

Critical success factors for ERP implementation in midsize and small organizations

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Abstract— many firms around the world have shifted their information technology (IT) strategy from developing information systems in-house to purchasing application software such as enterprise resource planning (ERP) systems.

IT managers responsible for managing their organization's ERP implementation view ERP systems as their organizations' most strategic computing platform. This paper presents a novel taxonomy of the critical success factors in enterprise resource planning (ERP) implementation process. ERP benefits cannot be fully realized unless a strong alignment and reconciliation mechanism is established between technical and organizational imperatives based on the principles of process orientation. It is suggested in the taxonomy that measurement takes place in a balanced perspective, and for providing useful information that can enable the decision-making process and, which can help deliver the corporate objectives and therefore lead the business competitively forward. Upon this premise, the taxonomy is based on a comprehensive analysis of ERP literature combining research studies and organizational experiences. The taxonomy reflects the essential features of ERP systems, as being built based on the principles of business process management. Furthermore, it illustrates that ERP benefits are realized when a tight link is established between implementation approach and business process performance measures.

Index Terms— Critical Success Factors, ERP, Implementation, midsize and small organizations.

1 INTRODUCTION

Many successful cases of ERP system have been reported, but still have many ERP systems as failed systems. The failure of ERP system or the use of the system will definitely cause a huge loss for the organization and may lead to bankruptcy [1].

There are many benefits associated with an ERP system. All can lead to increased efficiency and will give a company a more competitive advantage in the global economy. In order to achieve this, companies should consult experts during the implementation process in order to deliver the above-mentioned benefits, and avoid system failure [2].

This paper presents a novel taxonomy of the critical success factors in enterprise resource planning (ERP) implementation process. ERP benefits cannot be fully realised unless a strong alignment and reconciliation mechanism is established between technical and organisational imperatives based on the principles of process orientation. It is suggested in the taxonomy that measurement takes place in a balanced perspective, and for the purpose of providing useful information that can enable the decision making process and, which can help deliver the corporate objectives and therefore lead the business competitively forward. Upon this premise, the taxonomy is based on a comprehensive analysis of ERP literature combining research studies and

organisational experiences. The taxonomy reflects the essential features of ERP systems, as being built based on the principles of business process management. Also, the research is expected to contribute towards identifying the Critical success factors (CSFs) that reduce the likelihood of ERP system failure in order to encourage many firms to consider these factors in the ERP implementation which can help them to avoid system failure and to achieve effective usage of the ERP system. This study will also contribute in technology diffusion through motivating other companies to implement an ERP system and will provide them with the needed CSFs for ERP implementation.

2 LITERATURE REVIEW

2.1 ERP DEFINITIONS AND DRIVERS

Like many newer fields in IS, the definition of ERP software, synonyms are integrated standard software packages, enterprise systems, enterprise wide-systems, enterprise business-systems, integrated vendor software, and enterprise application systems (Gable, 1998; Holsapple and Sena, 1999; Rosemann, 1999), has been defined by various authors but with not much differences.

Rosemann (1999) defines ERP system as a customizable, standard application software which includes integrated business solutions for the core processes (e.g. production planning and control, warehouse management) and the main administrative functions (e.g., accounting, human resource management) of an enterprise. Slight differently, Gable (1998), however, defines it as comprehensive pack-

age software solutions seek to integrate the complete range of a business processes and functions in order to present a holistic view of the business from a single information and IT architecture.

Since the focus of manufacturing systems in the 1960s was on traditional inventory control concepts, most of the software packages were limited generally to inventory based on traditional inventory processes (Gumaer, 1996; S, 2000). Due to the need for software designed specifically for manufacturing operations, the focus of manufacturing systems have moved to material requirement planning (MRP) systems which translated the Master Schedule built for the end items into timephased net requirements for the sub-assemblies, components and raw materials planning and procurement (Gumaer, 1996; S, 2000).

Since 1975, the MRP system has been extended from a simple MRP tool to become the standard manufacturing resource planning (MRPII) (Chung and Snyder, 1999). In addition, Shtub (1999) states that the MRP systems, which trade with resource capacities, are known as MRPII systems. However, the shortcomings of MRPII in managing a production facility's orders, production plans, and inventories, and the need to integrate these new techniques led together to the development of a rather more integrated solution called ERP (Chung and Snyder, 1999).

