Critical Success Factors for ERP System Implementation

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Abstract. As more and more enterprises move from functional to process-based
IT infrastructure, ERP system becomes one of today's most widely used IT
solutions in many large enterprises. In spite of the widely used IT solutions,
many ERP implementations are not successful. It takes longer time and costs
more money than expected. Given the large investment that an ERP project
requires and the potential benefits it can offer if successfully implemented, it is
important to understand what is needed to ensure a successful ERP
Implementation. In this paper, we try to explore the critical success factors
(CSFs) for the implementation of an ERP system both from the management
perspective and technology perspective. Based on the lessons learnt from the
previous literature and case studies, we propose a conceptual framework for
successful implementation of an ERP system. This framework summarizes the
CSFs that need to be addressed during a whole process of ERP implementation,
i.e.: pre implementation phase, implementation phase and post-implementation
phase. Limitations and future research directions are concluded in the end.

Keywords: *Critical success factors, ERP implementation, Conceptual framework*

l. INTRODUCTION

In today's fiercely competitive business environment, there is a strong need for the
enterprises to be closer to the customer and deliver value added product and services
in the shortest possible time. In order to achieve improved efficiency and
effectiveness, more and more large enterprises move from functional to process-based
IT infrastructure. Enterprise Resource Planning (ERP) system is such a strategic tool,
which integrates information and information-based processes within and across
functional areas in an organization. In general, the benefits ERP systems offer, as
Davenport [1] notes, include not only increased decision making-speed, improved
control of operations and costs, and cost reductions, but also improved enterprise-
wide information dissemination. However, many ERP implementations are not
successful. Surveys conducted by Harvard Business School revealed that despite the
high investments in ERP systems, ERP implementations are still mired by cost and
schedule overruns, resistance to business process change, unavailability of adequate
skills, and overall underachievement relative to the expectation of benefits accruing
from ERP [2]. Given the large investment that an ERP project requires and the
potential benefits it can offer if successfully implemented, it is important to

understand what is needed to ensure a successful ERP Implementation. The objective of this paper is to develop a critical success factors (CSFs) research framework that the ERP practitioner should address during the whole process of the system implementation. Compare to previous similar study, the framework groups the CSFs from the technical and management perspectives. Moreover, the success measures and associated critical issues affecting ERP implementation during each phase of the ERP system implementation are discussed.

The rest of this paper is organized as follows: we first synthesize an ERP system implementation process model and develop a set of success measures for ERP system implementation based on previous literatures. After that, the proposed CSFs conceptual framework is developed and further explained. Finally, implications and future research directions are concluded.

2. THE ERP IMPLEMENTATION PROCESS

Previous researchers described the implementation process of the ERP system by models having three to six stages [4]. Markus and Tanis [5] developed a four-phase ERP implementation process model. The phases are chartering, project, shakedown, and onward and upward. Ross [6] presented a model using the following five stages: design, implementation, stabilization, continuous improvement and transformation. Based on these researches, we propose a 3-stage process model shown below in Fig. 1. The pre-implementation stage includes both the broader business focus of the Markus and Tanis chartering phase and the Ross design phase. More specifically, implementation strategy describes plan for change that ensures alignment with overall
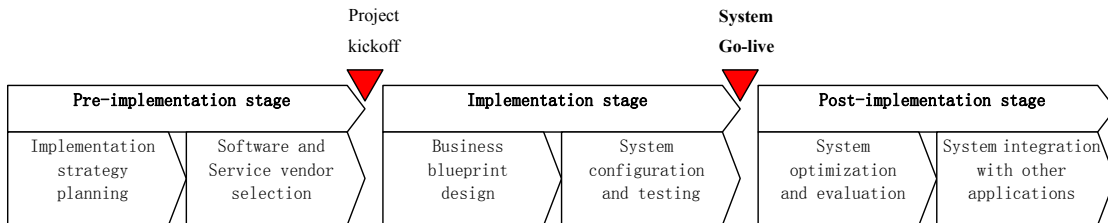

Figure 1. Synthesized Process Model for ERP Implementation

corporate strategy, and determines organizational principles and approach of implementation. While most enterprises nowadays purchasing standard ERP packages from outside ERP vendors rather than developing an ERP system in-house, software and service vendor selection become more important to ensure the perfect match between the ERP system and their specific business requirements. The second implementation stage includes business blueprint design and system configuration and testing. These are taken and extended from the Ross model. The final stage is post-implementation and includes both incremental and radical improvements to business process and technical infrastructure enabled by the implemented ERP system corresponding to the onward and upward phase of Markus and Tanner. Two stage

gates, project kickoff and system go-live, represent a distinct milestone in the ERP process. It is crucial that management conduct a review at the end of each stage to make sure everyone agrees on its outcome before moving on to the next stage.

