RISK MANAGEMENT; Risk Assessment in Enterprise Resource Planning Projects

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A B S T R A C T

Objective: Numerous risk factors have to be taken into account which includes technological and managerial aspects, both psychological and sociological; moreover, they can be deeply interconnected and have indirect effects on the project. Therefore, the risk management process is highly difficult and uncertain. **Methodology:** This article focuses on the Risk Assessment phase which is the central of the risk management process. In particular, the main purpose is to provide managers with new and old techniques, adapted to the ERP case, which can be used in an innovative approach for the context analysis and risk assessment in ERP projects. **Results:** This article presented a proposal for specific methodologies regarding the context analysis and the risk assessment phase in ERP project risk management. **Conclusion:** This proposal of a panel of attributes useful for studying the identified risk factors and a ISM-based technique for the analysis of interdependencies among risk factors and between risk factors and effects in the risk analysis phase.

1. Introduction

In recent years Enterprise Resource Planning (ERP) systems have received much attention. ERP are extremely complex information systems; whose implementation is often a complex adventure for business enterprises. The organizational relevance and risk of ERP projects make it important for organizations to focus on ways to make ERP implementation successful. However, dealing with risk management in ERP project introduction is an ambitious task. Numerous risk factors have to be taken into account which includes technological and managerial aspects, both psychological and sociological; moreover, they can be deeply interconnected and have indirect effects on the project. Therefore, the risk management process is highly difficult and uncertain (O'Leary, 2000; Hitt et al., 2002; Markus et al., 2000).

2. Materials and methods

The principle reason for managing risk in an organization is to protect the mission and the assets of the organization. Therefore, the risk management is a management function rather than a technical function. Managing risks to systems is of vital importance. Understanding risk, and in particular, understanding the specific risk of a system allows the owner to protect the information system commensurate with its value to the organization. The fact is that all the organizations have limited resources and risk can never be reduced to zero. So, understanding risk, especially the magnitude of the risk, allows organizations to prioritize scarce resources (Chapman, & Ward, 2003). This view of the relationship of Risk Management to Risk Assessment is depicted in (Figure 1) Even if organizations tend to use a single method for Risk Management; multiple methods have typically been used in parallel for Risk assessment. (Dai et al., 2002). This happens because different Risk Assessment methods might be necessary, depending on the nature of the assessed system (e.g. structure, criticality, complexity, importance, etc.).
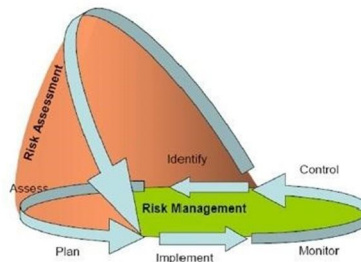
Figure 1: The relationship of Risk Management to Risk Assessment

Methodologies and techniques for risk assessment usually aim to provide:

- a more confident and rigorous basis for decision-making and planning;
- a better identification of opportunities and threats;
- a pro-active rather than re-active management;
- a more effective allocation and use of resources;
- Better corporate governance.

3. Discussion and results

3.1. Risk Assessment

Risk assessment is the central phase of the risk management process. This phase allows us to understand the nature of risk in terms of which factors could impact on project success, the interactions, their probability of occurrence, detection difficulty and potential impact on the project, in order to quantify their risky and prioritize them. It consists of two principal issues (Figure 2): 1. Risk Identification and 2. Risk Quantification (Barki et al., 1993). These processes interact each other and with the other projects in the general framework; although they are here presented as discrete elements with well-defined interfaces, in practice they may overlap. Risk assessment is a complex undertaking, usually based on imperfect information. There are many methodologies aimed at allowing risk assessment to be repeatable and give consistent results (Henley, & Kumamoto, 1981).
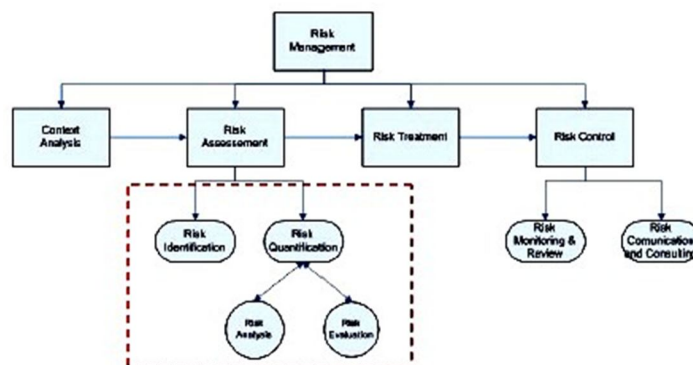

