# Critical Success Factors for ERP Projects

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## Abstract

Over the past decade, Enterprise Resource Planning systems (ERP) have become one of the most important developments in the corporate use of information technology. ERP implementations are usually large, complex projects, involving large groups of people and other resources, working together under considerable time pressure and facing many unforeseen developments. In order for an organization to compete in this rapidly expanding and integrated marketplace, ERP systems must be employed to ensure access to an efficient, effective, and highly reliable information infrastructure. Despite the benefits that can be achieved from a successful ERP system implementation, there is evidence of high failure in ERP implementation projects. Too frequently key development practices are ignored and early warning signs that lead to project failure are not understood. Identifying project success and failure factors and their consequences as early as possible can provide valuable clues to help project managers improve their chances of success. It is the long-range goal of our research to shed light on these factors and to provide a tool that project managers can use to help better manage their software development projects. This paper will present a review of the general background to our work; the results from the current research and conclude with a discussion of the findings thus far. The findings will include a list of 23 unique Critical Success Factors identified throughout the literature, which we believe to be essential for Project Managers. The implications of these results will be discussed along with the lessons learnt.

## 1. Introduction

The development of Enterprise Resource Planning (ERP) software packages during the past decade has turned the enterprise software market into one of the industry's hottest and most volatile segments (Davenport, 1998). ERP implementations are complex undertakings. Enterprise Resource Planning (ERP) packages have transformed the way organizations go about the process of providing information systems. Instead of crafting each new information system locally, organizations are able to install well-integrated, internationally sourced packages that seek to provide best practice from IT systems world wide (Smyth, 2001). ERP systems help to manage company wide business processes, using a common database and shared management reporting tools. ERP systems support the efficient operation of business processes by integrating business activities, including sales, marketing, manufacturing, accounting, and staffing (Brady, Monk, Wagner, 2001).

Watson and Schneider, 1999 describes an ERP system as a term for an integrated enterprise computing system (Watson and Schneider, 1999). In fact, the literature has often described ERP systems as a supply of a number of integrated applications, usually consisting of manufacturing, logistics, distribution, accounting, marketing, finance, and human resources (Binggi, Sharma and Godla, 1999; Gable, 1998). However, there are a number of challenges that are associated with the implementation of ERP systems.

First ERP systems are expensive and consequently require complex decision-making processes to purchase them. Second, ERP systems usually effect the whole organization. As such, requires a combination of technical and human expertise to select, develop and implement successfully (Ragowsky and Romm Livermore, 2002). Third, there have been many reported failures of ERP implementations. Examples include companies such as FoxMeyer Drugs, Applied Materials, Hershey, Mobil Europe, and Dow Chemicals. This introduces the question of whether ERP systems are viable (Ranganathan and Samarah, 2001; Chen 2001). For the reasons that ERP systems touch so many aspects of a company's internal and external operations, their successful deployment and use are critical to organizational performance and survival.

The objective of this paper is to describe the factors, which are critical for successful implementation of ERP systems. In order to conduct this research a review of the literature on the subject was conducted. Papers on ERP implementation projects were reviewed by focusing on implementation successes and failures of ERP projects. ERP systems have been found to have conceptual links with almost every area of information

system research (Markus and Tanis, 1999), thus the literature review on information system implementation has also been included in order to identify the relationships that link the information system project successes and failures to ERP critical success factor.

## 2. Success in Information Systems Development

The literature describes software application success as one of the most enduring research topics in the field of information Systems (DeLone and McLean, 1992). Prior researches have addressed the definition and measurement of success as a thorny matter in information system implementation. The definition of success depends on the point of view of the person who defines it. It became clear early on in the research that people often mean different things when talking about information systems or ERP success (Markus and Tanis, 1999; Esteves and Pastor 2000).