3. SUCCESS ISSUES FOR ERP IMPLEMENTATION

3.1 Success Measures for ERP Implementation

Markus et al. [7] argue that the definition and measurement of ERP success are thorny matters and success depends on the point of view from which you measure it. Thus, there are no agreed measures on how to define ERP system implementation success. Delone and McLean [8] classified six dimensions of ISs success including system quality, information quality, Use, User satisfaction, Individual impact and Organizational impact. Zhang et al. [9] summarized seven measures from previous literature used as surrogates of ERP implementation success. These measures are user satisfaction, intended business performance improvements, Oliver White's ABCD Classification Scheme, on time, within budget, system acceptance and usage and predetermined corporate goals. In reality, IT staffs generally talk about success when the project completes within budgets, timeframe and/ or when the new system ''works''. However, in the eyes of the business managers, success is achieved when the organization is able to better perform all its business processes and when the integrated ERP system can support the performance development of the company.

From the process viewpoint, we find that the notion of "success" changes as the implementation project unfolds. Thus, we need define different success measures for each stage of the project. For the pre-implementation stage, success measures are ERP organizational readiness and competent ERP package and consultant service vendor. The former one helps the management have a thorough strategic thinking to gain better understanding of the alignments between ERP and corporate goals. The latter shows its significance in shaping the ultimate outcome of the implementation. For the implementation stage, success is mainly concerned with completion of the ERP project, to predefined technical standards, on time and within budget. For the last stage, success is more concerned with the user satisfaction and perceived contribution of the system to organizational performance. Throughout, the success should be assessed both from the information technology (IT) and general management perspectives.

3.2 Critical Success Factors for ERP Implementation

Critical success factors have been defined as "those few critical areas where things must go right for the business to flourish" [10]. They are particularly useful to practitioners as they provide clear guidance on where to focus attention and resources in planning an ERP implementation project. Most of the previous researches on

critical success factors in ERP systems implementation have developed prioritized lists of factors. Based on a review of the literature and with extensive personal interviews with ERP practitioners that culminated to the development of the three stages of ERP implementation, we group a set of the fourteen most important critical success factors for the ERP project along with the technical and management dimensions. These are shown in the table 1.

Table 1. Critical Success Factors for the ERP System Implementation

Management perspective	Technical perspective
Top management support [7,11,12]	Data accuracy and integrity [11,12]
Clear goals and objectives [11,12]	Enterprise IT infrastructure and legacy system [9]
Company wide business process reengineering(BPR) and change management [11,12,13]	Suitability of hardware and software [12]
Effective project management [12]	System reliability and flexibility [12]
Stakeholder active involvement [14]	Organizational IT skill [15]
Organizational culture [12,13]	Software and service vendor competency [12,13]
User education and training [11,13]	System perceived usefulness and learnability [15]

4. CONCEPTUAL RESEARCH FRAMEWORK

Drawing from the discussions above, we propose an integrative conceptual research framework, which is comprised of a set of theoretically important constructs. The framework has been developed based on the project life cycle approach, illustrating the critical factors that need to be addressed at all three stages: pre-implementation, implementation, and post-implementation stage. The framework is shown in figure 2.

4.1 Critical Success Factors in Pre-implementation Stage

ERP implementation has been characterized as a ''root canal'' surgery [16]. The pain is extremely unbearable during the surgery but things get better soon after the surgery. Company should first have a thorough strategic thinking and evaluate whether the organization are ready for the massive changes that would occur. Thus, factors such as clear goals and objectives, organizational culture and organizational IT skills should be more considered. On the other hand, during this stage, successful companies draw their process requirement needs and select the software packages that best fit these needs to the greatest extent possible. To increase the chance of success, two aspects should be cared when selecting software and hardware: (1) Compatibility of software/hardware and company's needs; (2) Ease of customization. By the way,