Figure 2: Risk Assessment Phase

3.2. Risk Identification

Common Risk Management approaches emphasize the need of identifying "risks" early in the process. Chapman and Ward (2003) assert that a key deliverable for an effective risk management is a clear, common understanding of the sources of uncertainty facing the project and what can be done about them (Chapman, & Ward, 2003). The real sources of risk are the un-identified ones, so that the identification phase can be considered as an initial risk response action. Comprehensive identification using a well-structured systematic process is critical for the RMP, because a risk not identified at this stage may be excluded from further analysis. Identifying issues involves two specific tasks (Tchankova, 2002):

- *Search*: for sources (and then responses), employing a range of techniques;
- *Classify*: to provide a suitable structure for defining sources (and then responses), aggregating or disaggregating particular issues as appropriate.

The identification phase involves the production of a list or register of sources. The identification of sources, effects and responses can be assessed in a variety of ways, by individual activity or involving other people, in order to stimulate imaginative thinking and draw on the experiences of different

individuals. The approach depends on the nature of the activities under review, types of risk, the organizational context and the purpose of the analysis. The idea is to structure formal procedures to systematically capture personal experience, so that group processes where a wide range of personnel are sought is particularly desirable in order to provide this comprehensive view and pooling the experiences. These techniques include: interviewing individuals, interviewing groups or group processes such as brainstorming and decision conferencing, based on experience and records, flow charts, brainstorming, systems analysis, scenario analysis and systems engineering techniques (diagrams, cause-effects diagrams, event or fault trees, Quality Function Deployment QFD), checklists, judgments. In Table 1 the typical risks of a project are reported according to PLC stages.

Table 1: Sources of risk in each stage of the project life cycle (PLC), Source: (Chapman & Ward, 2003)

Stage	Uncertainly management issues
Conceive the product	Level of definition
	Definition of appropriate performance objectives Managing stakeholder expectation
Design the product strategically	Novelty of design and technology Determining 'fixed' points in the design
	Control of changes
Plan the execution strategically	Identifying and allowing for regulatory constraints
	Concurrency of activities required
	Capturing dependency relationships
	Errors and omissions
Allocate resources tactically	Adequate accuracy of resource estimates
	Estimating resources required
	Defining responsibilities (number and scope of contracts)
	Defining contractual terms and conditions
	Selection of capable participants (tendering procedures and bid selection)
Execute production	Exercising adequate co-ordination and control
	Determining the level and scope of control systems
	Ensuring effective communication between participants
	Provision of appropriate organizational arrangements
	Ensuring effective leadership
	Ensuring continuity in personnel and responsibilities
	Responding effectively to sources that are realized
Deliver the product	Adequate testing
	Adequate training
	Managing stakeholder expectations
	Obtaining licenses to operate
Review the process	Capturing corporate knowledge
	Learning key lessons
	Understanding what success means
Support the product	Provision of appropriate organization arrangements
	Identifying extent of liabilities
	Managing stakeholder expectations

### 3.2.1. Identification tools and technique: literature review

A number of interesting techniques and tools supporting the identification of the issues exist in literature. Experts in their own domain have intuitive methods of recognizing a situation of risk. As such, the identification tools presented in this section are more general in nature and need a collaborative approach so that all aspects of the project are examined for risk situations. Checklist approaches, as well influence diagrams, cause-effects diagrams, event or fault trees, can be very effective in focusing the attention of managers but strongly caution against over-reliance on checklists and similar approaches to drive the identification of sources and responses. What follows is a review of potential techniques provided by Ahmed et al. (2007).