In information systems implementation research, there has been a lot of attention given to measuring "success" in implementation (DeLone and McLean, 1992, Garrity and Sanders, 1998). In fact the question of what factors are critical to information systems implementation success is an essential focus for software project managers. A study of the recent literature has shown that most of researchers have identified a set of CSFs in ERP implementation, however, only a few categorized these CSFs into respective ERP models or frameworks (Markus and Tanis, 1999; Kuang, Lau, and Nah, 2001; Esteves and Pastor, 2000; Brown and Vessey, 1999; Holland and Light, 1999; Gable et al. 2001).

A study involving seventeen recent papers, which discussed implementation issues of ERP systems, resulted in the following list of 23 CSFs. The CSFs identified in the literature include:

| Critical Success Factors | Frequency of CSF found in literature |
|---|---|
| 1. Top Management commitment and Support | 14 |
| 2. Business Process Reengineering | 14 |
| 3. Use of Project management to manage implementation | 13 |
| 4. Change Management Culture & Program | 13 |
| 5. Clear Goals, focus and scope (Business Plan and Vision) | 11 |
| 6. Selecting the right team (competence) | 10 |
| 7. Avoidance customization | 10 |
| 8. Project Champion | 9 |
| 9. User Training and Education | 9 |
| 10. Effective Communication | 9 |
| 11. Use of ERP's consultants | 8 |
| 12. Vendor package selection | 6 |
| 13. User participation | 5 |
| 14. Technical and business knowledge | 5 |
| 15. Integration of the system | 5 |
| 16. Appropriate Management expectation | 4 |
| 17. Appropriate Business & IT Legacy Systems | 3 |
| 18. Software Development, Testing & Troubleshooting | 3 |
| 19. Vendor Partnership | 3 |
| 20. Use of vendors' development tools | 3 |
| 21. Monitoring & Evaluation of Performance | 2 |
| 22. Management Structure | 2 |
| 23. Interdepartmental cooperation and communication | 2 |

**Table 1: CSFs Found in Literature Review**

Table 1 shows how often each factor was cited in the seventeen papers. Among the most common factors identified by the researchers are top management support, use of ERP's consultants, selecting the right team work,

clear goals, focus and scope, utilizing project management to manage the implementation, project champion, change management culture and program, user training and education, BPR, effective communication and avoidance

customization. Each of the CSFs identified had an impact on ERP implementations.

In the case of ERP, system success takes on a special attention as the cost and risks of these massive technology investments rival their potential pay-offs. Failures of ERP system implementation have been known to lead to organizational bankruptcy (Markus and Tanis, 1999; Davenport, 1998). There are significant overlaps between the success measures for information system and ERP systems. Most of the success measures for information system are applicable to ERP systems. However, there are still some sophisticated aspects of ERP system, which cannot be addressed effectively by information system success measures such as the tremendous difficulties in practical implementation and the transfer of embedded tacit business knowledge (Tan and Pan, 2002).

From the literature, it has been realized that companies could spend hundreds of millions of dollars and many years implementing ERP solutions in their organizations. Once an ERP system is implemented, going back is extremely difficult because it is too expensive to undo the changes ERP brings into a company. There are several failed ERP attempts, and companies lost not only the capital invested in ERP packages and millions paid to outside consultants, but also a major portion of their business. Thus, Implementing an ERP system is a careful exercise in strategic thinking, precision planning, and negotiations with departments and divisions (Bingi, Sharma and Godla, 1999). It is important for companies to be aware of certain critical issues before implementing any ERP package. Careful consideration of these factors will ensure a smooth rollout and realization of full benefits of the ERP solution.

