A methodological proposal to assess the feasibility of ERP Systems Implementation Strategies

Capaldo Guido, University Federico II of Naples, Italy, guido.capaldo@unina.it
Rippa Pierluigi, University Federico II of Naples, Italy, pierippa@unina.it

Abstract

Continuous failures in ERP systems implementation project are today the main challenge in the feasibility of integrated information systems. Failure can be determined by different factors, both from technological side and organizational side, if not well managed. In this paper, we propose a methodological approach based on technochange management in order to assess the feasibility of ERP implementation strategy and reduce the risk of failure in terms of project metrics and early operational metrics. A case study in a big Italian Telecommunication Firm will be presented.

"1. Introduction"

The recent literature [11, 12, 34, 22, 35, 14, 10, 15] has highlighted numerous cases of failure amongst companies that implemented Enterprise Resource Planning (ERP) systems.
The main problems underlying the disappointing results of ERP implementation are manifold, and they can concern not only the technical implementation (for example inadequate definition of functional requirements, underestimating the difficulties related to legacy closing, errors in the choice of ERP software, etc.), but also the organizational one (for example, lack of commitment on the part of top management, lack of involvement of end users who become, as a result, resistant to change, etc.).
Companies typically tend to underestimate the difficulties related to the organizational implementation of ERP systems, and focus instead on the problems concerning the technical implementation [3, 2, 4, 8]. Failing to take proper account of problems related to both technical and organizational phases of ERP systems implementation makes the choice of implementation strategy very risky. What is needed to a successful IT implementation process is an integrated technical and organizational solution.
In fact, if both the technical and organizational problems have not been properly identified and anticipated, they emerge once work is under way, and this can seriously affect IT Management staff who are not prepared to deal with the problems, and increase the risk of the implementation process failing.
Scientific problems in the field, which this paper aims to make a contribution, are related to the evaluation of the feasibility of strategies for ERP implementation [11, 12, 13, 14]. The literature on ERP systems suggests that companies use different strategies for implementation [36, 20]: the "Big Bang" strategy or the "Incremental" strategy. The first strategy aims to implement the system in one go, whereas the second adopts a step by step approach. The benefits to be gained through the Big Bang strategy are considerable because it allows for total integration of information systems within a short time. It needs to be remembered, however, that this kind of strategy involves low levels of technical customization as it is assumed that the organization should adapt to the characteristics of the system and not vice-versa. This is why the Big Bang strategy presents a series of risks associated with problems of technical and organizational implementation. These kinds of risks, therefore, must be carefully analyzed.
On the other hand, the incremental type strategy tends to reduce the risk percentage, because technical implementation of different modules of the ERP systems allows for a timely resolution of criticalities that may occur. Although the technical risks involved are fewer, there are also fewer benefits to be derived from adopting the system, bearing in mind the duplication of computer resources and the high costs to be sustained during the transition phase from the old to the new system.
In view of the considerations highlighted above, the methodology presented in this study aims to provide an answer to the following questions:

- On what basis can firms assess the feasibility of a Big Bang strategy?
- How can technical implementation criticalities as well as organizational ones be dealt with successfully?
- How can difficulties which potentially affect the effectiveness of the strategy be identified, analyzed and assessed?

The methodology proposed in this paper has been developed within a research project involving DIEG (Department of Business and Managerial Engineering) and SSC (Shared Service Center).

1530-1605/08 $25.00 © 2008 IEEE

SSC is a consortium no profit created by Pirelli and Telecom Group. The two groups are representative of several business sectors (tire production, real estate, fixed an mobile telecommunication, broadband) and of several countries (Pirelli operates in more than 160 countries while Telecom is active in large part of the Europe and South America).
In early 2000s, both in Telecom Group and Pirelli Group each firms – as a consequence of a top-down decision of corporate top management – adopted ERP. Each implementation process was supervised by a specific transversal area of SSC. SSC, so, reached an enormous amount of knowledge on the problems affecting ERP implementation process, in different sectors and in different countries.
The main problem was that large part of such knowledge wasn't formalized and wasn't shared in a unique methodology.
A research group made on by DIEG researchers and SSC managers worked to develop a methodological approach that would collect the knowledge accumulated by SSC managers in several ERP implementation process leaded by SSC.
The result is a methodological approach aimed at recognizing, analyzing and dealing with critical factors that may enhance the successful implementation of ERP systems. The methodology proposed was tested following a simulation approach in Telecom Italia Spa, the leader in TLC market in Italy. This simulation was validated by managers of SSC on the basis of their know-how in terms of ERP implementation process in order to understand the level of fitting between the methodological aim and SSC know-how.
The main research questions of the methodological proposal are: under which conditions a firms can choose if one strategy is better than other in terms of ERP implementation process effectiveness? How can firms analyze and recognize the main criticalities related to an ERP implementation strategy? And how can we define the success of the ERP implementation process?

