

# A Study of Key Critical Success Factors (CSFs) for Enterprise Resource Planning (ERP) Systems

H. Gupta, K. T. Aye, R. Balakrishnan, S. Rajagopal, Y.-Y. Nguwi  
School of Business,  
James Cook University Singapore

**Abstract**— Corporate adopt Enterprise Resource Planning System hoping to increase the efficiency and productivity of employees and ultimately increase sales revenue. However, many companies end up paying high price to implement the Enterprise Resource Planning System without benefiting from such systems. Most of these failures arise with Small and Medium Enterprises and resulted in many Small and Medium Enterprises refuse to take the initial step and invest in an Enterprise Resource Planning System. There is a lack of consolidation of literature documenting the success and failure factors behind it. This paper aims at consolidating the key critical success factors that typically govern the outcome of implementing Enterprise Resource Planning System in Small and Medium Enterprises. In this paper we attempt to relate the main critical success factors with the management decisions. Further, the critical success factors are ranked based on the importance to the success of the Enterprise Resource Planning System implementation.

**Keywords**- ERP, success factors, CSF, SME, developing countries, implementation, planning

## I. INTRODUCTION

Technology and process changes are vital parts of growing an enterprise to meet global competition. ERP is more than simply technology; it required high degree of planning, integration of data and commitment. Integrating ERP into SMEs or large scale enterprises is quite a challenge and all the organizations are facing similar issues. A case study highlighting a few CSFs carried out in Malaysia SME was published by Goni et. al.[1].

In the past few years, large, medium or small enterprises have attempted to develop, design and implement the ERP system suitable for their business. The key critical success factors (CSFs) in ERP implementation vary among large, medium and small enterprises. The relevant CSFs relate to different functions such as finance, management, availability of resources, staff levels and growth levels. The objective of this study is to present a comprehensive study that synthesizes different process models for ERP implementation phases and identifies the relevant critical success factors for subsequent evaluation.

Companies in developed countries apply and implement ERP system to regularize and improve their business stream in order to be competitive. During the implementation, they face substantial difficulties and barriers like capital limitations,

resources, poor management etc. ERP implementation for companies in developing countries is still at its infancy stage as compared to the developed countries. Part of the reason for this is that they do not see benefits to justify the costs involved.

The initial cost of implementing ERP is high and it must be accompanied with appropriate management for employees to cope with the changes. Poorly implemented ERP system in SMEs could potentially lead to slower financial growth and have adverse effect on the prosperity of a nation. To encourage companies to implement ERP system, they need to understand how ERP could contribute to their future growth and lead to a sustainable business success in long term. The differences in organizational structures, cultural activities, and revenue model add on to the complexity in implementing ERP. It was found that about 40% to 60% of ERP projects failed and it was concluded that ERP projects are considered high risk [3].

The aim of this study is to find out the CSF behind the success and failure to ERP system. This study helps to find out a well-defined system with ERP implemented to improve business success. This paper will first present relevant backgrounds that forms the foundation of the subsequent part of methodology which analyses and ranks CSFs according to their reported frequency and importance.

## II. BACKGROUND

Prior to examining the crucial CSFs, this section introduces some key terms. Although some of these terms are fundamental, their actual meanings may sometimes differ from generic understanding. These are crucial to avoid confusion that may arise prior to discussion in the subsequent sections. The following sub-sections will explain these key terms.

### A. Small and Medium Enterprises (SME)

The Organisation for Economic Co-operation and Development (OECD) defined SME as a company which employs not more than 250 employees [2]. While the upper limit for European Union is 250 employees, some countries set the limit to 200 employees. The United States considers SMEs to include firms with less than 500 employees. This upper limit varies across countries. Despite the differences in upper limit, they all agree to a common ground that SMEs play a vital role in the development of a nation. SMEs will be the local strength

and have the potential to achieve global reach. The importance of SMEs contributing to country's economy is increasing.

#### B. Enterprise Resource Planning (ERP) System in SMEs

Among the many factors that deter SMEs from implementing ERP, Wu [4] described why ERP projects are not implemented too frequently by SMEs. The three reasons for non implementation of projects are: limited resources, lack of funding and human resource. In their paper, three local SMEs that implemented an industry specific ERP system were studied. The outcome of the study is that industry specific ERP implementation has a shorter period of implementation, lower impact on organizational adaptation, and lower cost of investment.

