

TAXONOMY OF ENTERPRISE RESOURCE PLANNING SYSTEM

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1. INTRODUCTION

In the beginning of this paper deals with the qualitative leap in global information technology, which we must keep pace with, in order to reap the benefits available, for example Enterprise Resources planning systems is type allow easy storage, sharing and retrieval of information and uniform maintenance for an organization operating across countries and continents, a global perspective enables it to better serve the world market. In addition, a standardized information system can provide leverage in performance of business management. Furthermore, a global IT system easy harmony and compatibility with the work across the organizations in the world, which enables employees to transfer between business units without, further training on different IT systems.

Recently ERP systems can cover a wide range of functions and integrate them into one unified database. For instance, functions such as Human Resources, Supply Chain Management, Customer Relations Management, Financials, Manufacturing functions and Warehouse Management functions were all once stand-alone software applications, usually housed with their own database and network, but today, they can all fit under one system called *ERP*.

2. OVERVIEW OF ERP

ERP systems are an information system that manages, through integration, all aspects of business including production planning, purchasing, manufacturing, and sales, distribution, accounting and customer service¹, which allows seamless integration of information flows and business processes across functional areas within a company². ERP system support information sharing along company process flow and help it to achieve better productivity and results. ERP packages offer a workflow engine to generate automated workflow according to business rules and approval matrices so that information and documents can be routed to operational users for transactional handling, and to managers and directors for review and approval³. ERP systems are becoming standard information systems, regardless of size and nature of the organization⁴. ERP systems are currently highly sought after by organizations because they provide a tightly integrated solution to an organization's information system needs⁵. Moreover, Extend ERP systems typically handle the manufacturing, logistics, and distribution, inventory, shipping, invoicing, and accounting for a company to control the activities of companies like sales, distributes, billing, production, inventory management, and human resources management, finance management, so on. Furthermore, ERP II used technical of internet to extend its benefits, SCM, CRM, and e-business, which support magic services to customers and suppliers through internet to meet their needs.

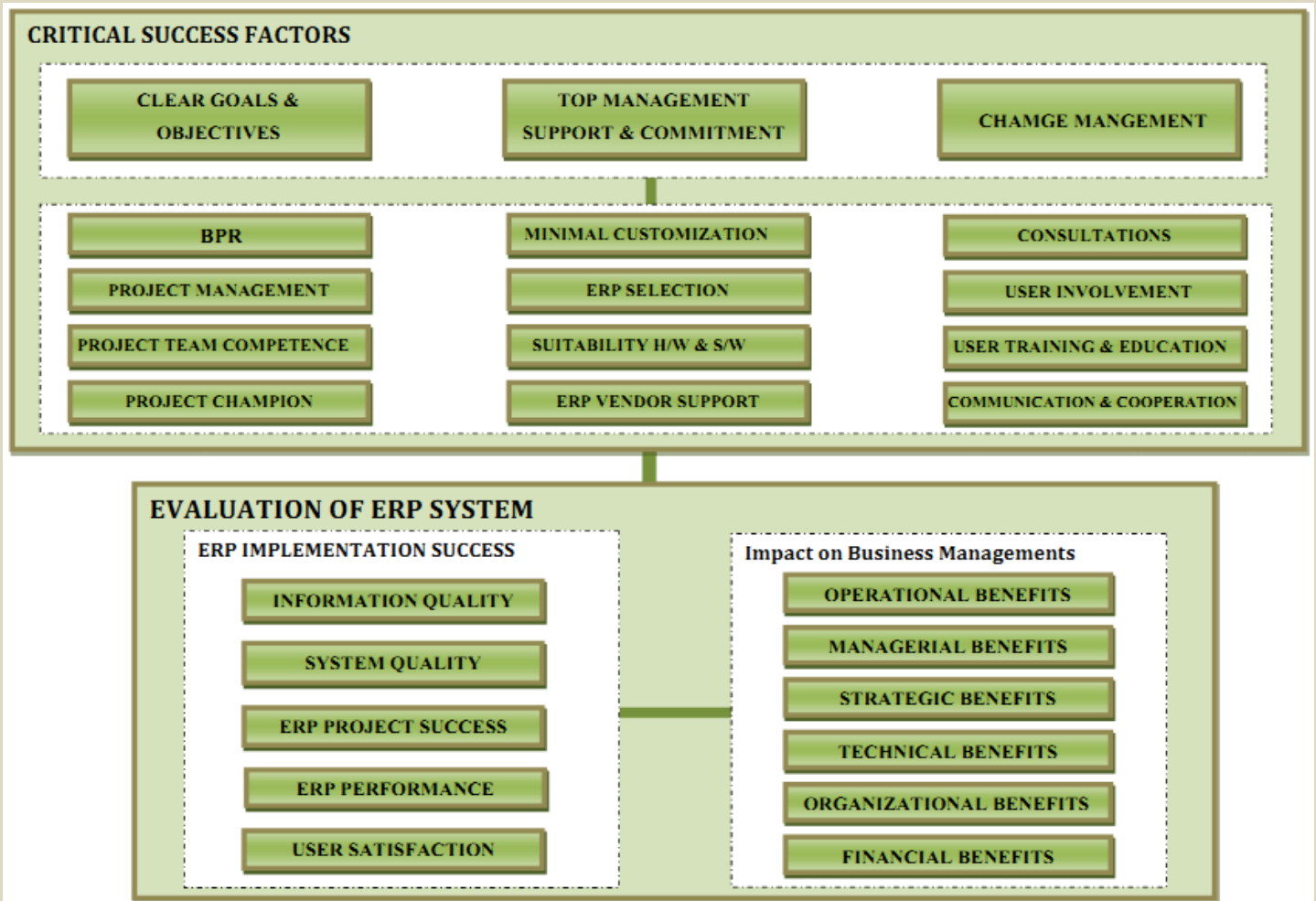
The concept of Enterprise Resource Planning (ERP) can be viewed from different perspectives. First, ERP is computer software. Second, it can be seen as a means of integration all processes and data of an organization and create a comprehensive integrated structure. Third, ERP is software with reengineering processes of company to adapt with