"2. ERP implementation process: a theoretical framework"

Technochange management is the use of IT to drive improvements in organizational performance. Because technochange involves both IT and organizational changes, it differs both from IT projects and from organizational change programs [20]. IT project is a temporary structure led by a project manager who is expected to produce an outcome that meets stated specifications on time and within budget. IT project doesn't take into account the risks that "users" (employees, customers, suppliers, etc…) will *not use* the technology, but that they will *minuse* it (that is, use it in ways project sponsors did not expect), or they will use the technology without capturing the expected benefits.
Organizational change management consists in change methodologies that target one or more focus (human resources development and training, organizational culture, reward systems, job redesign, organizational structure, etc…). Technochange considers both IT project and organizational change management objectives. A program of change initiatives of which an IT project is one, others may include organizational or business process restructuring, change in reward systems, job redesign, training, etc… Organizational change programs evolved to address the very serious risks that people might not be motivated enough, nor be skilled enough, or not allowed their managers and organizational practices to behave in new ways.
In effective technochange, IT solutions are complemented with related organizational changes to achieve an appropriate fit between IT and the organization.

2.1 Enterprise Systems Success

"Success (or failure) of enterprise systems is not a monolithic concept. Rather, it is multidimensional and relative" [21]. It is relative, first, to the time at which it is assessed. Second, success is often judged relative to the organization's unique goals for the system.
When measuring the success of ERP systems, a balance scorecard of success metrics is the right approach to address different dimensions (financial, technical, human) at different points in time. In [20], a minimum set of success metrics includes the following:
•*Project Metrics*. Performance of the enterprise system project team against planned schedule, budget, and functional scope. These are the classic performance measures applied to project managers;
•*Early Operational Metrics*. How business operations perform in the period after the system becomes operational until "normal operation" is achieved. Specifically, these metrics include some normally used to track the business as well as some unique to enterprise systems (labor costs, time required to fill an order, customer calls unanswered, partial orders filled, orders shipped with errors, inventory levels, and so on);
•*Longer-Term Business Results*. How the organization performs at various times after normal business operation has been achieved

(return on investment, achievement of qualitative goals such as "one face to the customer," better management decision making attributable to higher-quality data, continuous improvement of business metrics after operations return to normal, maintenance of internal enterprise system competence (among both IT specialists and end users), ease of upgrading to later versions of the enterprise system software, and so on).

One of the major challenges that IT management has to face on to determine the success of the implementation process is represented by the ability to know, recognize and deal with critical factors affecting ERP implementation.

Critical success factors for ERP projects have been studied from a number of different perspective [11]. In the following section, critical factors will be analyzed by two different perspectives: problems affecting technical implementation and problems affecting organizational implementation.

2.2 Critical success factors

Knowing, recognizing and being able to deal with the critical factors that if not well managed can determine the failure of the implementation process is one of the major managerial challenges facing ICT Management.

This has encouraged researchers in various countries to analyze, through in-depth empirical studies, cases where the implementation process of ERP systems has succeeded or failed, and try to find out the role played by certain critical factors.

Pervasiveness of critical factors in al the world are evidenced in literature; the problems relating to ERP systems are referable to the following aspects:

