Towards a Unified ERP Implementation Critical Success Factors Model

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Abstract
This research in progress paper seeks to contribute to our understanding of the critical success factors of ERP implementations. It attempts to build a consensus from previous research work and to derive a unified model of critical success factors in ERP implementations. Applying grounded theory method, we identified a set of critical success factors. These critical success factors are categorized in strategic and tactical factors from organizational and technological perspectives.

Keywords: Enterprise Resource Planning, ERP, critical success factors, ERP implementations

1 Introduction

According to [Kumar and Hillegersberg 2000], Enterprise Resource Planning (ERP) systems are configurable information systems packages that integrate information and information-based processes within and across functional areas in an organization. The current generation of ERP systems also provides reference models or process templates that claim to embody the current best business practices.
During the last years, many organizations have implemented ERP systems, due to several reasons. According to [Ross and Vitale 1998] the six common motivations to ERP implementations are: need for a common platform, process improvement, data visibility, operating cost reductions, increased customer responsiveness, improved strategic decision making.

An ERP system implementation affects all areas of an organization, not just its technological infrastructure but also its business processes and the roles and skills of its employees.

Despite the benefits that can be achieved from a successful ERP system implementation, there is already evidence of failure in projects related with ERP implementations [Davenport 1998]. Too often, project managers focus on the technical and financial aspects of a project and neglect to take into account the nontechnical issues. To solve this problem, some researchers are using the critical success factor (CSF) approach to study ERP implementations.

In this paper we review previous literature on CSFs in ERP implementations and through the application of grounded theory method, we build a unified model of CSFs found. This paper describes the early results of a project whose goal is to model the critical success factors for ERP implementations. We attempt to model each CSF and the related key performance indicators (KPIs) using a formal language.

This paper is organized as follows. First, we briefly describe the research method. Next, we present a review literature of CSFs in ERP implementations and then, we describe in detail the unified model proposed. Finally, some conclusions and further work are included.

## 2 Research Method

The research method used was grounded theory method. The choice of this methodology ties in with the commitment to the process of developing emergent theory. Grounded theory is a general methodology for developing theory that is grounded in data systematically gathered and analysed. The methodology was presented initially by [Glaser and Strauss 1967].

Grounded theory differs from other qualitative approaches. Traditional qualitative approaches collect the data first before commencing the analysis and long after they have left the research site. In contrast, grounded theorists use their emerging theoretical categories to shape the data collection while doing the fieldwork. The rigour of the
grounded theory method depends upon developing the range of relevant conceptual categories, saturating those categories, to explain the data.

In this report we present the results of the first step of grounded theory, denominated open coding. This step consists on grouping and classifying concepts into categories, and defining the attributes or characteristics pertaining to a category. The research is mainly built on data gathered through specialized literature in implementation of ERP systems, and by following the discussion in books and journals. This paper presents the results of this first step of grounded theory.

Our use of the grounded theory method was composed of the following phases:

- The first phase (research design phase) had two steps. The first step was the definition of the research subject and scope. Through the analysis of articles related with ERP systems, we detected a shortage of knowledge about the implementation of ERPs in organisations. Therefore, the goal of this study was to analyse (identify and define) the CSFs of ERP implementations. The second step consisted in the collection and analysis of specialised literature.

- In phase two (data collection phase) we located a set of papers related with CSFs models that became our primary research documents.

- Phase three (data analysis phase) represents the operations where data are divided, conceptualised, and organised in new ways. We only made the open coding process.

To increase validity and reliability of the resulting unified model, the several sources of information where triangulated and inconsistencies where clarified with additional documentation (namely with documents published in the trade press).

- The last phase (comparison phase) was a comparative analysis of the resulting model with other studies related with the subject.

3 CSFs in ERP implementations

[Rockart 1979] was the first that applied the CSF approach in the information systems area. He proposed the CSF method to help CEOs specify their own information needs about issues that were critical to their organizations, so that information systems could be developed to meet those needs. According to his account, CSFs are "...the limited number of areas in which results, if they are satisfactory, will ensure successful competitive performance for the organization".
We tracked the recent academic and trade literature to find research in this field. In the trade press there are some studies of this nature based in one or two ERP implementation case studies (e.g. [Barranco 1998]). Also, some consultants have developed CSFs from their accumulated expertise (e.g. [Deloitte Consulting 1998], [Godwin 1998]). Other studies are more a set of advises where some critical factors are proposed rather than a CSFs analysis done.

We collected all the publications published in the most important conferences and journals in information systems in the last three years, categorizing them through an ERP life-cycle based framework that is structured in phases proposed by [Esteves and Pastor 1999]. Implementation phase articles where then categorized on ERP research issues (see fig. 1). Implementation success issue was analysed in 16 articles, but only 8 articles describe CSFs in ERP implementations ([Bancroft et al. 1998], [Brown and Vessey 1999], [Gibson and Mann 1997], [Holland and Light 1999], [Holland et al. 1999], [Parr et al. 1999], [Stefanou 1999], [Sumner 1999]).