#### C. Enterprise Resource Planning (ERP) in Developing Countries

ERP plays a vital role in organisations which are in the pursuit of expansion. The business success after implementation of ERP directly contributes to the development of the industries in a country and hence contributes to the development of the nation. However the literature related to comparison of ERP implementation, in particular for developing countries, is limited. This limitation gives rise to doubts among SMEs in developing countries to implement ERP. Huang have done an important study [12] of the implementation issues among developing and developed nations. The major drawbacks in developing countries are factors like cultural, economic and infrastructure issues. According to Zhang [5], the success rate of implementing ERP successfully is 33% and a large number of up to 90% of ERP implementations are over budget, as stated by M.H. Martin [6].

#### D. Critical Success Factors (CSFs)

To understand the resistance of ERP in developing countries and to overcome those resistances, we need to understand the relevant CSFs concerning the success of ERP. For this reason, Asemi [7] produced a detailed writing about the comparison of CSFs in implementing ERP for developing and developed nations. Before reviewing that, we would first go into the details about the CSFs for successful implementation of ERP. There are various literature and research papers explaining the different methods of compiling the CSFs. We found an interesting paper which focuses on conceptual analysis.

Since our main aim is to focus more on the management and people factor rather than limiting our research to technical aspects only, we have come up with a unique relation of CSFs with the ERP implementation strategies. Accordingly, we have categorized the CSFs into 3 main categories. Managerial factors consist of all the CSFs which relate to the management, its decision making capability and support to the organisation. It states clearly the understanding about project management, managerial ideology, organizational structure and change management techniques. Second is technical factors, which include ERP implementation time, costs and complexity, and

the availability of in-house expertise in technology [8]. Third is people factors, which consists of staff and department training, quality programs, attitude of staff towards the management and vice-versa [9]. The top CSFs we are considering according to this classification are:

Managerial Factors:

- Top Management Commitment and Support
- Change Management
- Project Champion
- BPR and Software Configuration
- Business Plan and Vision
- Effective Communication and Planning
- Post Implementation Evaluation
- Risk Management
- Focused Performance Measures
- Quality Improvement Measures
- Organizational Culture
- Implementation Cost

Technical Factors:

- Software development, crisis management
- IT Infrastructure
- Selection of ERP
- Data Conversion and Integrity
- Legacy System Considerations
- Vanilla ERP
- System Documentation

People Factors:

- User Involvement
- User Education and Training
- Personnel
- Employee Attitude
- Empower Attitude
- Empower Decision Makers

#### E. CSF of ERP in Developing Countries

There is a difference in the implementation of ERP in developing and developed countries. The key considerations are costs and resource availability. The significant costs involved discourage SMEs in developing countries from implementing ERP. This study considers developing and developed SMEs as two different categories. The basic differences in developing and developed countries are economic, cultural and infrastructure. In another analysis [11], it was pointed out that there are four key differences, lack of knowledge, cost, integration and culture. In a detailed study from Palvai [12], the main factors that affect the ERP implementation are divided into internal and external factors. These factors are:

Internal Factors:

- Management Commitment
- Manufacturing Strength
- Business Size
- Government Regulation
- Infrastructure
- Business Process Reengineering

External Factors:

- Regional environment
- Computer culture
- Economic growth
- IT Maturity

F. Phases of ERP Implementation

Majority of ERP implementations are based on mixing several phases. There are various phases defined by renowned researchers. Markus [14] proposed that the implementation of enterprise systems is made up of 4 phases. They are project chartering, the project, shakedown, and onward and upward, as depicted in Figure 1.

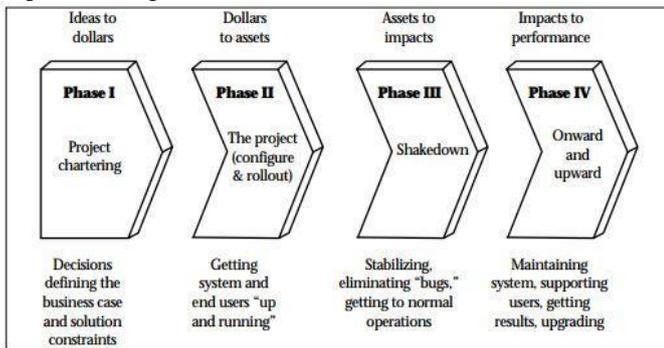


Figure 1: Phases of enterprise system[14]

Phases according to the CSFs for ERP proposed by Goni [1] in the research paper about the CSFs for ERP implementation in Malaysian context is relevant to the research we are carrying out. According to Goni, first we need to list out the CSFs. Then these CSFs are categorized into 3 main categories. First phase is termed ERP pre-implementation, second phase is ERP implementation, and third phase is ERP post-implementation. The three phases of implementation are systematic, organized and contribute to the overall success of whole ERP implementation as shown in Figure 2.