1. *Inadequate requirements definition.* Research indicates that inadequate definition of the functional requirements accounts for 60% of implementation failure [37, 11]
2. *Legacy status and ERP customization*. The complexities of existing business legacy systems must be successfully managed. Customizing an ERP system has been associated with an increase in IT costs, a longer implementation time, and the inability to benefit from the vendor's software maintenance and upgrades [3, 11, 17, 5, 18, 23, 28, 29, 30, 33, 6].
3. *Misfit of application software with business processes.* One of the reasons why implementation of an ERP fails is because the software is not compatible with the company's business processes. It often happens that the processes are not adequately reviewed before being adapted to the software applications and this leads to a loss of time, productivity and, therefore, potential benefits of ERP [11, 33, 29, 31, 28, 5, 9].
4. *Inadequate resources.* Researches show as companies often try to save money by getting internal staff to work on the project, even if these people do not have the right skills and even if it means increasing their workload by up to 150% [7, 20].
5. *Absence of strong commitment on the part of top management.* Strong commitment on the part of top management is necessary to ensure a successful implementation project that must be considered a strategic one for the company's future [13, 35, 8, 12].
6. *Lack of clear strategy guiding redesign of processes.* The introduction of an integrated platform is a strategic choice and as such needs to be evaluated by top management. The objectives of the whole organization, as well as an inter-functional and unifying overview, need to be worked out and publicized [8, 19, 11, 28].
7. *Delegating the responsibility for the project to external implementers*. Implementation should not be handed over to external people. Help from consultants may be of value during the course of the project, but the management of it should rest firmly within the company [8, 25, 30].
8. *Resistance to change and lack of involvement on part of end-users*. Resistance to change is often the result of a lack of involvement on the end users in defining the implementation process [7, 12, 37 30, 31, 23].
9. *Inadequate qualification of end users.* One of the reasons why implementation is often unsuccessful is the lack of adequate preparation and the scant attention that is paid to staff training. The courses that are held for ERP implementation are extremely important since these are what enable the employees to learn about the new software interfaces and the processes affecting the functioning of the whole enterprise [7, 12, 37 3].

.

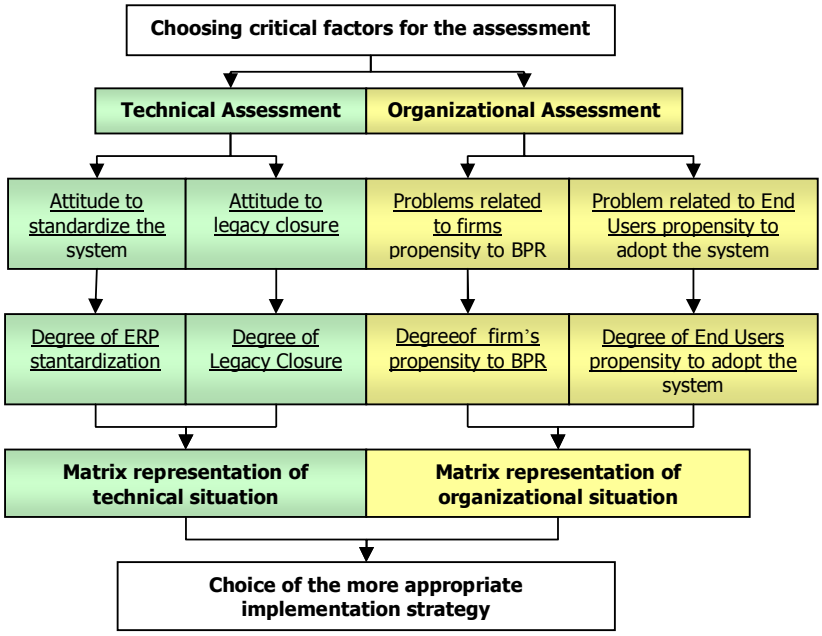


Figure 1 - Flow chart of the proposed methodology

"3 The proposed methodology"

As stated above, the methodology proposed in this paper has been developed within a research project involving DIEG (Department of Business and Managerial Engineering) and SSC (Shared Service Center).

Figure 1 shows the flow chart of the methodology. Starting from the literature quoted in the previous paragraphs, research group selected the critical factors influencing the implementation process of ERP systems, that best fit with the experience accumulated by management of SSC in the ERP implementation processes.

Factors were been divided into two main categories: technical and organizational factors (see next section). Then, the selected critical factors was been used to develop technical and organizational indicators. Positional matrices were been used to evaluate the level of feasibility of Big Bang strategy in ERP implementation process.

3.1 The methodological approach

The basic underlying hypothesis is that the Company has not yet decided to adopt the system and therefore has not yet started any kind of implementation process. The Company, however, does have an idea as to which specific ERP system to adopt and is therefore in possession of a series of information which will help to assess the feasibility (and relative costs and timescale) of the implementation as well as the organizational roll out processes.