![Figure 1 - Nº. of publications related with each topic of implementation phase.](image)

The studies by [Bancroft et al. 1998] provide nine CSFs derived from discussions with 20 practitioners and from studies of three multi-national corporation implementation projects.

Based in a trade and academic literature review, [Brown and Vessey 1999] defined the variables that appear to be critical to successful ERP implementations.

[Gibson and Mann 1997] analyzed the implementation phase of 9 companies and based in interviews they create a list of 6 CSFs.
[Parr et al. 1999] identified ten CSFs based in interviews with 10 senior members of multiple ERP implementation teams.

[Stefanou 1999] identified three CSFs by analyzing a large number of cases that were published during the last few years in respected periodicals or reported by leading IT and management consulting firms.

[Sumner 1999] presented four lists of CSFs, each one representing a specific case study and the related CSFs found.

The most extensive study whose subject is the definition of CSFs in ERP implementations is the Holland and Light model ([Holland and Light 1999], [Holland et al. 1999]). They conducted some case studies, across a range of industries, looking in particular at organizations implementing ERP software. Holland and Light proposed a CSF research framework based on a review of literature and the experiences of the organizations in their study. The model groups the CSFs into strategic and tactical factors.

Next section describes the different categories and the related CSFs.

4 Towards a Unified Model

We collected all the CSFs listed in the literature above and then, we determined the similarities, or patterns of communality, between them. The next step was to map them in a matrix (see Fig. 2). In our view, the nature of the ERP implementation problems includes strategic, tactical, organizational, and technological perspectives. Therefore, we propose that the CSF model should have these four perspectives. The organizational perspective is related with organizational concerns like organizational structure and culture, business processes. The technological perspective focuses on aspects related to the particular ERP product in consideration and on other related technical aspects, such as hardware and base software needs. The strategic perspective is related with core competencies accomplishing the organization's mission and long-term goals, while the tactical perspective affects the business activities with short-term objectives.

Although we have organized and structured in a matrix, we note that the several CSFs are inter-related. In our description of the CSFs we will try to clarify the relationship between them. Wherever necessary, we have provided a common name for the same concept named differently by the various authors. In the sequel, we provide a detailed description of the several CSFs, classified according to their respective perspective.
4.1 Organizational Perspective

Strategic factors:

- **Sustained management support.** Sustained management commitment, both at top and middle levels during the implementation in terms of their own involvement and the willingness to allocate valuable organizational resources [Holland et al. 1999]. Management support is important for accomplishing project goals and objectives and aligning these with strategic business goals [Sumner 1999].

- **Effective organizational change management.** Organizational change refers to the body of knowledge that is used to ensure that a complex change, like that associated with a new big information system, gets the right results, in the right timeframe, at the right costs. The change management approach will try to ensure the acceptance and readiness of the new system, allowing the organization to get the benefits of its use. A successful organizational change approach relies in a proper integration of people, process and technology.
• **Adequate project team composition.** ERP projects typically require some combination of business, information technology, vendor, and consulting support. The structure of the project team has a strong impact in the implementation process. Two important factors are the integration of third-party consultants within the team and the retention within the organization of the relevant ERP knowledge.

• **Good project scope management.** This factor is related with concerns of project goals clarification and their congruence with the organization mission and objectives. This includes both scope definition and subsequent scope control. Some components of this factor are: scope of business processes, business units involved, ERP functionality implemented, and technology to be replaced/upgraded/integrated and exchange of data.

• **Comprehensive business process re-engineering.** This is related with the alignment between the organization business processes and ERP business model and related best practices. This process will allow the improvement of the software functionality according to the organization needs. Managers have to decide if they do BPR exercise before, during or after ERP implementation.

• **Adequate project champion role.** The main reason why this person is considered to be central to successful implementations is that she/he has skills that are critical for handling organizational change [Parr et al. 1999]. The role of the project champion is very important for marketing the project throughout the organization [Sumner 1999].

• **Trust between partners.** During the implementation phase there are different partners involved such as consultants, software and hardware vendors. An adequate partnership between them will ensure the achievement of the goals defined.

• **User involvement and participation.** User participation refers to the behaviors and activities that users perform in the system implementation process and user involvement refers to a psychological state of the individual, and defined as the importance and personal relevance of a system to a user [Hartwick and Barki 1994]. User involvement and participation will result in a better fit of user requirements achieving system quality, use and acceptance.

**Tactical factors:**

• **Dedicated staff and consultants.** Usually, in many cases the time dedicated to the implementation project is shared with other activities. It is also important to ensure that the staff believes in the project success. Consultants should be involved in a way that helps the implementation process while also sharing their expertise with the staff involved. This is related with the recruitment and motivation of staff and consultants.
• **Apropriate usage of consultants.** Determining the number, how and when to use external consultants appropriate to the ERP implementation needs. The usage of external consultants will depend of the internal know-how that the organization has at the moment.

• **Empower decision makers.** Project team members must be empowered to make quick decisions due to reduce delays in implementation related with slow decision making [Parr et. al 1999]. It has been found that organisations should attempt to make decisions as rapidly as possible, as even small delays can have an impact on such a long-term project [De Bruin 1997].