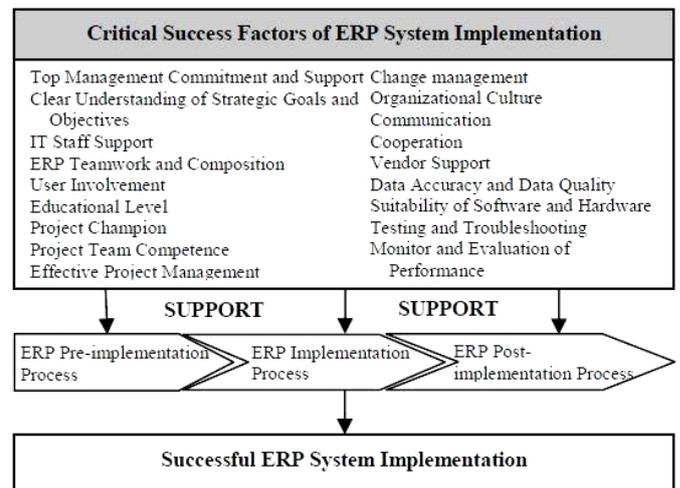


Figure 2: Successful ERP System Implementation [2]

A. Pre-Implementation Phase

This phase consists of planning and knowledge gathering including the management support. It starts with direction given by the management followed by finding the right person to handle the project, sourcing for vendors, proposing suitable products to the management, getting ERP vendors to demonstrate product, analyzing the suitability to business, and includes training for respective functional managers.

B. Implementation Phase

Implementation phase is a continuation from the pre-implementation phase. It consists of actual technical aspects of ERP implementation including integration and testing. It starts with hardware and software preparation followed by installing the ERP system, integrating the ERP system, data migration and testing, implementing training for end users and launching the ERP.

C. Post-Implementation Phase

This is the phase after implementation. This phase deals with system maintenance and support.

III. RESEARCH METHODOLOGY

This study is based upon the various CSFs proposed by various researchers around the world. The CSFs are extracted from 20 literature documents and 2 case studies analyzed by various researchers [15-24]. We made an attempt to analyze the critical factors, generalize and extract the major factors considered by all the literature. Figure 3 shows the research approach adopted in this study. First, we carefully review the various literatures and identify the important CSFs. In step 2, we consolidate the number of occurrence for each CSF appearing in different literatures. Subsequently, we identify the major CSFs and rank them according to its occurrences. Next, we establish the relationship between CSFs and ERP implementation cycle. Finally, we propose an appropriate

control matrix and framework suitable for implementation targeting at SMEs in developing countries.

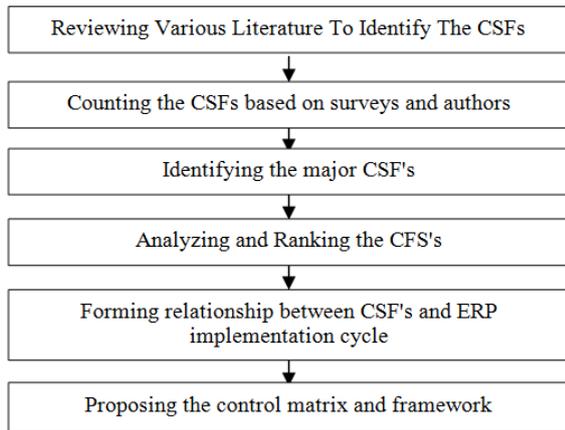


Figure 3: The Research Approach

**A. Pre-Implementation Phase**

Table I shows the list of all the CSFs that are cited in different studies [15-32] on ERP systems. There are number of researches that have been conducted throughout the world, but the research shows that the ERP implementation, especially in the SMEs in the developing countries face additional challenges.

**B. Analysis of CSFs**

There are 62 factors mentioned in the 18 research papers as shown in Table I. On analysing the number of occurrences, we identified the most critical and common factors mentioned by the authors. Each CSF can be associated with the corresponding implementation stages of the ERP and a relationship can be derived between the factor and the implementation phase.

From the analysis, we identify that the top management support, change management and project management are the highest ranked success factors. We form a model based on these three CSFs that represents their inter-relationship, as shown in Figure 4. These three major CSFs are described further in the following sub-sections.