ERP systems work essentially at integrating inventory data with financial, sales, and human resources data, allowing organisations to price their products, produce financial statements, and manage effectively their resources of people, materials, and money (Markus et al., 2000). The emergence of ERP in the early 1990s led to the inclusion of other functions such as accounting and sales management (Gupta, 2000). In fact, ERP advocates believe that ERP could combine both business processes in the organization and IT into one integrated solution, which MRP and MRP II were not able to provide (Chung and Snyder, 1999) [4].

2.2 ERP SYSTEM

An ERP system is a technology infrastructure that can assist a company in integrating information from all internal departments with suppliers and customers. It links all areas of a company's internal functions and processes with the external ones in order to create a close relationship between customers and suppliers. ERP also allows information to be shared between different partners, supports the effectiveness of the supply chain management, and improves the flow of information. These should enable managers to make better decisions based on more accurate and up-to-date information.

The ERP system was introduced by ERP providers, such as SAP (Systeme, Anwendungen, Produkt in der Datenverarbeitung) (Systems, Applications, & Products in Data Processing), Oracle, PeopleSoft, and others to eradicate legacy system problems, provide single and integrated technological platform, and thereby assist companies in gaining a competitive advantage and thus competing globally. However, implementing ERP system requires changes in the organizational culture as a whole, takes a long time to implement, and consumes a considerable amount of money. Therefore, companies need to know clearly what ERP system is and in what ways the system could affect the company before thinking of implementing the system.

Al-Mashari (2003) noted that, since the 1990s ERP system have been considered by many researchers and practitioners as one of the most innovative developments in Information Technology and one of the most well-known IT solutions for this decade, and this is in fact because ERP system has become one of the main prerequisites and the backbone of e-business era.

Companies are beginning to realize that in order to survive in the global business environment they must improve not only their organizational efficiency, but also their whole supply chain. This is because competition today is not limited between companies only, but it has extended to be among their supply chains as well. These reasons force many companies to keep up to date and make large investments in developing and implementing better technologies and system such as ERP system [3].

2.3 ERP SYSTEM IMPLEMENTATION

Many companies around the world began implementing ERP system in 1990s. The main reason behind the implementation of ERP system is to re-engineer business processes through a uniform information system (Rajagopal, 2002). During the mid to late 1990s, around 30,000 companies worldwide implemented ERP system (Mabert et al.,

2003). Companies worldwide have spent \$10 billion per annum on ERP systems (Yusuf et al., 2004). Between 1996 and 2003 there was a tremendous upward growth in the number of ERP systems. However, in the last few years, ERP systems seem to have been forgotten and this has led to a significant decline in the ERP market [5].

Many leading international companies have successfully implemented ERP systems. These companies have experienced the expected benefits of ERP system. An order with Autodesk Software Company that used to take two weeks is now completed within four hours. Cisco's ERP system enabled it to cut costs and substantially increase its revenue. ChevronTexaco improved its supply chain management through the implementation of an ERP system. It achieves an annual net profit of \$100 million. IBM's R/3 implementation was one of the most successful implementation [4].

However, there have been some significant failures. Dell felt that ERP system would fail to cope with their sales volume. Thus it cancelled the ERP project and lost \$115 million. Another case in point was FoxMeyer. The pharmaceutical giant suffered a loss of \$100 million and made bankrupt after unsuccessful implementation [7].

Implementation of ERP system is very costly and takes a long time to be implemented. This reason prevents many companies from implementing ERP system and limits the market share of ERP systems. However, in order to solve this problem, top ERP vendors need to develop special ERP packages to meet the need of small size companies to increase the market share of ERP systems. With this solution, small and medium sized companies can also benefit from ERP system. This solution also enables the global proliferation of ERP systems [8].

Implementing technological solutions and techniques such as ERP system could improve and integrate the internal and external flow of information within an organization. Such innovations would also improve SCM performance, enhance decision-making based on accurate information and improve the relationship, collaboration, and exchange of information. It would improve the movement of goods and services to outsource suppliers, customers, and other partners in the supply chain and finally achieve a competitive advantage and increase profitability [9].