If we consider that the company objective is that of adopting a Big Bang strategy, the methodology suggests carrying out a 360° assessment, taking account, in advance, of all the problems that might affect the success (that is, the timescale, relative costs and effectiveness) either of the implementation or the going live process. In this way the Company can work out the number, nature, complexity and objectives of any change management policies they need to adopt as regards both the technical and organizational implementation process. As a result, the Company can assess whether these policies are compatible or not with company objectives and resources.

The bottom line is that they can decide whether to adopt the system or not, fully aware of the major technical and organizational/ management implications. In this way, there is much less risk that the attractiveness of the project (which may seem very appealing in terms of potential benefits resulting in better profits and more business) does not outweigh consideration of the technical and organizational complexity involved in the implementation.

In the following section will be described the different phases of the research methodology. First of all, the way the indicators were developed starting from the literature review. Then, how the indicators can be used to assess the feasibility of the implementation strategy of an ERP system through the use of the positional matrix will be illustrated. Finally, the field study and the results obtained in the simulation test will be described.

3.2 Indicators For Assessing The ERP Implementation Process Feasibility

On the basis of the critical factors that can affect a successful implementation of an ERP system (see section 2.2), two typology of critical factors was identified: technical critical factors and organizational critical factors. Technical implementation encompasses two main broad area: 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). More in detail, technical critical factors engage the need to integrate all the legacy systems that cannot simply be abandoned with the new ERP system; finding the appropriate level of customization for the ERP system to prevent future problems during up-dating or maintenance of the system; an analysis of the adaptability of pre-existing technological infrastructure to the ERP system; the choice of an ERP system which best conforms to the company's computer specifications.

Starting from technical issues [11, 36, 35, 21, 1, 16] evidenced in literature, indicators and variables to measure the technical implementation process were developed:

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

The firm in the technical configuration of the system has to decide the level of standardization, software personalization and parameterization. The overall architecture of the ERP system must be configured analyzing the AS IS situation, that means identify the attitude of the firm to work with automatized process situation and the level of customization in legacy system currently used. What this means is that the system tends to be adapted to the company on the basis of specific, unique features of the company itself.

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 the following table. The higher the attitude to standardize the system, the higher the feasibility of the Big Bang strategy.

"Table 1 - Technical indicators: attitude to standardize the system"

1. Attitude to standardize the system	
Indicators	*Variables*
1.1 Dimension	Number of business process (transversal to functional areas) effectively supported by legacy
1.2 Customization Needs	Number of customization needs

Attitude to legacy closure: prospective systems should be planned based on the legacy status in the current system [26]. When the system is new (thus in the ERP situation) this assessment is necessary. The effectiveness of the ERP implementation depends on number and efficiency of legacy currently working in the firms, integration of legacy systems and feasible substitution of current legacy systems.

The higher the attitude to legacy closure, the higher the effectiveness of the scope to be reach with the ERP system.

The variables aimed to measure the attitude to legacy closure (see table 3) were identified on the basis of both literature review and empirical evidence highlighted in the case study. Each indicator must be low to allow a Big Bang strategy.

"Table 2 - Technical indicators: attitude to legacy closure"

2. Attitude to legacy closure	
Indicators	*Variables*
2.1 ERP Size	Number of modules and submodules that are being implemented
2.2 Legacy Systems Status	Number of legacy still running to be closed
	Number of functional areas effectively supported by legacy systems

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). What is more, 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"*.

Degree of end users propensity to adopt the system: The changes that are related to the introduction of the new system can be obstacle by the end users resistance to changes. [32] The importance 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 up by the ERP in terms of users acceptance in an acceptable length of time, a set of indicators (see table 4) was developed based on literature review previously illustrated.

"Table 3 - Organizational indicators: End User propensity"

3. End users propensity	
Indicators	*Variables*
3.1 Characteristics of end users	Academic level
	Previous experience of ERP systems
	Experience of other information systems (legacies)
	Position within company hierarchy
3.2 Presence of Change Enablers within organizational system	Staff training investment
	Job rotation
	System in place for mapping and monitoring Human Resources competences
	To what extent the system encourages the workforce to be involved in innovation process

Degree of BPR propensity of the firms: ERP systems are process oriented; therefore only in a process-based organization they can completely express their integration potentiality.

This indicator measures the propensity of the firm to reengineer its processes (through BPR) and adopt the rational of the information system. Thus, before the implementation process, BPR should take place taking into account the propensity of the firm to operate following BPR principles. Indicators to measure the BPR propensity of the firm are shown in table 5.

