

An AHP Approach to Evaluate Factors Affecting ERP Implementation Success

Capaldo G., Iandoli L., Rippa P., Mercanti S., Troccoli G.

Abstract— In previous authors' researches (Capaldo et al., 2006, 2007, 2008) a model aimed at providing IT management with an effective instrument to reduce the risk of failure of implementation process was presented. The model is based on the analysis of technical and organizational issues that may affect a successful implementation process. This model will be the methodological assumption to develop a tool to plan change management activities in ERP implementation process. To overview some criticalities of the model, a survey based on Analytic Hierarchy Process was carried out. Two sets of expert were selected: academician and professional. On the basis of the results obtained, variables will be reduced and ranked in order to obtain a final set of indicators to put in the tool.

Index Terms—ERP systems implementation, ERP critical factors, AHP, Survey

I. INTRODUCTION

In previous research, authors developed a model to predicting and managing the risk in implementing ERP systems. This model has been developed and tested in collaboration with a large Italian telecommunication firm.

The model is based on two sets of critical factors affecting the successful implementation of an ERP system: technical critical factors and organizational critical factors.

Technical factors encompasses two main broad areas: customization of the system (inadequate definition of functional requirements for the customization of the systems) and legacy system analysis (underestimating the difficulties related to legacy closing, uniformity of the data transferred from old legacy systems to ERP systems, integration between ERP system and old legacy systems).

In particular, technical critical factors engage the need to: integrate all the legacy systems that cannot simply be abandoned with the new ERP system; find the appropriate level of customization for the ERP system to prevent future problems during up-dating or maintenance of the system; analyze the adaptability of pre-existing technological infrastructure to the ERP system; choose an ERP system which best conforms to the company's computer specifications.

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On the basis of the technical issues (Holland and Light, 1999; Vogt, 2002; Umble et al., 2003; Markus and Tanis, 2000; Akkermans and van Helden, 2002; Kimar et al., 2002) highlighted in the literature, indicators and variables to measure the technical implementation process were developed:

(1) Attitude to standardize the system: as stated in Nah and Delgado (2006), for an ERP implementation to be successful, the complexities of existing business legacies need to be successfully managed. Where possible, customization of the ERP system should be avoided. The more the ERP is customized, the higher IT costs, the longer the implementation time, and the higher the difficulties in upgrading the system (defining the architecture before the implementation prevents reconfiguration at later stages).

In the technical configuration of the system the firm needs to decide the level of software personalization and parameterization. The overall architecture of the ERP system must be configured by analyzing the AS IS situation, that means identifying the attitude of the firm to work with automatized process configuration as well as the level of customization in the legacy system currently used. This means that the system tends to be adjusted to the company on the basis of its specific, unique features.

In order to assess the level of standardization needed by the firm, attitude to standardize the system should be evaluated through the indicator showed in table. The higher the attitude to standardize the system, the higher the feasibility of the Big Bang strategy.

(2) Attitude to legacy closure: prospective systems should be planned based on the legacy status in the current system (O'Byrne and Wu, 2000). When the system is new (thus, in the ERP situation) this assessment is necessary. The effectiveness of the ERP implementation depends on: the number and the efficiency of legacies currently working in the firms; the integration of legacy systems and feasible substitution of current legacy systems. The higher the attitude to legacy closure, the higher the effectiveness of the target to be reached with the ERP system.

The variables aimed at measuring the attitude to legacy closure were identified on the basis of both literature review and empirical evidence highlighted in the case study. Each indicator must be low to enable the adoption of a Big Bang strategy.

Organizational critical factors are related to business process reengineering activities (delegating the responsibilities for the project to external implementers, misalignment between application software and business process, lack of

commitment on the part of top management) and change management activities (cultural resistance to change, inadequate qualifications of end-users, job rotation activities, lack of face time among team members).

In addition, the team responsible for overseeing every stage of the process needs to be carefully chosen on the basis of specific competencies and professional experience. Finally, to make sure that the adoption of the new system is successful, strong commitment is necessary on the part of top management, which should also make sure that excellent communication channels are in place.

The feasibility of organizational assessment can then be assessed using the following indicators: “degree of end users propensity to adopt the system” and “degree of business process reengineering (BPR) propensity of the firm”.