ERP system. Furthermore, several ERP definitions are there and almost all are more or less similar. The good definition of ERP is more than software, it is restructuring business processes associated with enterprise system, its package software solution have new automated way of effectively integrating, managing and controlling almost all aspects of business processes, functions and wide-resources from different areas of the business by using centralized database, ensuring that all information is entered only once to be able to produce and access information many times in real time environment.

3. TAXONOMY OF ERP SYSTEM

ERP system is a costly and risky investment due to the enormous resources to be allocated for their implementation. While companies are willing to invest in ERP systems, they want to make sure their investments yield the expected benefits. Nowadays the demand for ERP systems is rapidly increasing but many of them fail to achieve their goals in terms of ERP utilization and overall expected improvement. The novelty of this research paper is the identification taxonomy of ERP system which has two parts CSFs and evaluation of ERP. The CSFs contain fifteen factors that important to readiness of company to implement ERP successfully. The evaluation of ERP divided into two major dimensions revealed were namely success of ERP implementation and impact of ERP. These dimensions can evaluate ERP success and lead to positive role of ERP system. In the following figure (1) shows the taxonomy of ERP system.

Figure (1): Taxonomy of ERP System



4. CRITICAL SUCCESS FACTORS

The authors undertook an extensive literature review of Critical Success Factors of ERP, and on the basis of the frequency of citations made by authors in the context in general. There are many researchers who have discussed and studied CSF affecting the ERP system implementation but the authors mentioned some important studies depending on the size of the companies or whether they belong to developing countries. The authors focus on the CSFs most commonly used and based on importance and effectiveness to successful ERP implementation in the previous studies. From the previous reviews, the authors revealed fifteen CSFs that affecting in successful ERP implementation as listed below: Top Management Support and Commitment, Clear Goals and Objectives, Project Management, Change Management, and Selection ERP, BPR, minimum customization, Suitability H/W and S/W, Communication and Cooperation, and ERP Vendors Support, Project Champion, User Involvement, User Training and Education, external Consultants, and Project Team Competence. In the following table (1) these fifteen CSFs collected from previous researches⁶⁻²⁵ in the same area, are listed with an indication to the name of authors who suggested these as important and effective.

