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TOWARDS THE UNIFICATION OF CRITICAL SUCCESS FACTORS FOR ERP IMPLEMENTATIONS

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Abstract

Despite the benefits that can be achieved from a successful ERP system implementation, there is already evidence of high failure risks in ERP implementation projects. Too often, project managers focus mainly on the technical and financial aspects of the implementation project, while neglecting or putting less effort on the nontechnical issues. Therefore, one of the major research issues in ERP systems today is the study of ERP implementation success. Some authors have shown that ERP implementation success definition and measurement depends on the points of view of the involved stakeholders. A typical approach used to define and measure ERP implementation success has been critical success factors approach.

Along this line, in this research we seek to contribute to our understanding of the critical success factors of ERP implementations and how these factors can be put into practice to help the process of project management in ERP implementations. We attempt to build a consensus from previous research and to derive a unified model of critical success factors in ERP implementations.

For this purpose we apply grounded theory as our main research method. We have collected all the relevant research material and we have coded it. To increase the validity and reliability of the study, the several information sources have been triangulated and inconsistencies have been clarified with additional documentation. This study provides the results of the open coding process from our application of the grounded theory method. After the coding step, we obtain an initial unified model of the critical success factors in ERP implementations. We then map these critical success factors in a matrix with four perspectives: organisational, technological, strategic and tactical.

1 INTRODUCTION

An Enterprise Resource Planning system (ERP) is an integrated software package composed by a set of standard functional modules (production, sales, human resources, finance, etc.) developed or integrated by the vendor, that can be adapted to the specific needs of each customer. The current generation of ERP systems also provides reference models or process templates that claim to embody the current best business practices by supporting organisational business processes.

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 factors (CSFs) approach to study ERP implementations.

This paper summarises the principal findings of a research project seeks to provide a comprehensive understanding of CSFs in ERP implementations. The first stage of the research is concerned with the unification of the CSFs proposed by some authors. Thus, the goal of this study is to unify previous research on the subject, to define and to unify concepts related with CSFs. We use the grounded theory method as the research method. We use the work of 10 research studies that identify lists of CSFs and that define them. Other works were analysed but they just present a list with lack of information on how they get the CSFs or their definition. Although these studies have separately developed lists of CSFs, we have determined similarities or patterns of communality between them.

The paper is organised as follows. First, we explain the research method used. Next, we define success and failure in ERP implementations. Then, we describe the CSFs model proposed. Finally, we give some conclusions and further work.

2 RESEARCH METHOD

We follow a qualitative research approach. This kind of research provides the understanding of a problem through research instruments that are oriented towards searching /determining/finding/analysing the facts in a temporal and geographic mark, giving significance to the context and usage. The reason to choose qualitative research is due to the fact that the main concerns of this research are organisational.

The research method used is grounded theory proposed by Glaser and Strauss (1967). The choice of this methodology ties in with the commitment to the process of developing emergent theory. This inductive approach "*generates structural patterns and hypotheses from repeated synthesis of the qualitative findings themselves, within their full organisational context - in contrast with traditional hypothesis-testing methods which seek a more contextual-neutral, formal model*" (Evans, 1997 P5). Grounded theory differs from other qualitative approaches. The rigour of the grounded theory method depends upon developing the range of relevant conceptual categories and saturating those categories, to explain the data.

The key process in grounded theory is coding. "Coding represents the operations by which data are broken down, conceptualized, and put back together in new ways. It is the central process by which theories are built from data." (Strauss and Corbin, 1990 P57). The main procedures of the methodology are open, axial and selective coding:
- Open coding: labelling concepts that represent discrete happenings and other instances of the phenomena.
- Axial coding: procedures by which data are put back together in new ways after open coding, by making connections between categories.
- Selective coding: the process of selecting the core category, systematically relating it to other categories, validating those relationships, and filling in categories that need further refinement and development.

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 10 papers related with CSFs models that became our primary research documents: Bancroft et al. (1997), Brown and Vessey (1999), Clemons (1998), De Bruin (1997), Dolmetsch et al. (1998), Gibson and Mann (1997), Holland et al. (1999), Parr et al. (1999), Stefanou (1999) and Sumner (1999).
- 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.

In this report we describe the open coding procedure. Next, we describe the concept of ERP success and failure and we present each of the concepts developed, their relationship with the data gathered, and the related categories.

3 SUCCESS AND FAILURE IN ERP IMPLEMENTATIONS

Nowadays, in the emerging ERP research area, the definition and measurement of ERP implementation success is a thorny issue. Markus and Tanis (2000) state that success means different things depending of who defines it. Thus, for instance, project managers and implementation consultants, "*often define success in terms of completing the project on time and within budget. But people whose job is to adopt ERP systems and use them to achieve business results tend to emphasise having a smooth transition to stable operations with the new system, achieving intended business improvements like inventory reductions, and gaining improved decision support capabilities*" (Markus and Tanis 2000, P2). This relative point of view for success can also be applied to failure, and people will also qualify an implementation as a failure according to their goals.