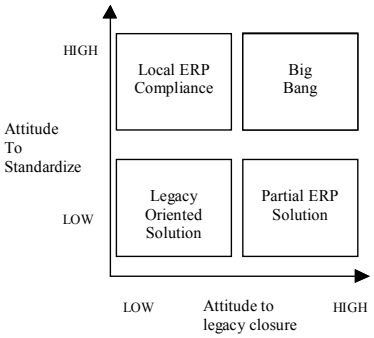
"Table 4 - Organizational indicators: BPR propensity"

4. BPR propensity	
Indicators	*Variables*
4.1 Organizational system	Business model adopted
	Effective recourse to changes to business processes
	Inter-functional orientation of system to objectives and performance
4.2 Project Management expertise	Previous experience of Project Managers in ERP implementation systems
	Competences available for project management
	Inter-functional team project
4.3 BPR experience and know-how.	Previous BPR planning and know how in planning and design BPR
4.4 Monitoring of risks linked to BPR implementation	Analysis of external limitations
	Analysis of internal limitations
	Resistance to change
	Re-conversion of individual competence profiles
4.5 Evaluation of processes	Quality systems

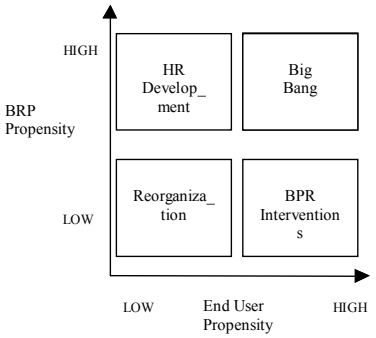
3.4 Feasibility assessment of Big Bang implementation strategy

An assessment of the feasibility of a Big Bang strategy means that values should be high for both set of technical indicators. In fact, high propensity to standardize the system means low cost and time in the configuration phase, while high level of propensity to legacy closure means low time and effort to integrate current business legacies.

On a graph (where the horizontal axis shows the attitude to standardize the system and the vertical axis the attitude to legacy closure) technical feasibility of a Big Bang strategy is represented by the upper right-hand corner (Figure 1).



"Figure 2 - Strategy positional matrix for technical assessment"



"Figure 3 - Strategy positional matrix for organizational assessment"

Big bang strategy could be chosen when some characteristics are satisfied by the firms, for example:

- legacy systems provided for every business process
- low number of legacy system functionalities not supported by an ERP system
- standardized business process

When the firm's current state presents high risk in the Big Bang strategy approach (that is when the levels of the indicators aren't high), an incremental strategy should be preferred.

In the matrix showed in figure 1, incremental strategies are represented in the following cells:

- *Legacy Oriented Solution*: reduction and rationalization of existing legacy system;
- *Partial ERP Solution*: standard implementation of some modules/sub modules;
- *Local ERP Compliance*: standard implementation of residual planned modules.

On the other side, organizational feasibility of a big bang strategy is allowed when both set of organizational indicators present high value. In fact, high degree of end user propensity allow for an effective ERP implementation with minimal effort required in training activities. At the same time, high level of BPR propensity increases the likelihood of system success.

On a graph (where the horizontal axis shows cultural resistance to change and the vertical axis the level of difficulty of BPR interventions) organizational feasibility of a Big Bang strategy is represented by the upper right-hand corner (Figure 2).

In a hypothetical scenario, the best situation to implement an ERP system with low risk of failure is represented when the following conditions are satisfied (in according with the critical success factors review presented in the third section):

- Process based organizational structure
- Availability of project managers and cross functional project team
- Vast experience in BPR projects
- Certified quality control system
- End users with a good educational background and limited experience in the use of legacy systems
- Availability of change enablers

In all other possible scenarios Change Management initiatives are necessary to pursue big bang strategy. As figure 2 shows, such incremental strategies are the following:

- *Reorganization*: Human Resources (HR) development activities and BPR interventions;
- *BPR Intervention*: redefine the organizational processes and roles and responsibilities;
- *HR Development*: competencies evaluation and recruitment of employees with IS project experiences

"4. Field analysis: a simulation"

A group made up of researchers from DIEG, SSC personnel and Human Resources management at Telecom Spa tested the methodology proposed at Telecom Italia Spa. After the experimental phase, the work group analyzed the results obtained and the significance of the indicators. This evaluation process led to a partial revision of the indicators which became the proposal presented in this thesis. The test was carried out on the SAP HR module, where the implementation of the other modules had already been done in 2002. In 2004 the company decided to implement the module for computer management of Human Resources and by using the methodology it would able them to evaluate whether it was feasible to implement the module in one go. Otherwise they would have to

implement the HR module using an incremental type system.