Table (1): CSFs of ERP System

N	CRITICAL SUCCESS FACTORS	Holland and Light (1999)	Cantu (1999)	Esteves and Pastor (2000)	Nah et al. (2001)	Somers & Nelson (2001)	Zhang et al.(2002)	Akkermans & Helden (2002)	Al masharis et al. (2003)	Umble et al. (2003)	Loh and Koh(2004)	Jiang (2005)	Gargeya and Brady (2005)	Ferratt et al. (2006)	Jafari et al. (2006)	Jing & Qiu, (2007)	Nattawee & Siriluck (2008)	Mokhtar (2009)	Parijat. (2010)	Scorta Iuliana (2010)	All Noudoostbeni et al. (2010)	
1	Top Management Support and Commitment	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
2	Project Management	√		√	√	√	√	√	√	√	√	√			√	√	√	√	√	√	√	√
3	Change Management Program	√		√	√	√				√	√						√		√			
4	Clear Goals and Objectives					√		√		√			√		√	√	√	√	√	√	√	√
5	BPR	√	√	√	√	√	√				√	√			√	√	√				√	
6	Communication and Cooperation	√		√	√	√		√	√		√				√	√	√	√			√	√
7	Project Team Competence	√	√	√	√	√				√	√		√				√	√	√	√	√	√
8	Project Champion	√		√	√	√		√			√							√	√			
9	Minimal Customization			√	√	√					√								√			
10	ERP Vendors Support			√		√	√	√							√	√	√				√	
11	Consultations	√		√		√							√	√			√			√	√	
12	Selection ERP	√		√		√		√	√					√			√			√		
13	Suitability H/W and S/W(IT)	√	√				√					√			√							
14	User Involvement			√			√					√			√		√					
15	User Training and Education	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√

- **Top Management Support and Commitment (TM)**

Top management support is the most important success factor in ERP implementation from its early life. Successful enterprise resource planning system implementation depends on the degree of top management support that should provide direction to the firm's overall management, question the implementation teams, and monitor the progress of the project. In addition, continuous top manager support will ensure enough workers & financial & material resources to finish the ERP implementation project with the specific quality, quantity and time. Moreover, top manager can evaluate and review business & technique and solve conflict that may appear in the ERP implementation process.

- **Project Management (PM)**

ERP systems implementation is a set of complex activities undertaken requiring careful selection of the appropriate project management structure and methods. C.C. Sum and other²⁶ determined the complex activities of ERPs implementation are involving all business functions and often requiring between one and two years of effort, thus companies should have an effective project management strategy to control the implementation process, avoiding overrun of budget and ensuring the implementation within schedule. There are five major parts of project management: (1) having a formal implementation plan, (2) a realistic time frame, (3) having periodic project status meetings, (4) having an effective project leader who is also a champion, and (5) having project team members who are stakeholders.

- **Change Management**

A change management strategy is effective implementation of an ERP system that can cause resistance, confusion, redundancies, and errors. ERP implementations fail to achieve expected benefits because companies neglected of change management critical. According to Nah and other²⁷, the improvisational change methodology is a useful technique for identifying, managing and training changes in implementing ERP projects.

- **Clear Goals and Objectives**

ERP implementations require clear goals and objectives of how the company should operate in order to satisfy customers, empower employees, and facilitate suppliers for the next years. The organization must carefully define why the ERP system is being implemented and what the critical business needs for adopting ERP are.

- **Business Process Reengineering (BPR)**

It is very important to configure the ERP system aligns with business processes to gain full benefit of ERP systems of the best practices offered by the system in order to be compatible with the ERP software. Each company needs customized software, but the organization must keep minimum customization to reduce problems such as code error, difficult update and increases the level of complexity, risks and costs because of modification.

- **Communication and Cooperation (CC)**

Communication is a critical success factor by the companies that keeps everything working properly among stakeholders (project team, rest of the team of organization, client). Lack of coordination and communication is lead to fail in BPR implementations. Then good coordination and communication within the project team are essential to avoid failure. Communication weakness among stakeholders may lead to failure of ERP implementation.

- **Project Team Competence(PTC)**

Jiang and other²⁸ noted that project team competence is the fourth most important success

factor for IS implementation. The project team refers to the proper selection that would be driving the success of ERP implementation. Loh and Koh²⁹ stated that the ERP team should involve the best people in the organization.

- **Project Champion (PC)**

The project champion plays critical role in implementation success in the entire life cycle of the implementation project. Project Champion undertake the strong character, skillful and experience in ERP implementation and delegate the responsibility of ensuring acceptance of the system by end users and keeps a close eye on the technological integration with business aspects of the ERP.

- **Minimum Customization**

ERP vendors offer two types of ERP system as standard and ERP customized. ERP standard is low cost and time but not fit like customized, which generally fit to organization. Minimizing customization will avoid mistakes and encourage vendors to release new version but increase information systems costs, take longer implementation time, and inability of vendor maintenance and upgrades.

- **Vendors Support**

Vendor support play crucial role in shaping the ultimate outcome of implementation, so software vendors should be carefully selected to avoid irritations and time exceed. It is important for the vendor's staffs to have knowledge ability in both business processes and ERP system functions to avoid many problems during ERP implementation.