(3) Degree of end-users propensity to adopt the system: Changes related to the introduction of the new system can be hampered by the end-users’ resistance to change. (Subramanian and Hoffer, 2005). It is therefore important to test the effect of ERP implementation on users, studying

issues related to adaptation, acceptance and routinization stages.

In order to estimate if the firm has all potentiality to deal with the changes brought about by the ERP in terms of users’ acceptance in a reasonable span of time, a set of indicators (see the table) was developed on the basis of the above illustrated literature review.

(4) Degree of BPR propensity of the firms: ERP systems are process-oriented. Therefore, they can completely express their integration potential only in a process-based organization.

This indicator measures the propensity of the firm to reengineer its processes (through BPR) and adopt the rationale of the information system. Thus, before the implementation process, BPR should take place taking into account the propensity of the firm to operate according to BPR principles. Indicators to measure the BPR propensity of the firm are shown in the following figure

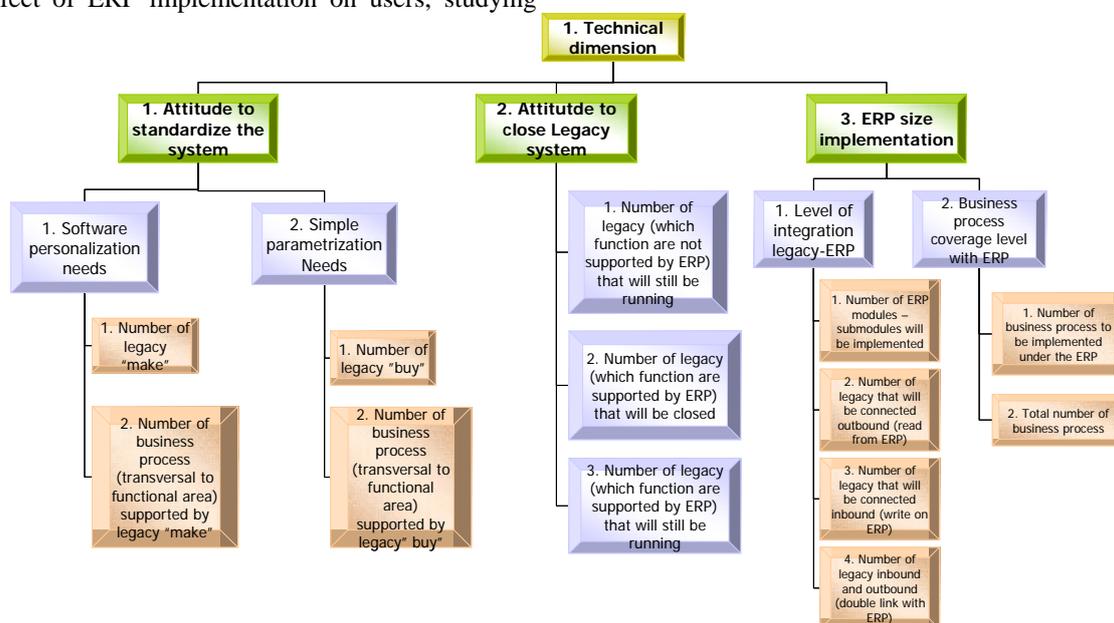


Fig. 1 - Technical issues in ERP implementation process

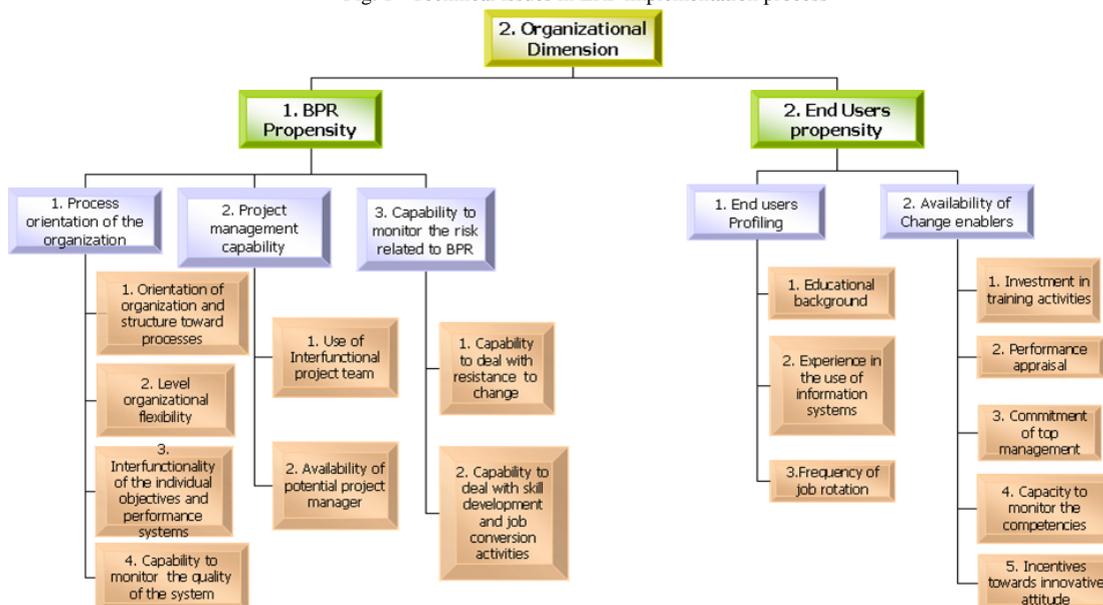


Fig. 2 - Organizational issues in ERP implementation process

I. THE AHP SURVEY

Currently, this methodology can help managers to understand the more appropriate implementation strategy. On the basis of a simulation, the methodology was tested in a big Italian telecommunication firm. The aim of the methodology is to build a tool to help IT managers in the assessment phase of the implementation process. At the end of the simulation, researchers had to face with some criticalities. First of all, the methodology was developed on the basis of a collaboration with a big Italian telecommunication firm, and this represent a first limit in term of generalization of the methodology. Secondly, the number of variables seems to be too higher, and it is necessary a reduction of these variables editing the ones that could be useless in the tool. Related to this aspect is also the chance that some variables could be correlated in some way.