The following two tables have been derived from the literature on ERP failure and success case studies. Table 2 summarizes some of the ERP failures, whereas table 3 summarizes some of the ERP success. These ERP project successes and failures represented in the table below are just some of the cases reported in the literature during the research period. The tables show the substantial negative implications for failing in an ERP implementation project and the different factors that were identified as the cause.

| Author | Organization | Industry | Implementation Scope | Why Failure? |
|---|---|---|---|---|
| (Okolica, 2001) | Hershey Foods Corporation | Candy | SAP $110 million | Integration of the two systems had not been tested adequately |
| (Okolica, 2001) | Whirlpool Corp | Home Appliances | SAP | Delay shipments of appliances to distributors and retailers. One major problem of Whirlpool is the coordination of technical and business expertise. Whirlpool ignored the cautionary advice from the consultant and chose to go live. |
| (Scott, 1999) | FoxMeyer Drugs | Distributor of Pharmaceuticals | SAP/ R3 $500 million | Excess Shipment resulting from incorrect order and costing the company millions of dollars. The company failed because of inadequate risk management and change management, lack of knowledgeable personnel, BPR and training and re-skilling for the employees and lack of clear goal focus and scope of the project. |
| (Nielsen, 2002) | UNSW | Higher Education Sector - Australia | PeopleSoft | Cost over runs. It was expensive for the university to take people out of normal positions. |
| (SMU 2001) | SMU | Higher Education Section - USA | PeopleSoft | Over budget because of unexpected costs that had not been budgeted for. 20 million (AUS) reportedly over budget (40 million total). First university to implement all three modules of PeopleSoft in Australia. Staff not happy with the benefits of the systems v. the cost. |

| (Martin 1998) | Dell | Computer | SAP | Lack of clear goal, focus and scope as changes needs to be able to be made quickly in ordering, manufacturing and other systems, but it cannot be done in a highly integrated system. |
| (Mearian 2000) | Petsmart | Pets and animals | SAP Retail | Hard to incorporate ERP to existing systems |
| (Pender 2000) | Siemens Power Transmission | Telecommunic ations | Baan - $12 million (US) | Lack of top management support because not enough funding to continue project. |
| (Stedman 1998) | Purina Mills | Unknown | SAP | Hired in new SAP trainers lead to the project failure because the consultants lacked background information on the business. |
| (Hirt and Swanson 2001) | A-dec Inc. | Dental Equipment Man. | Baan | Baan training is seen as too expensive |
| (Holland et al. 2001) (Stedman 1999) | Reebok | Sports equipment | SAP | ERP system failure because the system does not fit with organizational processes. |

**Table 2: ERP Failures Derived from Literature Review**

Table 2 has shown that 7 out of 11 cases of ERP failure were implemented by SAP. This is followed by two cases about PeopleSoft implementation and two cases about Baan implementation. The factors identified in the literature, which lead to ERP failure, were integration problems, lack of external consultant involvement, inadequate change management, lack of BPR and user training, lack of clear goal and scope and lack of top managements support.

| Author | Organisation | Industry | Implementation scope | Why success? |
|---|---|---|---|---|
| (Davenport 2000) | Earth grains | Bakery Products (USA) | SAP's R/3 | The project started with the clear strategy and each department had analyst reporting issues to management Change compensation system to employees after implementation. Involved interpersonal skills for training and strong knowledge on technical and the company business process. |
| Sumner (1999) | Monsanto | Chemical and life Sciences SAP | | Success factors in Mpnsanto project dealt with the management structure, the redesign of business process, and investment in re-skilling by proving training, and acquisition of external expertise. |
| (Grygo 2000) (Diehl 2000) | U.S. Mint | Coin Production | PeopleSoft - $40 million | The project started with a business requirement. Employers were able to see how everything needed to be coordinated. People received training in the use of the system and used of external consultant on the project. The Project also involved Senior management and Organisations understand that the undertaken project will be painful and expensive but expected to provide savings of $80 million over the next seven years. |

