up and terminates the system.
- **Onward & upward phase**. It continues from normal operation until the system is upgraded or replaced with a different system. At this phase, the organization should be able to ascertain any benefits of its investment. They may include continuous business improvement and improved users' skills; however, several problems may be recognized. Loss of system-knowledgeable personnel, no willingness for system upgrading, and judgment about system failure may occur in this stage.
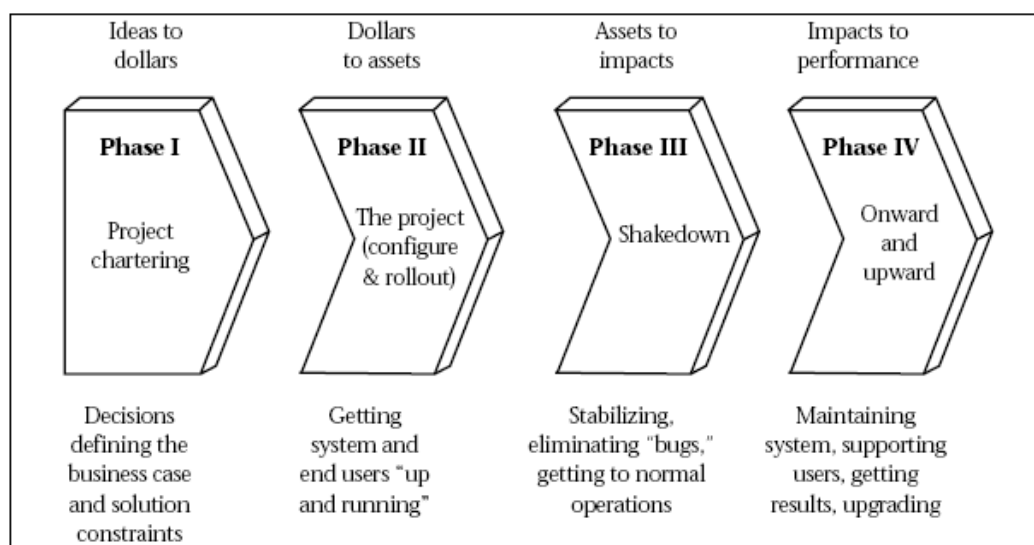

Figure 2: Enterprise System Experience Cycle
Source: Markus and Tanis (2000)

A single ERP system package may not able to cover all of the companies' needs; therefore companies should find other systems to be integrated with their ERP package software (Al Mudimigh et al, 2001). It is reasonable that most SMEs adopt a single ERP package and single ERP package with other systems (Mabert et al, 2003). SMEs were likely to adopt different software from different suppliers (Van Everdingen et al, 2000). However, the integration should be carefully managed by understanding the nature of integration, its potential problems, and how it affects the company.

ERP adoption brings important consequences for the company. The company should be able to adjust its business processes and operations once an ERP system was implemented. Because ERP has an integrated architecture, customization will be very costly. Most companies would prefer to change their operating processes rather than customizing their software package. SMEs might benefited from their flexibility to change so that the degree of customization able to be maintained at minor or significant level (Mabert et al, 2003).

Muscatello et al (2000) also suggest that the implementation of ERP is similar to the implementation of other modern technologies which involves human-factors related activities. Therefore, SMEs should prepare their personnel to accept and adapt themselves to the changes of operations, business processes and data management related to ERP implementation. To successfully adopt ERP, companies need two different types of training, ERP systems education and technical training for using ERP software. Education and training are needed by the individuals to meet their new responsibilities.

ERP'S SUCCESS STORIES BY SMEs

Although the adoption of ERP in SMEs is still in its early phase, some of them have been successful in their implementation. In the following section, two examples of ERP's success stories are provided. The success stories were taken from SAP and Oracle website. First, the experience of Aditya Auto Products and Engineering, an Indian automotive company which serves OEMs and tier-one automotive both in domestic and international market. Classified to be midsize business, the company has 400 employees and earns €15.4 million of revenue. It operates complex manufacturing and distribution network across India, Europe, and North America. SAP Bussiness All-in-One solution was finally selected to optimize Aditya's business operations. It claimed to gain the following benefits: (1) improved decision making via access to reliable, real-time information; (2) increased organizational efficiency and employee productivity; (3) improved control across plants with standardize business processes; (4) better visibility and control of production, inventory, logistics, and subcontractors; (5) enhanced reporting and evaluation of business performance; (6) increased ability to meet customer needs and attract new business (SAP Customer Success Story, 2008).

Second, the success story of Kafus, a Korean manufacturer of 250 employees which develops and produces a range of automotive components such as fuel systems, sensors, actuators and DC motors for domestic and international vehicle manufacturer. The penetration of Chinese automotive parts manufacturer into Korean market had force Kafus to differentiate its service and expand the business into the international market. The company then review its business and finally selected Oracle's JD Edwards EnterpriseOne to build its new system. The implementation of JD Edwards began in December 2006 and went live in September 2007. The benefits gained from the new system included: (1) cut account closing time from two weeks to three days; (2) improved inventory turnover by 85%; (3) increased efficiency by adopting best practice processes; (4) enabled staff to track sales by customer and/or product; and (5) supported global expansion and enhanced competitiveness (Oracle Customer Case Study, 2008).