4.1 Data Collection And Simulation

In the context of several meetings, the research project team tries to simulate what could happen measuring the technical indicators (Attitude to standardize the system, Legacy number and efficiency) and the organizational indicators (propensity of end users and propensity to BPR). We considered an hypothetical scenario. The simulation has been realized with Human Resource Information Manager of Telecom Italia and with technical team of SSC. After the simulation, we translated the results into the Strategy evaluation matrix. In this way, we gave some possible Change Management Activities related to a specific organizational situation.

"Table 5 - Technical scenario for simulation"

Attitude to standardize the system	Attitude to legacy closure
Some business process are not supported by any informatics system	Top management planned to implement large part of the modules
The current legacies were been adopted following a standard configuration	Half of legacies currently working have function not supported by the ERP systems
Some business process are not so well structured	All functional areas are supported by legacy systems

"Table 6 - Technical indicators in the simulation scenario"

Attitude to standardize the system						
Indicators	*Variables*	*1*	*2*	*3*	*4*	*5*
Dimension	Number of business process effectively supported by legacy		X			
Customization needs	Number of current customized legacy	X				
Attitude to legacy closure						
Indicators	*variables*	*1*	*2*	*3*	*4*	*5*
ERP size	Number of modules and submodules that are being implemented				X	
Legacy systems needs	Number of legacy still running undisposed			X		
	Number of functional areas effectively supported by legacy systems					X

In the current situation, the best strategy to implement the ERP system is the Local ERP compliance strategy, that means:

- Incremental strategy from technical point of view
- Implementation of a module or a submodule, with low level of personalization
- Step by step, other modules/submodules are implemented

"Table 7 - Organizational scenario for simulation"

BPR Propensity	End Users Propensity
Organizational structure based on processes with a stable use of interfunctional teams and project managers	50% of the technicians has project management capabilities
In the last 2 years 25% of the processes changed	High level of education
System for the evaluation of individual performances and competences, also at an interfunctional level	Vast experience in the use of *legacy systems*
The organizational climate is constantly monitored (management is aware of resistance to change problems and of job conversion difficulties)	Little job rotation experience (less than 10% of employees did it)
Use of a system for the monitoring and evaluation of the quality of processes	Top Management is involved in project management
There are no incentives for innovative attitude	There is no planning for future end-users training

On the basis of the above hypothesis, degree of BPR propensity and End Users Propensity was identified (table 9).

"Table 8 - Organizational indicators in the simulation scenario"

BPR propensity						
Indicators	*Variables*	*1*	*2*	*3*	*4*	*5*
Organizational system	Organizational model adopted		X			
	Capability of changing organizational processes		X			
	Interfunctional orientation of the objectives and performance systems			X		
Project management capabilities	Use of interfunctional project team		X			
	Availability of potential project manager			X		
Capability to monitor the risk related to the BPR implementation	Capability to deal with resistance to change		X			
	Capability to deal with skill development and job conversion activities		X			
Capability to	Quality control	X				

monitor the quality of the process						
End user propensity						
Indicators	*Variables*	*1*	*2*	*3*	*4*	*5*
End users profiling	Educational background			X		
	Experience in the use of information system		X			
	Job rotation		X			
Change enablers	Investment in HR development		X			
	Evaluation of HR development		X			
	Commitment of top management			X		
	Monitoring of competences			X		
	Incentives towards innovative attitude		X			

Needed organizational intervention:

- Investments in HR development
- Constitute an executive committee to monitor the project
- Adoption of systems to evaluate the competences and the resources of the employees
- Recruitment of employees with experiences in IS projects
- Plan an incentive systems that consider the end users effective use of the ERP system

4.2 Results

In the simulation phase, technical and organizational intervention were estimated on the basis of the AS IS situation through in-depth interview with IT managers of Telecom Italia Spa and software developer of SSC. In this way, opportune technochange activities were hypothesized.

The results of the simulation show two different aspect. The first is that the methodology was a valid tool to render explicit the tacit knowledge and the expertise accumulated by SSC managers during the ERP implementation processes, since the methodology and the simulation test was carried on with the support of SSC.