According to Markus and Tanis (2000), optimal success refers "to the best outcomes the organisation could possibly achieve with enterprise systems, given its business situation, measured against a portfolio of project, early operational, and longer term business results metrics." In this research we adopt Markus and Tanis point of view.

Pinto and Slevin (1987) defined a model of a project implementation success as $S = f(\chi_1, \chi_2, ..., \chi_n)$ where S is project success and χ_i the critical success factor i. In this work we attempt to define a model of this nature for an ERP implementation project. Thus, our first task is to define each χ_i.

4 TOWARDS A UNIFIED CSF MODEL

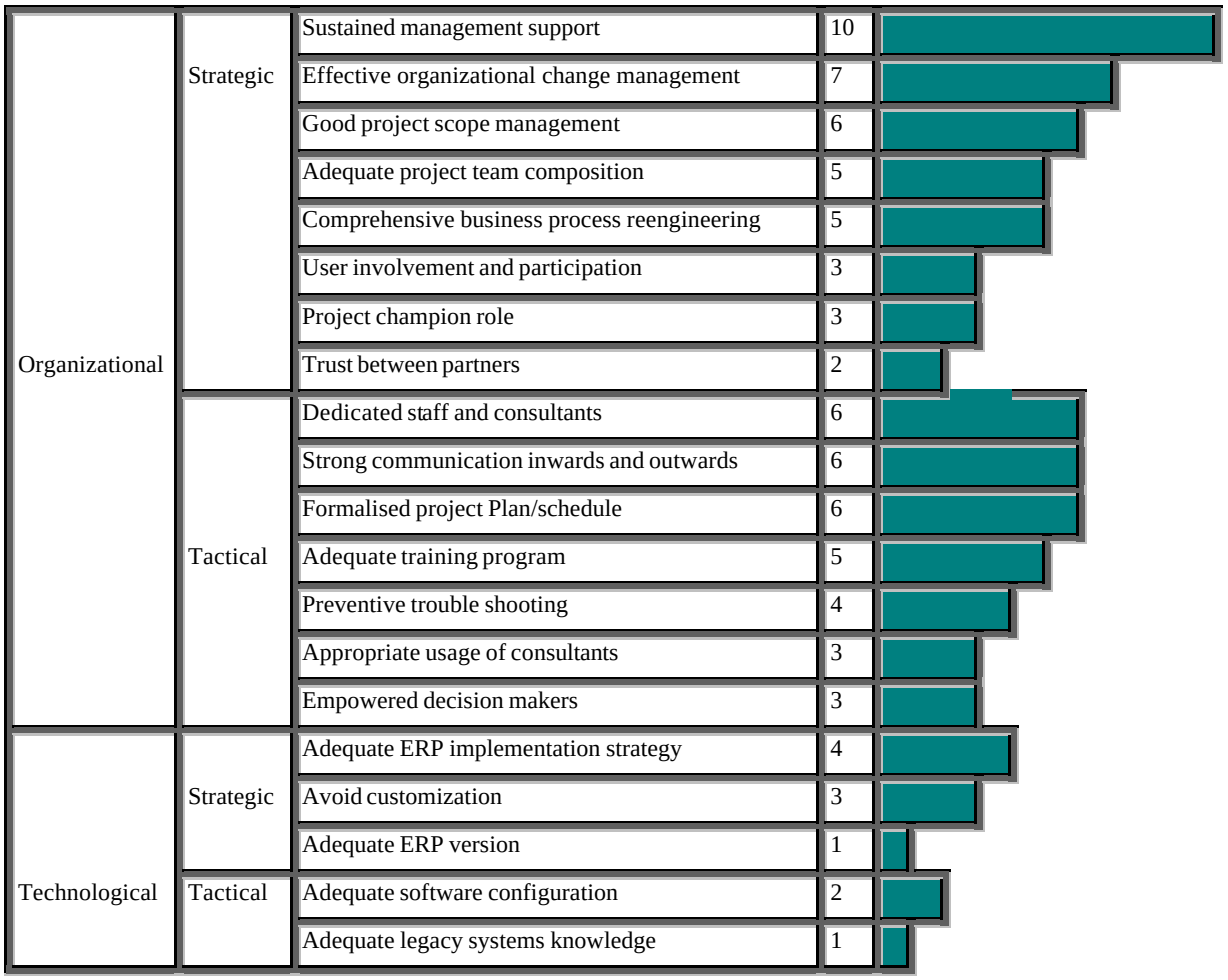
We collected all the CSFs found in the ERP literature and then, we determined the similarities or patterns of communality between them. The next step was to map them in a matrix (see Figure 1).

	Strategic	*Tactical*
Organisational	• Sustained management support • Effective organisational change management • Good project scope management • Adequate project team composition • Comprehensive business process reengineering • Adequate project champion role • User involvement and participation • Trust between partners	• Dedicated staff and consultants • Strong communication inwards and outwards • Formalised project plan/schedule • Adequate training program • Preventive trouble shooting • Appropriate usage of consultants • Empowered decision-makers
Technological	• Adequate ERP implementation strategy • Avoid customisation • Adequate ERP version	• Adequate software configuration • Legacy systems knowledge

Figure 1. Unified critical success factors model.