3.2.2. Identification Risk Factors in ERP Project

The identified factors are an useful guide for a more complete identification process which should be developed ad hoc for each ERP project. The output has to be considered as an input to the next indispensable steps of risk analysis and evaluation (in the quantification phases) in the general RMP. The first approach can be assisted by guidelines which categorize risks in different project dimensions, such as project life cycle (plan and timetable), project players (both internal and external parties), project objectives and motives, resources, changes in processes and organization structure, which can stimulate and drive managers during the process. The second approach instead, needs to start from an overall definition of what project success means in complex

projects like the ERP introduction. We mixed both the approaches. First of all, a number of key articles discussing and analyzing the ERP implementation process were collected and analyzed. The different approaches taken in the literature were compared from a risk management point of view to highlight the key risk factors and their impact on project success. Literature was further classified in order to address and analyze each risk factor and its relevance during the stages of the ERP project life cycle. The current state of the art in the ERP field is discussed (Aloini et al., 2008) presenting an extended literature review responding to the need of risk identification and focusing on the classification and the taxonomy of the principal risk factors and effects.

Then, effects were identified and risk factors analyzed starting from the Lyytinen and Hirschheim's (1988) classification of project failures, literature evidences and semi-structured interviews to practitioners, so that an overall framework, enumerating risk factors, effects and macro effects, was drawn. Within this purpose, the first aim was to understand what project success or failure meant in this kind of project. Adopting the Lyytinen and Hirschheim's (1987) definition of "failure" and "success" of IT projects, which suggested a first classification of IT failure, we identified 10 main classes of risk effect on a ERP introduction project. Macro classes from Lyytinen and Hirschheim (1988) are: (a) Process failure, when an IT project is not completed within time and budget. (b) Expectation failure, where IT systems do not match the user expectations. (c) Interaction failure, when user attitudes towards IT are negative. (d) Correspondence failure, where there is not a match between IT systems and the specific planned objectives. This classification leads to suggest 10 risk effects and 19 risk factors usually happening in ERP projects, as shown in Figure3.