THE CRITICAL SUCCESS FACTORS (CSFs) IN ERP IMPLEMENTATION

The effective use of ERP system would provide competitive advantages to its adopters, including for SMEs. Therefore, it is important for every organization to recognize the elements that contribute to a successful ERP implementation in its environment. Having reviewed the literature and confirmed it to eight SMEs in UK, Loh and Koh (2004) found ten critical success factors (CSFs) that were most apparent for SMEs.

- **Project champion**. Project leader should be place in charge for business perspective, resolve conflicts and manage changes throughout the organization.
- **Project management**. An individual or a group of people should be assigned responsibilities to carry out certain aspects of the project management to deliver a successful project management.
- **Business plan and division**. A clear business plan and vision that outlines proposed strategic, benefits, costs, risks and timeliness in critical in focusing the business benefit.
- **Top management support**. Senior management should fully committed with its involvement and willing to allocate valuable resources throughout the project implementation.
- **Effective communication**. Management should communicate any expectation, requirement, comments and reactions.
- **ERP teamwork and composition**. A cross functional team should consist of the best people which understand the organization's business strategy and ERP's technical know-how.
- **Business Process Re-engineering (BPR) and minimum customization**. It is critical to ensure that the software fit to the business process and the organization should be willing to change its business to fit the new system with minimal customization.
- **Change management program and culture**. People, organization and culture should be managed by education and training to maintain the change throughout the entire ERP implementation.
- **Software development, testing, and troubleshooting**. The overall ERP architecture should be tested before its deployment to prevent reconfiguration at each phase of implementation.
- **Monitoring and evaluation of performance**. The project should be measure based on the criteria of cost, time and quality. Reporting should produce the information on the effects of ERP implementation to the business' goals.

Along with the CSFs, Loh and Koh (2004) also identify 9 critical people (e.g. vendors, consultants, operation manager, end users, and IT support personnel) and 21 critical uncertainties (e.g. unrealistic budget, unskilled personnel, employees' resistance to change, unclear system maintenance). They can be used to measure the success at different points in the ERP life cycle including chartering phase, project phase, shakedown phase, and onward & upward phase.

Using case studies of five Canadian SMEs to provide valuable details and insight, Snider et al (2008) identify six factors that are considered to be critical to the success of SMEs' ERP implementation. They are operational process discipline, small internal team, project management capabilities, external end-user training, management support, and qualified consultant. The rationale is provided in Table 4. Further, they also identified four distinctive factors (which are innovative and counter-intuitive in nature) which SME managers may need to look at when implementing ERP. These factors include part-time dedication, lack of formal communication, software modification, and informal strategy.

Table 4: Critical Success Factors

Factor	Rationale
Operational process discipline	Inconsistent operational processes conflict with the procedural rigidity of ERP.
Small internal team	A team of less than five inherently interacts with end-users, reaches consensus quickly, creates a sense of project ownership, and reduces administration and coordination costs.
Project management capabilities	Internal project leaders are frequently distracted by regular tasks, limiting their time to prepare critical project documentation.
External end-user training	Internal project teams often lack time and skill to preparing and delivering effective training sessions.
Management support	In the close-knit SME work environment, management leads by example. Encouraging employees positively towards the project is just as important as providing sufficient resources.
Qualified consultant	Internal project teams may depend heavily on external consultants, their technical expertise and soft skills.

Sources: Snider et al. (2005)

The CSFs are substantially critical to ERP implementation. However, some CSFs are more critical than others (Sun et al, 2005). They suggest that people-related factors must get the highest priority followed by data, process, and management/organisation respectfully. It supports the view that in ERP implementation people is more important than technology since other factors ultimately depend on people. Finally, Sun et al. (2005) argued that when the CSF priorities are combined with cost, schedule, and achievement level in a proper manner, they can be utilized to improve the success of ERP implementation.

CONCLUSION

ERP is expected to provide benefits to its adopters, including to small medium enterprises (SMEs). The benefits include tangible and intangible benefits. They can be identified in the dimensions of operational, managerial, strategic, organizational, and IT infrastructure. In general, integration of business operations/processes, availability of information and quality of information are the main perceived benefits of ERP implementation. However, there are particular areas where SMEs report higher benefits than larger organizations, and vice versa (Mabert et al., 2003). To successfully implemented ERP, organizations should recognize the barriers in attaining expected benefits; people-related issues appear to be more dominant than the technical-based.

A mixture of IT factors and business factors motivate SMEs to adopt ERP. However, several factors (i.e. SMEs' structure, financial resources, personnel's IT knowledge and skills, and strategic orientation) should be considered in analyzing the need for SMEs' ERP. CEO and innovation characteristics may influence the decision to adopt ERP in the early phase, yet it is the organizational characteristics (business size and employees' IS knowledge) that affect the extent of the adoption (Thong, 1999).

To gain the effective use of ERP implementation, SMEs should consider their capabilities in both technical aspects (e.g. implementation strategies, ERP packages, configuration of system, degree of customization and implementation costs) and human aspects (e.g. personnel's education and training, skills development, and change management). Finally, the critical success factors (CSFs) should be recognized to achieve a successful ERP implementation in the organization's environment. They can be used to measure the success at different points in the ERP life cycle which includes chartering phase, project phase, shakedown phase, and onward & upward phase.

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