In our view, the nature of the ERP implementation problems includes strategic, tactical, organisational and technological perspectives. Therefore, we propose that the CSFs model should have these four perspectives. The organisational perspective is related with concerns like organisational structure and culture and, 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 organisation's mission and long-term goals, while the tactical perspective affects the business activities with short-term objectives.

The CSFs were ordered according to the number of citations in the research studies and the related perspectives (see Figure 2). This figure shows that organizational aspects are considered to be more important than technological ones. Given the cross-functional nature and large budget of a typical ERP implementation, the extent of top management support appears to be the most important factor.



Organizational	Strategic	Sustained management support	10
		Effective organizational change management	7
		Good project scope management	6
		Adequate project team composition	5
		Comprehensive business process reengineering	5
		User involvement and participation	3
		Project champion role	3
		Trust between partners	2
	Tactical	Dedicated staff and consultants	6
		Strong communication inwards and outwards	6
		Formalised project Plan/schedule	6
		Adequate training program	5
		Preventive trouble shooting	4
		Appropriate usage of consultants	3
		Empowered decision makers	3
Technological	Strategic	Adequate ERP implementation strategy	4
		Avoid customization	3
		Adequate ERP version	1
	Tactical	Adequate software configuration	2
		Adequate legacy systems knowledge	1

Figure 2. CSFs relevance by perspective

Although we have organised and structured the CSFs 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 ORGANISATIONAL 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 organisational 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 organisational change management. Organisational 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 organisation to get the benefits of its use. A successful organisational change approach relies in a proper integration of people, process and technology.

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

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 organisation of the relevant ERP knowledge.

Comprehensive business process reengineering. This is related with the alignment between business processes and the ERP business model and related best practices. This process will allow the improvement of the software functionality according to the organisation needs. Managers have to decide if they do business process reengineering 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 s/he has both the position and the skills that are critical for handle organisational change (Parr et al. 1999). The role of the project champion is very important for marketing the project throughout the organisation (Sumner, 1999).

User involvement and participation. User participation refers to the behaviours and activities that users perform in the system implementation process. User involvement refers to a psychological state of the individual, and is 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 better system quality, use and acceptance.

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

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 internal staff involved. This is related with the recruitment and motivation of staff and consultants.

Strong communication inwards and outwards. Communication should be of two kinds: 'inwards' the project team and 'outwards' to the whole organisation. This means not only sharing information between the project team but also communicating to the whole organisation the results and the goals in each implementation stage. The communication effort should be done in a regular basis during the implementation phase.

Formalised project plan/schedule. This means to have a well-defined plan/schedule for all the activities involved in the ERP implementation, 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 budget. To ensure the project completion according with the plan/schedule, close monitoring and controlling of time and costs should be done, as well as implementation project scope and plan/schedule review, whenever justified.

Adequate training program. The training plan should take into consideration both technical staff and end-users, and its scope will depend on the type of implementation approach selected (see bellow). Some organisations use an in-house training approach while others prefer using training consultants.

Preventive trouble shooting. This factor is related with 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 'go live' moment. The time and effort involved in the transfer of data from previous systems should not be underestimated.

Appropriate 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 on the internal know-how that the organisation has at the moment.

Empowered decision-makers. Project team members must be empowered to make quick decisions to reduce delays in implementation related with slow decision-making (Parr et. al, 1999). 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).

4.2 TECHNOLOGICAL PERSPECTIVE

Strategic Factors:

Adequate 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 implementation strategy ranging from 'skeleton' to 'big-bang' implementations (Gibson et al, 1997). 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.

Avoid customisation. Wherever and as far as possible, the ERP-hosting organisation should try to adopt the processes and options built into the ERP, rather than seek to modify the ERP to fit the particular business practices (Parr et al, 1999). Thus, it is recommended that customisation adheres to the standardised 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 minimises the customisation effort.

Adequate ERP version. An organisation needs to determine which ERP version it will implement. Frequent upgrades can cause problems. This is particularly relevant when the organisation has to wait for a future release that includes the functionality required (De Bruin, 1997).

Tactical Factors:

Adequate software configuration. Software configuration involves adapting the generic functionality of a package to the needs of a particular organisation (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 in all these tasks. Before going life, validation tests should be applied.

Adequate legacy systems knowledge. Legacy systems are the business and IT systems prior to the ERP that encapsulate the existing business processes, organisation 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 those legacy systems for which the ERP does not provide an adequate replacement.

5 CONCLUSIONS AND FUTURE 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.

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 P67). The analysis of the CSFs literature shows that management support is the most important factor in an ERP implementation followed by organisational change management. These CSFs have almost nothing to do with technology and almost everything to do with people and process, due to the effort that has to be undertaken by the whole organisation in a project of this nature.

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.

In the development of case studies we pretend to take into account some recent studies that categorised the different types of ERP implementations (Parr and Shank, 2000). The model developed here constitutes the basis for further research, whose goals will be to validate the model, to represent the CSFs proposed using a formal modelling language, and to develop for each CSF a set of key performance indicators that will help in using the model.

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