Figure 3: Risk factors, effects and effects macro-classes, Source: (Aloini et al., 2008)
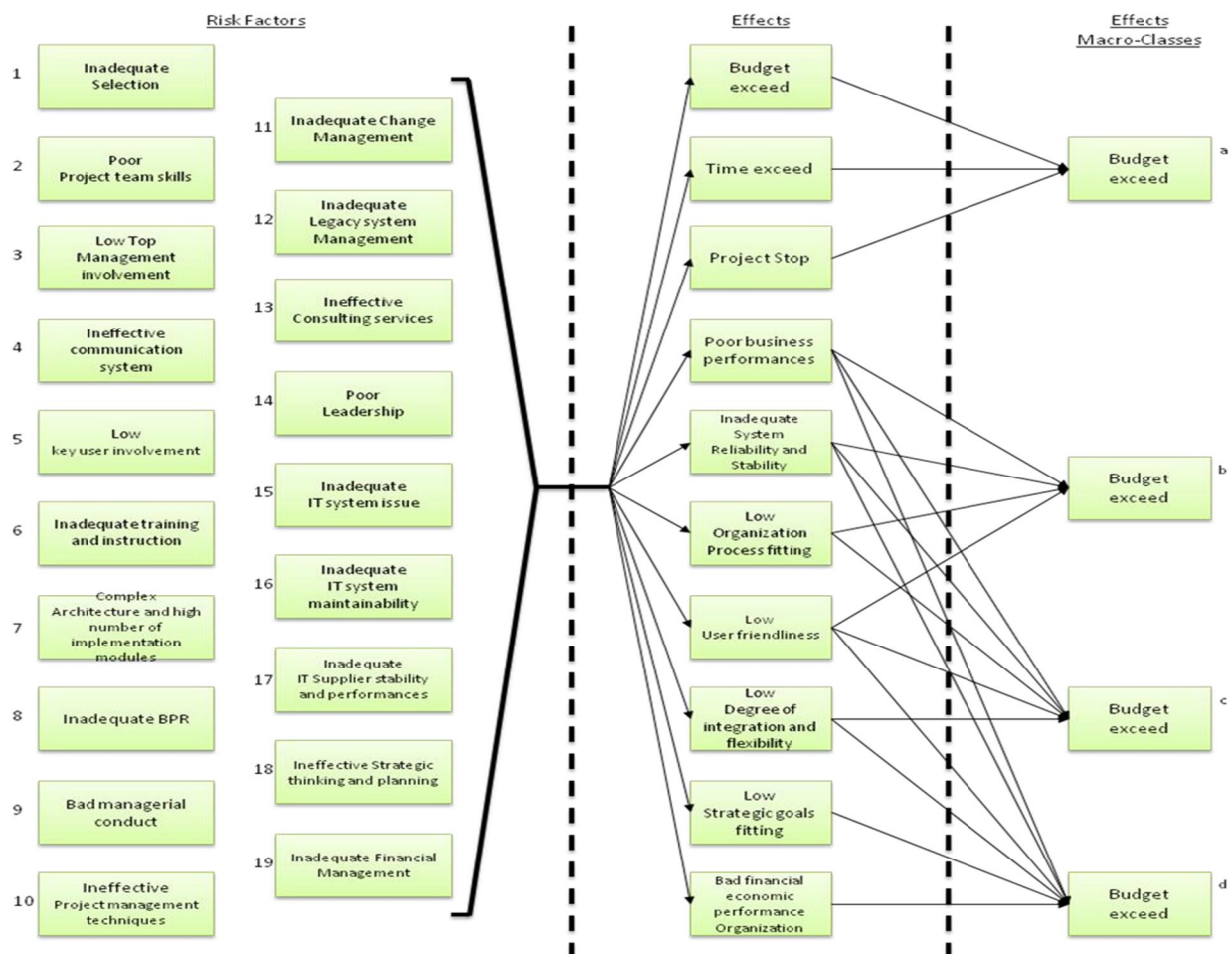
3.3. Risk Quantification

Risk Quantification aims to evaluate the risk level of the identified factors to synthesize a ranking which could drive and prioritize the selection of the treatment strategies. It involves the evaluating risk and the risk interaction (PMI book, 2000) to assess the range of possible project outcomes. In this approach, the definition of risk quantification entails two essential components: uncertainty (i.e. the probability of occurrence of a risk factor, U - both the unconditioned and conditioned probability, the second one is due to a risk factor interaction) and exposure (i.e. the impact or effect of the occurrence of a risk factor on the project, E).

Risk assessment can be complicated by a number of factors, including the following issues:

- Opportunities and threats can interact
- A single risk factor can cause multiple effects

- Opportunities for one stakeholder can be threats to another
- The mathematical techniques used can create false impression of precision and reliability

The Australian Standard distinguishes the approach to risk quantification in: qualitative, semi-quantitative and quantitative.

3.4. Risk Analysis

The function of risk analysis is to investigate on the risk factors in order to provide a deeper understanding of the risk features which enables a more reliable estimation of the probability of occurrence, interrelationships and impact in order to determine the influence of risk factors on the system as a whole. Risk factors, in fact, form a cumulative effect on one or more aspects of the project and it is easier to mitigate risk events if they can be bunched in groups and preferably dealt at a higher level in the long run than focusing on one particular risk event, in which case the project is likely to be micro-managed (Heall & Kunreuther, 2007). Risk analysis may vary in detail according to the risk, the purpose of the analysis, and the required protection level of the relevant information, data and resources. Some theories include in risk analysis also the estimation of the occurrence probabilities of the risk factors, the entity of effects that we, instead, include in risk evaluation phase. Anyway, as stated above, the type of performed analysis should be consistent with the criteria developed as part of the definition of the Risk Management context