| Sumner (1999) | Ralston Purina | Manufacturing | Oracle | The CSF for Oracle project at Ralston included Strong management support, experienced technical consultants and project manager and effective user training |
|---|---|---|---|---|
| Sumner (1999) | Sigma Chemical | Chemical Industry | SAP | Support from top management, BPR, Invest in training and re-skilling and used of consultants. |
| Hewlett-Packard (2000) | Scripps Metabolic Clinic | Multi specialty medical group and clinical research institution. | Lawson ERP integrated solution on HP 9000 | Reliable vendor partnership and successful system integration |
| Harreld (2000) | Houston Independent School District | Public Sector and Education | SAP ERP modules | Project started with well plan BPR and focused on the integrating legacy system and an existing PeopleSoft Inc. Selected a right team also become part of success factor. The system already has shown a 42 percent return on investment and has lowered inventory by $1M |
| ExperienceP oint (2001) | ExperiencePoint | Manufacturers of aircraft | Not provided | The project started with the used of external consultant. Manage to get top management support and user participation. The company also provided training to the user in order to improve their understanding towards the system. |
| Sumner (1999) | Anheuser Busch | Manufacturer of Beer and related food product | SAP | Provided a cost savings based upon integration of data and processes, a common database, and increase leverage of purchasing and buying. The critical success of the implementation included used of external consultants, project champion, BPR, top management support, technical and business knowledge. |

**Table 3: ERP Successes Derived from Literature Review**

Table 3 has shown 9 cases of ERP successful implementations. 5 out of 9 cases were implemented by SAP. There were two successful cases that were implemented by external consultant. Most of the reasons that lead to ERP success were having clear goals and scope, adequate change management, user involvement, adequate training and education, strong technical and business knowledge, BPR, top managements support, used of external consultant and project champion.

The purpose of identifying the critical success factors is to specify the crucial areas in the implementation of ERP, which results in successful implementation. According to Rockart (1979, p. 83), CSFs are "the limited number of areas in which, if they are satisfactory, will ensure successful competitive performance for the organization". Implementing an ERP system needs to be prospectively managed because of the far-reaching changes ERP brings to companies (Bingi

et al., 1999). Furthermore, the difficulties and high failure rate in implementing ERP systems have been widely cited in the literature (Davenport, 1998). Thus, organizations must learn to identify the critical issues that affect the implementation process and address them effectively to ensure that the promised benefits can be realized and potential failures can be avoided.

## 3. Discussion

By looking at the total of 23 CSFs for ERP implementation, it can be concluded that CSFs of ERP implementation are quite well studied. It is also shown that all these CSFs were interrelated and changes in one of the CSFs influenced all the others, directly or indirectly. Though all the factors had an important role to play in successful ERP rollouts the degree of focus in the literature varied. For instance, good Project

Management gained eminence over say, integration of different functionalities. The most frequently discussed CSF, identified by most of the researchers (refer to table 1) was that a successful ERP implementation required top management support, because an implementation involves significant change to existing business processes as well as a significant amount of capital investment therefore gaining the required amount of support from senior management becomes paramount. The other frequently cited factors are issues related to the use of ERP consultants, this has been deemed vital to ERP projects because an ERP implementation typically requires a person with a sound knowledge of underlying business processes and the required technical skills to map new technologies and functionalities onto processes. Good consultants are however in short supply due to the lack of requisite skills and experience. The skills and competence of the project team are also a key factor influencing the success of ERP implementations because the more experienced and skilled the team the less time and money is spent on ensuring smooth rollouts with minimal errors; experienced teams also have good contingency and risk management plans for successful ERP rollouts.