qualified ERP vendor and service consultant are also important as they can provide continuous support throughout the system lifecycle.
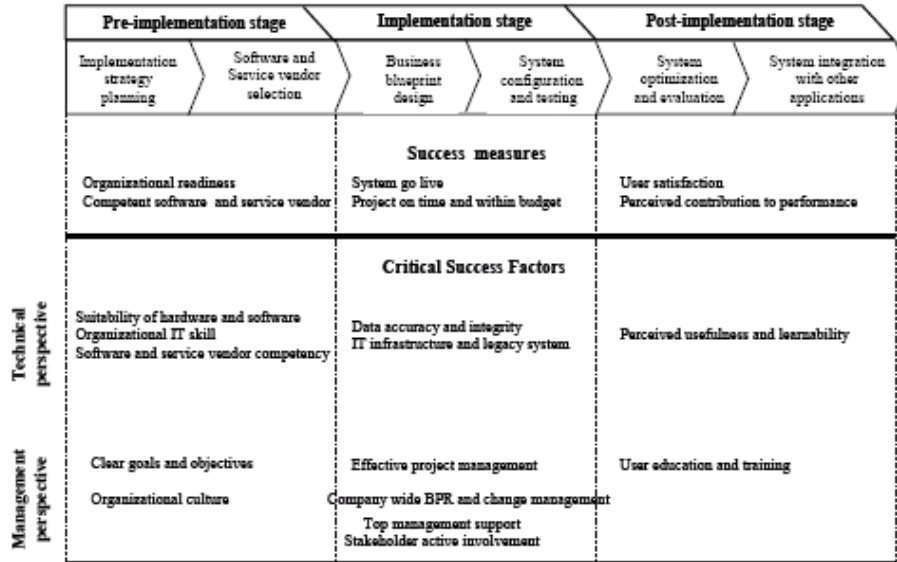
Pre-implementation stage		Implementation stage		Post-implementation stage	
Implementation strategy planning	Software and Service vendor selection	Business blueprint design	System configuration and testing	System optimization and evaluation	System integration with other applications
Success measures					
Organizational readiness Competent software and service vendor		System go live Project on time and within budget		User satisfaction Perceived contribution to performance	
Critical Success Factors					
Technical perspective: Suitability of hardware and software Organizational IT skill Software and service vendor competency		Data accuracy and integrity IT infrastructure and legacy system		Perceived usefulness and learnability	
Management perspective: Clear goals and objectives Organizational culture		Effective project management Company wide BPR and change management Top management support Stakeholder active involvement		User education and training	

Figure 2. **Conceptual Framework of ERP Implementation Success**

4.2 Critical Success Factors in Implementation Stage

Since ERP system integrates information and information based processes within and across all functional areas in an organization, ERP implementation is usually accompanied by enterprise-wide business process re-engineering. It requires that the basic business practices embedded in the ERP system be adapted to the organizational processes. Generally, one of the main obstacles facing ERP implementation is resistance to change. In this respect, careful management of changes to business processes and continued support from top management is required to overcome such resistances. On the other hand, effective project management acts as a significant condition for achieving overall success with an ERP system. By having ERP users and other stakeholder work with the implementation team from the beginning of the project, this would facilitate the implementation process and lead to speedy and successful implementation of the ERP system.

From the technical perspective, data accuracy and IT infrastructure are also two key determinants of ERP success. Since ERP system modules are intricately linked to one another, inaccurate data input into one module will adversely affect the functioning of other modules. Data must be cleansed and transferred to the ERP system to ensure no disruption to performance. ERP implementation involves a complex transition from legacy information systems to an integrated IT infrastructure.

Thus, adequate IT infrastructure, hardware and networking are crucial for an ERP system's success.

4.3 Critical Success Factors In Post-implementation Stage

Users training and education is an important factor of the successful ERP implementation as many projects fail in the end due to lack of proper training. It makes the user comfortable with the system and increases the expertise and knowledge level of the people. Features of ERP system and hands on training are all important dimensions of training program for end users. According to Calisir [15], both perceived usefulness and learnability are determinants for end-user technical acceptance with ERP systems, leading to a successful ERP implementation.

5. CONCLUSIONS

In this short paper we have developed a conceptual research framework to identify those factors that are critical to the implementation of ERP systems. Our contributions are twofold: First, relating ERP success measures and critical success factors with implementation methodologies; second, grouping critical success factors into management and technology dimensions. We believe our work would assist both practitioners and academicians. The framework presented in the study could provide practitioners with insights on how to better implement the ERP system and the critical factors that need to be focused on in each stage of implementation. Also, the critical constructs identified in the framework can be used by academicians for further empirical studies. There is a need for empirical studies to test ERP success in relationship to these factors. More over, we feel more empirical research needs to be conducted to better understand the different roles played by various stakeholders viewing success in ERP implementation.

ACKNOWLEDGEMENTS

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