Secondly, the methodology can be an useful tool to analyze which technical and organizational activities must be planned to implement an ERP systems on the basis of the current technical and organizational status of the firm.

"5. Conclusion"

As part of a research project, the methodology presented in this paper aimed to analyze under which conditions one firm is able to implement an ERP system following a Big Bang strategy. Starting from literature review, several critical factors that affect a successful ERP implementation were identified. Then, the research group composed by DIEG and SSC was able to formalize the know-how SSC accumulated during several ERP implementation process in the firms of the Groups they served. In this way, the factors that best fit with such knowledge were selected to develop a methodological approach to evaluate the feasibility of ERP implementation process.

At the current stage, the methodology has been tested through a simulation experiment. An hypothetical organizational scenario was used to understand how the methodology is able to explain which factors can influence the choice of the more appropriate strategy.

First results allow us to say that the methodology is useful in the assessment stage in order to understand the feasibility of a Big Bang strategy. On the basis of the results of the indicators, specific ERP project planning can be defined in order to increase the chance of success.

5.1 Limits and future development

Research group is conscious of the limits of the methodology. Since it wasn't yet tested in a real application, current limits are the following:

- it has not been evaluated the correlation among the technical and organizational indicators.
- could be useful to weight all the variables on the basis of the impact that each variable could have on the implementation process.

In this way, future development concern;

- the simulation of the whole hypothetical organizational scenarios;
- the identification of opportune technochange activities related to each different scenario
- a survey on all the firms of Telecom Group to asses the AS IS situation (before the ERP implementation) and compare it with the TO BE situation (after the ERP go live);
- definition of the range of the indicators using fuzzy set logic;
- development of a consultancy service for the implementation of ERP systems;
- the identification of performance metrics to evaluate the economic impact of the implementation process.

"References "

[1] Akkermans, H., and van Helden, K. "Vicious and virtuous cycles in ERP implementation: a case study of interrelations between critical success factors", *European Journal of Information Systems,* (11), 2002, pp. 35-46.

[2] Aladwani, A.M. "Change management strategies for successful ERP implementation", *Business Process Management Journal,* (7:3), 2001, pp. 266-275.

[3] Al-Mashari, M., and Zairi, M. "The effective application of SAP R/3: a proposed model of best practice", *Logistic Information Management*, (13: 3), 2000, pp. 156-166.