• **Adequate training.** The training plan should take into consideration both technical and end-users and its scope will depend of the type of implementation approach selected. The training approach will depend of the ERP implementation strategy defined (see bellow). Some organizations use an in-house training approach while others prefer to use training consultants.

• **Strong communication inwards and outwards** Communication should be of two kinds: 'inwards' the project team and 'outwards' to the whole organization. This means not only sharing information between the project team but also communicating to the whole organization the results and the goals in each implementation stage.

• **Formalize project plan/schedule.** This implies having a well-defined plan/schedule of all the activities, with an appropriate allocation of budget and resources for these activities. Evidence shows that the majority of projects fail to finish the activities on time and within the budget constrains. To ensure the project completion according to the plan/schedule, close monitoring and controlling of time and costs should be done.

• **Reduce trouble shooting.** This factor is related to the problem and risk areas that exist in every implementation. Trouble-shooting mechanisms should be included in the implementation plan. Two important aspects are the adaptation and transfer of old data and the 'going live' moment. Both time and effort involved in transferring of data from previous systems should not be underestimated.

### 4.2 Technological Perspective

Strategic factors:

• **Avoid customization.** How much effort should be made by the ERP-hosting organization to try to adopt the processes and options built into the ERP, rather than to seek to modify the ERP to fit the business [Parr et al. 1999]. Thus, it is recommended that customization adheres to the standardized specifications that the software supports [Sumner 1999]. In this
sense, a good business vision is helpful because it reduces the effort of capturing the functionality of the ERP business model and therefore minimizes the customization effort.

- **ERP implementation strategy.** This includes management decisions concerning how the software package is to be implemented [Holland et al. 1999]. There are different approaches to ERP strategy ranging from 'skeleton' to 'big-bang' implementations [Gibson et al. 1999]. While 'skeleton' implementations are phased and provide usable functionality incrementally, 'big-bang' ones offer full functionality all at once at implementation end. The advantages and disadvantages of these extreme approaches should be measured, especially at a functionality level.

- **Adequate ERP version.** An organization needs to determine which ERP version it will implement. Frequent upgrades can cause problems. This particularly relevant when the organization has to wait for a future release that includes the functionality required [De Bruin 1997].

**Tactical factors:**

- **Software configuration.** Software configuration involves adapting the generic functionality of a package to the needs of a particular organization [Markus and Tanis 2000]. Also, there is the need to configure the interfaces according to the user's needs. Nowadays, there are some modelling tools that can help all these tasks. Before going live, validation tests should be applied.

- **Legacy systems.** Legacy systems are the business and information technology systems that encapsulate the existing business processes, organization structure, culture and information technology [Holland et al. 1999]. They are a good source of information for ERP implementations and the possible problems that can be found during the implementation. Another aspect is to decide which legacy systems will be replaced and the need to interface with that legacy systems that ERP does not provide with an adequate replacement.

**5 Conclusions and Further Work**

This study defines a unified CSFs model for ERP implementations. This model was developed through the application of grounded theory and based in a set of previous CSFs lists. The number of CSFs is large but they are divided in four perspectives: strategic and tactical perspectives, and organisational and technological perspectives.
Based in our literature review we would like to emphasize the following points:

- An important aspect is that most of the factors found can be considered "classics" since they are not specific to ERP implementations. Nonetheless, given the complexity of these projects, each factor "takes on greater significance" [Bancroft et al 1998, p. 67].

- All the authors mentioned that the organizational factors seem to be more qualitatively important than the technological ones. Therefore, ERP projects should be treated as top management project than as an information systems department project.

- It is obvious from the distribution of CSFs in Fig. 1 that also quantitatively, most of the CSFs are related to the organizational perspective.

- Two factors are relevant for all the authors, management support and organizational change.

- ERP projects are slightly different from other traditional information systems implementation projects. However, the CSFs from such information systems projects (effective project planning, effective change control, business justification or leadership) should be taken into account.

Our main contributions with the unification of CSFs lists proposed by some researchers are:

- Readers have a complete list of academic studies made in this area
- We define each CSF and not only mention it
- We have provided a common name for the same concept named differently by the various authors
- We categorize the CSFs in strategic and tactical (according to [Rockart 1979] approach), and we differentiate them according to the organizational and technological perspectives.

This study only provides the results of the open coding process from our application of the grounded theory method. The next steps will be axial and selective coding. We have not yet done these steps because the considered primary documents do not provide enough information to do. We pretend to make some case studies to validate the model we created through open coding and then proceed with the other two steps. With axial coding we hope to develop some relationships between the factors, some affecting positively and/or negatively others. Since the several factors do not necessarily have the same importance along the implementation phase, we want to distribute their relative importance along the various stages of the implementation stages.
Further research will try to define key performance indicators for each CSFs define above. Eventually, implementation project management benefits from an executive-support system build from our unified modelling of ERP implementation CSFs.

6 References


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