3.5. Risk Analysis in ERP Projects

The Risk Analysis stage is that risk factors are analyzed and classified according to the decisional attributes defined in the context analysis phase, such as control-ability, detect-ability, project life cycle, responsibility and dependence. (Figure 4)

Figure 4: Risk factors impact during ERP life cycle
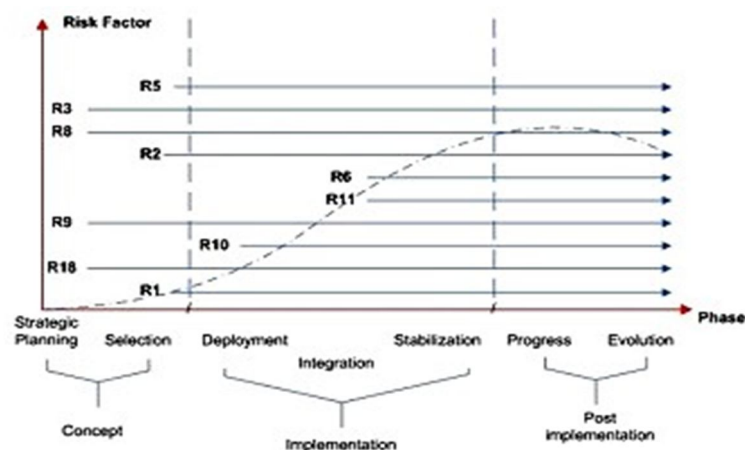
3.6. Risk Evaluation

In Risk Evaluation phase a ranking has to be elaborated in order to assess the priority and severity of each risk factor. Consequences, likelihoods and hence the level of risk should be estimated (this activity is sometimes assessed during the analysis phase). Finally, a comparison between the levels of risk against the pre-established criteria (i.e. in the risk criteria identification stage) and a balance between potential benefits and the adverse outcomes should be done. This process enables to make decisions about the extent and nature of treatments required and about priorities. It is important to note that in some cases the risk evaluation may lead to the decision of undertaking further analysis (Sarkis & Sundarraj, 2000). Risk evaluation is the function of risk management where risk events need to be prioritized so that risk mitigation plans are determined or based on past experience, lessons learnt, best practices, organizational knowledge, industry benchmarks and standard practices (Ahmed et al., 2007). Different aspects of the project - as for example strategies, budget or schedule - may be considered in the light of a risk event to determine risk mitigation options and incorporate the most suitable options into a mitigation plan. The criteria used by the Risk Management team have to take into account also the organization objectives, the stakeholder views and of course the scope and objective of the Risk Management process itself. The decisions made are usually based on the level of risk but may also be related to specified thresholds in terms of:

- consequences (e.g. impacts);
- likelihood of events;
- umulative impact of a series of events that could simultaneously occur or interact.

A large number of techniques supporting the evaluation phase exist, such as statistical sums, simulations, decision trees, expert judgments, multi-criteria decision, portfolio approaches, probabilistic networks, etc.

4. Conclusion

We have presented a proposal for specific methodologies regarding the context analysis and the risk assessment phase in ERP project risk management. The innovative contributions of the work are:

- The specification of the main dimensions which managers should use for a preliminary context analysis in ERP projects;
- An extended literature review aiming to the identification and classification of the main risk factors in ERP projects (risk factors were identified, homogenized and analyzed);
- the definition of the meaning of project success for such projects;
- the proposal of a panel of attributes useful for studying the identified risk factors and a ISM-based technique for the analysis of interdependencies among risk factors and between risk factors and effects in the risk analysis phase;
- a probabilistic-network based approach and a specific elicitation process to manage the risk evaluation phase;
- a software prototype automating the evaluation phase.

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