2.4 ERP COST AND IMPACT

The contribution that ERP packages, including those from SAP AG, PeopleSoft, Oracle, and Baan, have made to the business world has been remarkable. ERP systems have increased the efficiency of a wide range of businesses by

providing them with seamless access to much of the information they need. An ERP system can be thought of as a business-wide integration mechanism of all organisational IS. This integration makes organisations able to take quick reaction to competitive pressures and market opportunities, be more flexible product configurations, achieve reduced inventory, and maintain tightened supplychain links. The study also identifies the various benefits of ERP implementation as perceived by the companies surveyed. ERP benefits can be classified into tangible and intangible. According to the Deloitte & Touche's survey (Computer Technology Research Corporation, 1999), tangible benefits refer to inventory reduction, reduction of personnel, increased productivity, improvements in order management, more rapid closing of financial cycles, reduction in IT and procurement costs, improvement of cash flow management, increase of revenue and profits, reduction in transportation and logistics costs, reduction in the need for system maintenance, and improvement in ontime delivery performance. Intangibles refer to the increased visibility of corporate data, new or improved business processes, improved responsiveness to customers, unanticipated reduction in cost, tighter integration between systems, standardization of computing platforms, increased flexibility, global sharing of information, Y2K compliance improved business performance, and improved visibility into SCM process. However, a study of 63 companies shows that it took eight months after the new system was in to see any benefits.

However, the median annual savings from the new ERP system was \$1.6 million. Despite these significant benefits that ERP systems can provide, they are very expensive even under ideal circumstances. The cost of an ERP software itself can range from hundreds of thousands of dollars to several million dollars. This cost can further be escalated when considering hiring consultants to help in the selection, configuration, and implementation of the system. According to an IT research firm, Gartner Group, companies may spend up to three times as much money on consultants as they do on the ERP system itself (Computer Technology Research Corporation, 1999). Other costs may include the human resources needed to work full time on the implementation project. Additionally, an organization may need to install new hardware to run the ERP software, and a new database to store the ERP data. Furthermore, integrating the ERP system with other types of applications is usually a necessity. It is also important that end-user training and change management costs are considered in the equation (Computer Technology Research Corporation, 1999). In fact, every company that implements an ERP system is faced with its cost and complexity. However, the disastrous problems are usually those which relate to implementing an ERP system without thinking through its full business implications [10].

2.5 CSFs IN ERP SYSTEM IMPLEMENTATION

Most of the literature on ERP system focused on two main domains. The first one evaluates the suitability of ERP systems' software, vendors, and consultants. The second domain looked at the CSFs that affect ERP system's implementation success, such as ERP Teamwork & Composition, Top Management Support, Business Plan & Vision, Effective Communication, Project Management, Project Champion, Appropriate Business, and Legacy Systems.

An ERP implementation is typically a large new project, the likes of which companies will have never experience before. Consequently, prior to ERP implementation, companies need to understand their own competency such as their ability to use the system effectively, provide maintenance, and to take advantage of system opportunities in terms of development and innovation [11].

Therefore, companies need to start with necessary changes in their own business processes required in the implementation of ERP processes, and may eventually improve the entire supply chain, thus, gaining a competitive advantage in the marketplace. Implementation was one of the most critical issues for industrial companies in literature [12].

According to Nah and Lau (2001) critical factors for successful implementation of ERP system include ERP Teamwork & Composition, Top Management Support, Business Plan & Vision, Effective Communication, Project Management, Project Champion, Appropriate Business & Legacy Systems, Change Management Program & Culture, Business Process Reengineering (BPR) & Minimum Customization, Software Development, Testing & Troubleshooting, and Monitoring & Evaluation of Performance.

Loonam and McDonagh (2005) stated that, when companies plan to implement ERP systems, they have to pass through three stages:

1. Pre-implementation stage: where companies need to decide why they want to implement ERP systems, what they hope for from this system, what they need to prepare before initiate ERP implementation, and what are the CSFs (such as top management support) that could assist them to achieve successful implementation.

2. Implementation stage: which requires the company to anticipate and be prepared for the coming challenges and problems expected during the implementation stage. Organizational and technical issues usually arise during implementation.

3. Post-implementation stage: at this stage companies need to keep abreast of the latest technology in order to be able to deal with any new technology.

Switching from a traditional business process to a new way of conducting business through implementing a new information system such as an ERP system and therefore abandoning the legacy system in order to run the new business processes, is considered a difficult task and may cause a system failure, which in turn may lead to insolvency. Although, there are success stories with ERP systems, there are also cases of failure for some companies [12].