- **External Consultants**

External Consultants may have experience in specific industries, comprehensive knowledge about certain modules, and may be better able to determine which suit will work best for a given company. Many organizations use consultants to facilitate the implementation process, to perform requirements analysis, to recommend a suitable solution, and manage the implementation.

- **ERP System Selection**

The selection of a fit ERP system is another crucial aspect challenging and time-consuming process affecting the success of the implementation. Normally the organization selects a package that is most user-friendly, has adequate scope for scalability and covers an array of business processes where the organization experiences problems. Organization fit of the ERP package is defined as a close match between the ERP package and organization's business processes. Otherwise, the organization has to change its business processes to fit the ERP package.

- **Suitability H/W and S/W**

H/W and S/W are basic material of ERP; therefore suitable H/W and S/W are important factors to achieve usefulness of ERP. Due to the lack of professional expertise and experience on a developing country, many companies prefer to buy standard systems to shorten the ERP implementation cycle. Standard systems increase the success opportunity but cannot fully meet the company's needs thus the management must choose software that most closely fits its requirements. ERP vendors use different hardware platforms, databases, and operation systems, and certain ERP packages are only compatible with some companies' systems.

- **User Involvement (UI)**

User involvement is one of the most witnessed CSFs in ERP implementation projects.

This factor creates positive attitude in users toward the ERP system. Involving users early in the implementation of ERP, especially in the stage of defining organizational information system needs can decrease their resistance to the potential ERP systems, avoid expensive consulting cost and users become experts with the training.

- **User Training and Education (UTE)**

Training and education is essential factor to be carried on grade by grade through the course of implementation and operating ERP systems successfully. The user of ERP systems needs to know how the ERP system works and how the ERP is related to the business process to avoid ERP failure. Many companies use consultants to help during the implementation process and to transfer knowledge from the consultants to internal employees to enable them to manipulate the installed system correctly and effectively and reduce dependence on consultants and the consultation fees. Hence, ERP knowledge is necessary to educate users on the general advantage of an integrated system, usage of the new system and make the user comfortable with the system.

5. ERP IMPLEMENTATION SUCCESS

ERP implementation success contains five variables presented brief as follows:

- **ERP Project Success**

ERP project success can be measured in terms of time, cost and goals as usual information system contexts applied. Based on previous studies and research on the criteria of ERP project success, the authors found three criteria based on the answers expressed to some questions developed to ask whether the ERP project was completed on time, within budget, and whether the ERP system achieved company's goals. Joe Hofwegen³⁰ gave ERP implementation success definition based on three dimensions: (1) Project cost relative to budget; (2) Project completion relative to schedule; (3) level of scope creep encountered.

- **User Satisfaction**

User Satisfaction is a second dimension to assess ERP implementation success by getting responses to some questions from respondents about ERP system as well as the degree of overall satisfaction with the system. Bailey and Pearson defined the user satisfaction as the sum of one's feelings regarding an IS³¹ and as a good surrogate measure of IS success³². In addition, Ginzberg³³ adopted user satisfaction to measure IS implementation success.

- **System and Information Quality, ERP Performance**

The quality of ERP is important criteria of ERP project success according to the D&M Model³⁴⁻³⁸, they concluded the project IS success such as ERP system depends on the System, Information and performance Quality dimensions in their models, to improve user satisfaction and business benefits. These items of questions below summarized from D&M model and others in same model. Moreover, Chang³⁹ proposed a model for measuring the performance of the information systems function. The model consists of three dimensions i.e. systems performance, information effectiveness, and service performance and emphasizes the comprehensiveness of the Information Systems Function Performance (ISFP) construct. He found out that the ISFP measures were positively related to improvement in business processes and organizational performance.

From previous literature, authors proposed measurement of ERP quality success as follows:

1. Quality of system (flexible, ease to use, reliable, data integration, efficient)

2. Quality of information (understandable, brief /concise, relevant, usable, available, immediately)
3. ERP of performance can measure through these points
 - User satisfied of interaction with ERP system
 - ERP is simple & flexes functionality of company
 - ERP improved customer satisfaction
 - ERP improved decision-making
 - ERP reduce organizational costs
 - ERP improve individual productivity
 - ERP improve worker's participation

6. IMPACTS ON BUSINESS MANAGEMENT

The measurement of impacts of ERP is hard same as measuring the success of information system. From literature reviews the authors addressed six groups of benefits that important and relative impact points of ERP system as follows.

• Operational Benefits

Brakely⁴⁰ found the principal benefits of ERP system are the ability to integrate business processes, effectiveness in reducing inventory costs, improving efficiency and increasing profitability. In addition, Michel⁴¹ found the using of ERP system be critical in improving customer satisfaction for example, NEC Technologies credits its installation of ERP for increasing its speed of order processing, improving invoicing and in drastically reducing its customer-service response times.