Since ERP covers a wide range of functional areas, it is important for the company to have a clear goal, focus and scope prior to ERP implementation as a lack of this CSF will most likely lead to project failure, companies that do not have a clear strategic plan in regards to their businesses have high failure rate of ERP implementations (Stefanou, 1999). Project management is also one of the CSF that is focused by most of the researchers. This CSF is closely related to other CSFs such as project champion, change management culture and, program and user training & education. Hence, project management plays an important role in planning the whole project direction and to ensure that the undertaken ERP project can be implemented on time, on budget and meet the requirements of the company. An organizational culture where the employees share common values and goals and are receptive to change is most likely to succeed in ERP implementation because change agents play a major role in the implementation by facilitating change and communication, and to leverage the corporate culture. Furthermore, user training and education should be available and highly encouraged to reduce the resistance to the introduction of the new ERP system. The other important factors are the issues related to reengineering the business processes and integrating the other business applications to the ERP backbone. There is no single ERP solution that can prove to be a panacea and fulfill all the business requirements. Integrating differing software packages from various vendors always poses a challenge to the organization and requires a huge expenditure in terms of ongoing maintenance; hence, the best practice for an organization to reduce the total cost of implementation is to reduce the amount of customization.

Other CSFs include interdepartmental cooperation and communication, software development, system testing and troubleshooting, monitoring and evaluation of performance, appropriate business and IT legacy systems, technical and business knowledge, addressing management expectations, vendor Partnerships, use of vendors' development tools and vendor selection. These CSFs have not yet been fully explored by researchers and their impact on ERP rollouts not studied in depth. Somers and Nelson (2001) have purposed some other CSFs like data analysis and conversion and defining the architecture that was not discussed in this report as these two CSFs are not commonly defined and justified by other researchers. Furthermore, most of the researchers seem to have neglected the important aspect of risk management in ERP implementation as most of the research work does not consider risk management as part of a successful ERP implementation. Though it has been stated previously that some CFSs are more significant than others a proper analytical study of interrelationships of CSF dependency is yet to be made. In addition, it can be seen that factors such as senior management support and commitment to the project are not substantially different from factors that are critical to the success of most IT projects and to organizational change of other kinds. It is not clear how these studies contribute to a specific understanding of factors critical to the success of ERP projects, as distinguished from other types of projects. Therefore more effort in these areas should be a focus for future research. In short, with a better understanding of the issues involved in ERP implementations and the CSFs, management will be able to make critical decisions and allocate resources that are required to make ERP implementations a success. The following section will continue with the proposal for future research topic as a result of the issue that we discovered in this section.

## 4. Conclusion

The implementation of ERP systems in organizations is an enormously complex undertaking. It is a high-risk project that needs to be managed and planned properly because it can affect nearly every aspect of organizational performance and functioning. In this paper, we have developed a comprehensive list of CSFs that have been broadly studied in the literature. We have discussed and delimited the research object of ERP systems and implementation. To ensure success

implementation, organizations must learn how to identify the critical issues that affect the implementation process and know when in the process to address them effectively to ensure that the promised benefits can be realized and potential failures can be avoided.

As mentioned earlier, studies of CSFs are well covered in the literature. However, Robey, Ross and Boudreas (2000) claim that the factors that relate to ERP implementation success appear especially obvious and not clearly distinguishable from the outcomes of implementation success that they supposedly predict. Thus, these "findings" may be somewhat tautological. Moreover, the CSFs in these research studies are not embedded in rich conceptual or theoretical frameworks. There is little explanation for why the factors identified are critical to success (Ragowsky and Romm Livermore, 2002). Based on the comprehensive annotated bibliography of ERP research that has been conducted by Esteves and Pastor (2001a), also claims that most of the studies do not provide a precise definition of the critical success factors found and some of them are based in only one case study. Therefore, more effort should be put in the definition and subsequent validation of critical success factors.

In addition, there are not much of discussions on risk management in ERP implementation. Therefore the development of techniques and approaches for the risk management of ERP implementation projects is an area to be improved. Furthermore, most of the identified CSFs are non-industry specify, there is a confusion about whether the identified CFSs vary across industry sectors. More research need to be focused in more industry specify CSFs.

As a conclusion, the future of successful ERP implementation does not rely on further improvements of technology, but on bringing people and business up to speed on the appropriate use of ERP technology to fit their defined business needs and objectives. Thus identifying the CSFs of an ERP implementation is paramount to ensure the success of the project.

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