In order to face with the above illustrated problems, a survey based on the AHP approached was planned and realized.

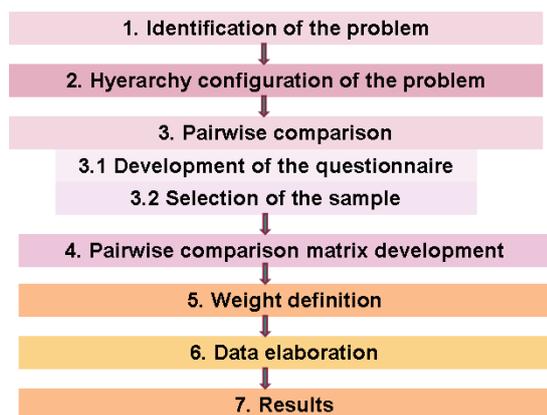


Fig. 3 - Phases of the AHP survey

The AHP enables decision-makers to structure a complex problem in the form of a simple hierarchy and to evaluate a large number of quantitative and qualitative factors in a systematic way under conflicting multiple criteria. It first structures the problem in the form of a hierarchy to capture the basic elements of a problem and then derives ratio scales to integrate the perceptions and purposes into a synthesis. In this hierarchy, the overall goal (usually the selection of the best alternative) is situated at the highest level; elements with similar features (usually evaluation criteria) are grouped at the same middle level and decision variables (usually candidates alternative) are situated at the lowest level. Then, all the elements at the same level are pair wise compared using the ratio scales 1,3,5,7 and 9 as Saaty suggested (1980). Then, for every evaluation criteria, judgements matrices are formulated. Finally, the relative weights of the criteria are estimated by calculating the eigenvalues for the judgments matrices with these relative weights aggregated and synthesized for the final measurement of given decision alternatives.

The hierarchy is represented in the table presented in the previous paragraph. The main goal is the success of the

implementation process, and the evaluation criteria are illustrated in the columns 1st to 4th. A group of expert opinion where selected in order to acquire useful information and to estimate the weight of the variables. The interviewers were experts in the academicians and professionals field. The academicians selected were researchers whom studied the ERP implementation process. Professionals were people involved in ERP implementation projects in someway.