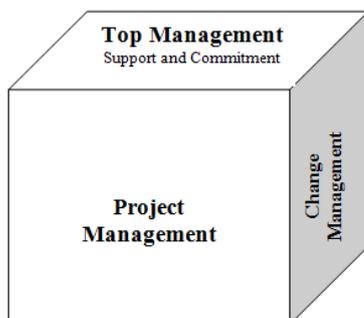


Figure 4: Top three CSFs forming inter-relationship

**1) Top Management Support.**

Top management support has been identified as the most important factor for the overall success of ERP implementation. It is necessary for the top management to have a clear vision, goal and business plan for the ERP. Top management should clearly convey the goals and benefits of the project. For instance, setting up a steering committee to communicate and engage with the project team and employees to ensure the relevant ERP project is in the right direction and scope. Top management should justify the investment of ERP system by providing the necessary resources and adequate time for the organizations to adapt to ERP system. Further, it is also crucial to align business strategy with IT strategy to have a synergy effect.

**2) Change Management.**

Change Management can be referred to anticipating the future changes [40] and effectively managing the changes. Research shows that change management is a critical factor for managing the transition in organization, user education and company culture. Company culture refers to the culture to accept changes, support changes and working towards improving through changes. Some authors have emphasised on change management to achieve sustainable competitive advantage. There is a connection between the organizational culture, change management, user involvement and education with the ERP implementation success. The organizational culture can impact the knowledge sharing which is vital during ERP implementation. Change management in an organization should not only be focusing on the training of individuals for ease of transition and acceptance, it should also be for future considerations of the overall culture of the organization. Change management is vital in all the implementation stages of the ERP in the organization.

**3) Project Management.**

An effective project management promises a successful organization through succeeded project implementation. Project management takes part in defining clear path and project scope. The project scope must be clearly defined and controlled. For instance, milestones and goals should be clearly set out, tracking of schedules should be in place, budgets and end results should be tallied to ensure a successful delivery of the project. Due to the large number of stakeholders involved in the project, it is crucial to convey the activities to everyone in the organization. Also, it is crucial for the project management to resolve any issues arising from the project and to be prepared for the unforeseen obstacles.

**IV. CONCLUSION**

The successful implementation of ERP in SMEs in the developing countries is mainly dependent on top management, change management and project management. This study has laid out the top CSFs contributing to business success. The top CSFs are top management to support and commit, change management to cope with changes related to all the aspects, and project management to lead a successful project. Further analysis will be published in another literature indicating a control matrix that maps these three CSFs into knowledge

formulation, strategy formulation and evaluation. This study forms the foundation from where the ERP implementation should be started and managed to turn the hefty costs of ERP into revenue.

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TABLE I. CONSOLIDATED TOP 30 KEY CSF

1	Critical Success Factor	L. GANESH et al [1]	M.S. ILKAY et al [2]	VEENA BANSAI [3]	MAJID AARBI et al [4]	ASHISH KR. DIXIT et al [5]	MUHAMMAD [6]	LIANG ZHANG et al [7]	FEYBARIANI GONI et al [8]	HONG SENG WOO [9]	PARUAT UPADHYAY et al [10]	SHASHANK SAINI et al [11]	ALI NOUDOOSTBENI et al [12]	M. Munir Ahmad et al [13]	Fiona Fu-Hoon Niah et al [14]	SCORTA IULIANA [15]	T.C.LOH [16]	MOOHEBAT [17]	ELISABETH J. UMBLE et al [18]	NOE GARCIA-SANCHEZ [19]	PRASAD BINGI [20]	No. of Occurrence
2	Top Management Commitment & Support	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	19
3	Project management (& evaluation)	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	15
4	Change Management Process	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	14
5	Project Team	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	13
6	Business process re-engineering (BPR) & software configuration	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	12
7	User Education & (training)	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	12
8	Data Conversion	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	11
9	Effective Communication Plan	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	11
10	Software Development & Crisis Management	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	11
11	Selection of ERP Package	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	10
12	Vendor (Service) Support	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	10
13	Business Plan Vision (goal/objective/scope)	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	9
14	Organization/Corporate Culture/Characteristics	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	9
15	Project Champion	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	9
16	Focused (monitoring & evaluation) performance Measure	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	8
17	Implementation strategy (methodology) & timeframe	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	7
18	User involvement	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	7
19	IT Infrastructure (suitability)	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	6
20	External consultant selection	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	5
21	Legacy System Consideration	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	5
22	Personnel/staff involvement	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	5
23	reasonable expectation with definite targets	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	4
24	employee attitude & (morale of implementation team)	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	4
25	empowered decision makers	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	4
26	use of committee for control purpose	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	4
27	vendor/customer relationships	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	3
28	ERP teamwork and composition	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	3
29	Implementation Cost	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	2
30	Project Monitoring	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	2