Owing to these failures, many companies are still indecisive on making an enormous investment, paying a large sum of money, and investing in a lengthy period for implementing such new system. In fact, these cases of failure deter many companies from implementing ERP system because they are frightened of having the same experience of prospect of bankruptcy [13].

As a result, Enterprise Systems seem to have been forgotten and becoming redundant. Consequently, technology diffusion between companies may be decreasing which may adversely affect the growth of new technology innovations. These were a result of reluctance from many companies to invest huge amounts of time and money in the implementation of an ERP system which could potentially fail or cause undesirable outcomes.

In fact, many companies have been dissatisfied with their ERP system, and in some cases the system has failed. Trunick (1999) pointed out that, only 40 percent of the implemented ERP systems show just some of its full effectiveness, and 20 percent of the implemented ERP systems were considered a complete failure. The rate of ERP systems failure may exceed 50 percent. 60 to 90 percent of the implemented ERP systems were not as effective as the companies had anticipated.

Through an extensive literature review and analysis, several CSFs have been identified. However, there is a consensus among researchers that classify the CSFs into three main categories. Table 1 presents the main factors and the degree of citation for each factor in literature.

3 CONCLUSION

The journey of ERP system begins with the implementation of the system, and continues post-implementation. However, continued effort is needed after the "go-live" of ERP system in order to reap the full benefits of the system. In fact, the journey of ERP system starts after the implementation stage. "Yes, there is life after go-live" (Deloitte, 1999).

TABLE 1: CSFs STUDIES

CSFs in literature	Degree of citation in literature	References
Top Management Support	High	Ang et al.(2002); Al-Mashari et al. (2003); Yusuf et al.(2004)
Project Management	High	Umble et al. (2003); Yusuf et al.(2004); Al-Mashari et al. (2003)
Business Process Reengineering	High	Hong and Kim (2002); Malbert et al.(2003); Yusuf et al.(2004)
User Training & Education	High	Mandal and Gunasekaran (2002); Umble et al. (2003); Sum et al. (1997)
User Involvement	High	Bingi et al. (1999); Burns and Turnipseed (1991); Cox and Clark (1984); Zhang et al., (2002)
Business Plan & Vision	Medium	Loh and Koh (2004); Somers and Nelson (2004)
Careful Package Selection	Medium	Wei and Wang (2004); Shehab et al., (2004)
Change Readiness & Culture	Medium	Hong and Kim (2002)
Clear Goals & Objectives	Medium	Umble et al. (2003); Yusuf et al. (2004)
Learning Competency	Medium	Zhang et al., (2002)
Minimal Customization	Medium	Somers and Nelsons (2001)
Monitoring & Evaluation Of Performance	Medium	Holland et al. (1999)
Project Champion	Medium	Akkermans et al., (2000)
Strategic IT Planning	Medium	Somers and Nelson (2004);
Teamwork & Composition	Medium	Loh and Koh (2004); Remus (2006)
Vendor Support	Medium	Motwani et al. (2002); Yusuf et al. (2004)
Appropriate Business & IT Legacy Systems	Low	Holland et al. (1999)
Data Analysis & Conversion	Low	Zhang et al., (2002)
Education on new Business Processes	Low	Woo (2007)
Partnership with Vendor	Low	Somers and Nelsons (2001)

Therefore, the CSFs should ensure the continued success of ERP system as well as reduce the likelihood of the system failure during the three stages of an ERP system's life cycle. The sustained commitment and support of the main CSFs from the beginning to the end of ERP system project is very important for the success of the system and for its effective impact on business performance [4].

In order to facilitate the continuous success of ERP system and to ensure a better impact on the business performance, CSFs should be involved with the ERP system during the implementation of ERP system. ERP system passes through three main implementation stages of system life cycle and that includes pre-implementation stage, implementation stage, and post-implementation stage.

This study concludes that 10 CSFs should be considered during the ERP implementation as the most important factors from the 20 factors identified by the literature. These factors are Top Management Support, User Involvement, Clear Goals & Objectives, Strategic IT Planning, User Training & Education, Vendor Support, Teamwork & Composition, Project Champion, Monitoring & Evaluation of Performance, and Education on new Business Processes. These top 10 critical factors can help companies to achieve successful implementation of ERP system.

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