[4]Askenas, L., and Westelius, A., "Five Roles of an Information System: A Social Constructionist Approach to Analysing the Use of ERP System", Informing Science, (Vol 6), 2003, pp. 209-220.
[5] Bajwa, D.S., Garcia, J.E., Mooney, T. "An integrative framework for the assimilation of Enterprise Resource Planning Systems: phases, antecedents, and outcomes, *Journal of Computer Information Systems*, 44:3, 2004, pp. 81-90.
[6] Bingi, P., Sharma, M.K., Godla, J. "Critical issues affecting an ERP implementation", *Information Systems Management*, 16:2, 1999, pp.7-14.
[7] Calisir, F., and Calisir, F. "The relation of interface usability characteristics, perceived usefulness, and perceived ease of use to end-user satisfaction with ERP systems", *Computers in Human Behavior,* (20), 2004. pp. 505-515.
[8] El Amrani, R., Rowe, F., Geffroy-Maronnat, B. "The effects of ERP implementation strategy on cross-functionality", *Info System Journal,* (16), 2006, 79-104.
[9] Fallowski G., Pedigo P., Smith B., Swanson D. "A recipe for ERP success", *Beyond Computing*, Semptember, 1998, pp. 44-45.
[10]Grant, D., Hall, R., Wailes, N., Wright, C. "The false promise of technological determinism: the case of ERP systems", New Technology, Work and Employment, (21:1), 2006, pp.2-15.
[11] Holland, C., and Light, B. "A critical success factors model for ERP implementation", *IEEE Software,* May/June, 1999.
[12] Hong, K.-K., and Kim, Y.-G., "The critical success factors for ERP implementation: an organizational fit perspective", *Information & Management*, (40), 2002, pp. 25-40.
[13] Ioannou, G., and Papadoyannis, C. "Theory of constraints-based methodology for effective ERP implementation", *International Journal of Production Research,* (42:23), 2004, pp. 4927-4954.
[14] Kim, Y., Lee, Z., Gosain, S. "Impediments to successful ERP implementation process", *Business Process Management Journal,* (11: 2), 2005, 158-170.
[15] King, R.W. *Ensuring ERP implementation success*, Information Systems Management, summer 2005.
[16] Kumar, V., Maheshwari, B., Kumar, U. "ERP system adoption process: a survey of Canadian organizations", *International Journal of Production Research,* 40, 2002, pp. 509-523.
[17] Lee, J., Siau, K., Hong, S. "Enterprise integration with ERP and EAI", *Communication of the ACM*, 46:2, 2003, pp. 54-60.
[18] Light, B. "The maintenance implications of customization of ERP software", *Journal of Software Maintenance and Evolution: Research and Practice*, 13, 2001, pp. 415-429.
[19] Mandal, P., and Gunasekaran, A. "Issues in implementing ERP: a case study", *European Journal of Operational Research,* (146), 2003, 274-283.
[20] Markus, M.L. "Technochange management: using IT to drive organizational change", *Journal of Information Technology,* (19), 2004, pp.4-20.
[21] Markus, M.L., and Tanis, C. "The enterprise system experience – From adoption to success", in *Framing the domains of IT research: glimpsing the future through the past*, R.W. Zmud (eds.), Cincinnati, OH: Pinnaflex Educational Resources, Inc., 2000, pp. 173-207.
[22] Motwani, J., Mirchandani, D., Madan, M., Gunasekaran, A. "Successful implementation of ERP projects: evidence from two case studies", *International Journal Production Economics,* (75), 2002, 83-96.
[23] Murray, M., Coffin, G. "A case study analysis of factors for success in ERP system implementations", *Proceedings of the Seventh Americas Conference on Information Systems*, Boston, Massachusetts, 2001, pp. 1012-1018.
[24] Nah, F.F.-H., Delgado, S. "Critical success factors for enterprise resource planning implementation and upgrade", *Journal of Computer Information Systems*, Special Issue, 2006.
[25] Nah, F.F.H., Lau, J.L.S., Kuang, J. "Critical Factors for successful implementation of enterprise systems", *Business Process Management Journal*, (Vol. 7, n.3), 2001, pp. 285-296.
[26] O'Byrne, P., Wu, B., "LACE frameworks and technique – identifying the legacy status of an information system from the perspective of its causes and effects", *Proceedings of the 34th Hawaii International Conference on System Sciences*, 2000
[27] Raymond, L., Rivard, S., Jutras. D. "Evaluating readiness for ERP adoption in manufacturing SMEs", *International Journal of Enterprise Information Systems*, vol.2, issue 4, 2006.
[28] Rosario, J.G. "On the leading edge: critical success factors in ERP implementation projects", *Business World* (Philippines), May 17, 2000, p. 27.
[29] Shanks, G. "A model of ERP project implementation", *Journal of Information Technology*, (Vol. 15, Number 4 / December 1), 2000, pp. 289-303.
[30] Somers, T.M., and Nelson, K.G. "A taxonomy of players and activities across the ERP project life cycle", *Information & Management*, (41), 2004, pp. 257-278.
[31] Somers, T.M., and Nelson, K.G. "The impact of strategy and integration mechanism on enterprise system value: empirical evidence from manufacturing firms" *European Journal of Operational Research,* (146), 2003, pp. 315-338.
[32] Subramanian, G. H., Hoffer, C.S. "An exploratory case study of Enterprise Resource Planning implementation", *International Journal of Enterprise Information Systems*, vol.1, no. 1, 2005.
[33] Sumner, M. "Critical success factors in enterprise wide information management systems projects", *Proceedings of the Americas Conference on Information Systems*, Milwaukee, Wisconsin, 1999, pp. 232-234.
[34] Themistocleous, M., Irani, Z., O'Keefe, R. "ERP and application integration", *Business Process Management Journal,* (7:3), 2001, pp. 195-204.
[35] Umble, E.J., Haft, R.R., Umble, M.M. "ERP: Implementation procedures and critical success factors", *European Journal of Operational Research,* (146), 2003, 241-257.
[36] Vogt, C. "Intractable ERP. A comprehensive analysis of failed ERP projects", *Software Engineering Notes,* March, 62-68, 2002, pp. 62-68.
[37] Wee, S. "Juggling toward ERP success: keep key success factors high", *ERP News*, February, 2000.