• Managerial Benefits

Managerial benefits can be measured by asking some questions relative to management operation to the user of ERP. Then the authors can work out the practical benefits depends on previous studies.

Davenport⁴² stated that there are different types of benefits and that some types are likely to arise before others do. For instance, benefits from improved transactional processes and common data appear to precede benefits associated with improvements in management and decision-making. According to O'Leary⁴³, ERP systems are designed to support business process improvements of this nature, thereby enhancing information quality, decision-making and firm performance. The efficiency of decision-making is improved.

• Strategic Benefits

Smith and other^{44,45} found while ERP installations often help small and midsize manufacturers there are several reasons why some firms are not rushing to install the systems for these reasons improve their strategic and competitive capabilities. Nevertheless Alshawi and other⁴⁶ recognized that huge investment in IT alone does not deliver ERP benefits and the management has to employ clearly defined measures and apportion responsibilities for delivering benefits. Furthermore, to exploit benefits fully, IT projects should form part of a larger business vision and strategy and be driven by that strategy.

• Technology Benefits

Technology benefits bring flexibility to the business and give global access to other institutions and help in next generation of software. Shang and Seddon⁴⁷ used Technology benefits in their measurement of ERP benefits and the three sub dimensions of technology

benefits with their suggestions are Build business flexibility for current and future changes, IT costs reduction, Increased IT infrastructure capability.

- **Organizational Benefits**

Organizational benefits are crucial benefits in institutions adopting ERP as Hunton, Kallunki, Liu and other concluded in their studies that the organizational benefits are significantly larger for organizations that have implemented an ERP-system in the last three years than for organizations that do not have such a system^{48,49}. In this regard, Shang and Seddon⁵⁰ showed the following six dimensions of organizational benefits: changing work patterns with shifted focus, facilitating business learning and broadening of employee skills, employee empowerment, building common visions, shifting work focus, increased employee morale and satisfaction.

- **Financial Benefits**

When the financial measurement is applied on benefits of ERP to users, the authors determine some financial indicators depend on previous studies which asked to respondents. In the report of Network Economic Research Center of Beijing University issue 'Research Report on the effect of ERP on Chinese Enterprises performance' in 2007, they find that the performance of enterprises which implement ERP is much better than those which do not implement ERP. In 2004 and 2005, the ROE (Return on Equity) of ERP users has been reported to have increased by 33.42% and the NPR (Net Profit Ratio) has been increased by 97.12%. In addition, Matolcsy and other⁵¹ found that there are six financial indicators of ERP users APD (account payable days), CR (current ratio), IT (Inventory Turnover), FAT (Fixed Asset Turnover), NPR (Net Profit Ratio), SC (Sales Changes) which have improved as well as the performance of ERP users which has improved.

7. CONCLUSION

The meaning of ERP is a technology strategy contains many modules of software and strategy for implementation in companies wishing to buy after the completion and establishment of the technical infrastructures for the company to become ready for the implementation of ERP without errors or failure. ERP is a packaged software solution that addresses the enterprise needs taking the process view of an organization to meet the organizational goals, tightly integrating all functions of an enterprise that integrates manufacturing, finance, sales, distribution, HR and other business functions with a single comprehensive database that collects data from and feeds data into modular applications supporting all the company's business activities. The features of an ERP system are core corporate activities, such as improved considerably by incorporating best practices, facilitate greater managerial control, speedy success decision making and huge reduction of business operational cost. ERP has many features distinguish it to other system where is characterized by integration of a majority of a business's processes, access data in real time, openness to internet and intranet, use RDBM, minimize redundant data registration, reduce registration errors, reduce the time to perform the different operational tasks, reduce inventories, increase efficiency and effectiveness, increase customer satisfaction, better utilization resources, accurate reports can be produced at any time, enhancement making decision, and globalization and standardization all processes.

This paper is designed taxonomy of ERP system depends on literature review relating to ERP system and attempts to gain an in depth understanding of the various CSFs, ERP implementation successes and impacts of ERP adoption. From the previous reviews, the authors proposed fifteen CSFs which affect to success of ERP system and 11 dimensions of evaluation of ERP. Furthermore every powerful work like ERP there is challenges and disadvantages try to reduce the attracting, and implementation from these are incorrect selection ERP package, incompetent implementation, inefficient usage, inflexibility, failure BPR, overload time and budget, dissatisfaction customer and not met needs of company, and lack training and consultation.

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