The reason of the selection of a sample made on by academicians and professionals was due to the fact that it is different the view of the implementation process. In fact, while academicians have prevalently knowledge about ERP systems based on literature reviews and case study, professionals look at the implementation process in a more practical way, with the constraints of time and budget. In addition, the sample is constituted bay experts coming from US and Europe, because of the different view of the implementation process widely based on the size difference and IT approach in the IT implementation process.

A questionnaire to develop the AHP analysis has been sent to academicians (both from Europe and US) and professionals (both from Europe and US).

At the end, we received 8 useful questionnaires from academicians and 8 from professionals. Interviewed academicians are managed in information and innovation research activities, while professionals were all been involved in more than one implementation project.

All of them had been experience with large part of SAP modules, and some professionals were also leader of the implementation project.

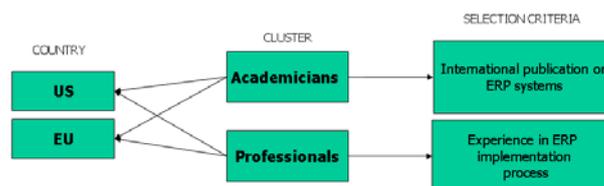


Fig. 4 - Sample of the survey

Following, first results of the survey are described. These results are based on the different perceptions about ERP implementation process between academicians and professionals.

II. RESULTS OF THE SURVEY

Results of the survey revealed a different opinion between academicians and professionals about the implementation process. In this paper, only some results will be presented. In particular, the comparisons related to the first level of the hierarchy will be illustrated.

The first level is the comparison between technical and organizational issues. Results revealed that for academicians, organizational issues are extremely more important than technical ones in the success of the implementation process.

Surprisingly, professionals disagree from academicians. In fact, based on their experiences, managers must consider in the same way both technical and organizational issues when implementing an ERP system.



Fig. 5 - Technical vs organizational issues

The second level of the hierarchy is showed in the following figure. Similarly to the previous case, professionals and academicians have different opinion about the importance of technical variables in the implementation process. The most important factor on the professionals side is the attitude to standardize the system, meaning that the firm should focalised its efforts in the adoption of the system without making any kind of customization instead that on the closure of legacy system, while for academicians, the different size of the project would have an higher impact on a successful implementation process than the attitude to standardize the system and to close legacy system.



Fig. 6 - Perceptions of technical variables

Finally, the last result present in this paper is the different expert opinion about the BPR propensity and End Users propensity. While professionals consider equally important both BPR propensity of the firm and the End Users propensity, academicians think that process orientation is much more important that the availability of well-disposed end users toward the new system.



Fig. 7 - Perceptions of organizational variables

III. FIRST IMPLICATIONS

Results of the analysis showed a significant difference in the meanings of the critical factors affecting the ERP implementation process. The first consideration is that professionals are more prudent in the management of the implementation process. In fact, first of all, they thought that organizational and technical issues are equally critical to be managed in the implementation process. From the organizational point of view, BPR propensity and End Users propensity are equally important factors to be managed in the implementation process.

Academicians opinion are consistently different from that of the professionals. In fact, in their opinion, the main problems in the implementation failures are concerned with the organizational implementation; where companies tend to underestimate the difficulties related to it and focus instead on problems concerning technical implementation.

First implication of the survey is the consciousness that AHP work very well in order to understand the different importance of the variables affecting a successful implementation process. Currently, we can delete all the variables with lower importance. Then, we can balance the different opinion of academicians and professionals, in order to have a final ranking of variable that best fit with expert opinion. Finally, after that the results of the survey will be implemented in the assessment tool, we will be able to apply it both in Europe and US, because of the balancing we made in the data analysis.

Further development of the model will be the extension of the survey to a wider sample (more academicians, more professionals, but also more European and America expert opinion).

Summarizing:

- First implication of the survey is the consciousness that AHP work very well in order to understand the different importance of the variables affecting a successful implementation process.
- Currently, we can erase some variables that seems to have a lower importance.
- Then, we can balance the different opinion of academicians and professionals, in order to have a final ranking of variable that best fit with expert opinion.
- Finally, after that the results of the survey will be implemented in the assessment tool, we will be able to apply it both in Europe and US, because of the balancing we made in the data analysis.
- Further development of the model will be the extension of the survey to a wider sample (more academicians, more professionals, but also more European and America experts opinions).

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