

RISK MANAGEMENT PROCESS IN PROJECTS

Elena DOVAL*

Abstract: *Due to the rapid changes in the external environment of organizations, projects of any type are subject to risks and uncertainty. If the uncertainty cannot be controlled, the risk instead, being a probability, can be anticipated, measured, and managed. In this context, the paper focuses on a number of general aspects regarding project risk, types of risks, and project risk management. Also, the project risk management process is presented in detail, addressing four stages: risk identification, risk analysis or assessment, risk management, and risk control. The methodology approached in this paper is based on the research of literature, direct observation, and own judgment.*

Key words: risk, project, risk management, risk exposure, risk management process

JEL Classification:M19, O22

1. Introduction

The project is characterized as a single specific action; it consists of a logical sequence of activities and coordinated and controlled components; it is conducted in a methodical and progressively organized manner, with constraints of time, resources and cost, to meet the defined objectives (Croitoru, 2015).

Any business and any project have distortions, challenges, and changes due to the influence of external factors, which are continually changing or internal ones, which are due to the different changes that occur during the activity. These influences lead to the emergence of risks and uncertainty.

* Spiru Haret University, Faculty of Legal Sciences and Economic Sciences, Brasov, Romania, doval.elenal@yahoo.com

When carrying out projects, account must be taken of the risks that may arise throughout them. These risks should not be ignored or hidden but they should be treated responsibly by the project manager and his entire team. A project manager is not able to solve every risk that appears in a project, so every person in his team has to do something about risks (Boide, 2014, p. 620).

John Cocke of IBM Research in Yorktown, New York, created the risk concept in 1974, proving that about 20% of the instructions on a computer did 80% of the work.

The literature presents the project risk in general (Wideman, 1992; Hillson, 2002; Raz et al., 2002; Ward and Chapman, 2003; Radovic, 2008; Zwickael, 2011). Also, different authors present their opinions on risk management in different fields of projects (Clark et al., 1990; Akintoye and Macleod, 1997; Ropponne and Lyytinen, 2000; Modarres, 2006; Bakker et al., 2010).

In the age of computer development, a new concept for rapid risk management is RISC-V (pronounced "risk five"). This is a calculation architecture based on the calculation principles of the reduced instruction set. It represents a significant step forward in processing the data at the required speed for all "heavy" applications that can be used daily (Preimesberger, 2019).

However, until the computerized or online use of risk analyses, of the main aspects of project risk, project management is outlined in this paper, and also, a risk management process consisting of four main stages are presented.

2. General aspects regarding risk and risk management

2.1. Risk in projects

The risk is the possibility of loss or injury (Merriam-Webster Online, 2009). Project risk is an uncertain event or condition that, if it occurs, affects at least one project objective (PMBOK Guide, 2008, p. 273).

The risk deals with the uncertainty of the events that could affect the project. Some potential negative events of the project are highly likely to occur on specific projects. Examples are (Wiley et al., 2012):

- Safety risks are common for construction projects;
- Changes in the value of local currency during a project affect the purchasing power and budgets of projects with large international components;

- Weather-dependent projects, such as road construction or coastal projects, risk delays due to exceptionally wet or windy weather.

Any successful contemporary business based on, inter alia, project management is not possible without risk estimation, quantification, control and management (Radovic, 2008).

The risks of the project are separated from the organizational risks that are associated with the business purpose of the project. The main differences of the project risk with the dangers of the organization are (Wiley et al., 2012):

- The risk of the project is the possibility that the project events will not take place as planned or that unplanned events will occur that will have a negative impact on the project.
- Known risks can be identified prior to their occurrence, while unknown risks are unforeseen.
- Organizational risks are associated with the business purpose of the project and assumed by the client when deciding to do the project.

Projects by their nature are risky, so the project manager has a key role in identifying, planning, and managing risks.

There are five ways to address project risks (Hobbs, 2015, p. 43):

Prevention: eliminating risks by doing things differently. This is not always a realistic possibility.

Avoidance (the backup plan): consists of following another plan that will lead to the same results but through a different route.

Reduction: measures are taken to reduce the likelihood of occurrence or reduce the risk impact.

Transfer: refers to the spread or division of risk so that its consequences will be significantly reduced (for example, with an insurance company).

Acceptance: there are a number of risks that are considered acceptable because their reduction costs more than the benefits that can be obtained if the necessary measures are not taken.

2.2. Types of risks in projects

There are many types of project risks. These risks can lead to cost, scheduling, or performance issues and may create other types of adverse consequences for the organization (Types of Risk in Project Management, online, 2019). The most common risks in projects are:

- Cost risk, usually escalating project costs due to low accuracy costs estimation and scope increase.
- Program risk (calendar), the risk that the activities will take longer than expected. The reductions of the program usually increase the costs and also delay the receipt of the benefits of the project, with a possible loss of the competitive advantage.
- Performance risk, the risk that the project will not produce results in accordance with the project specifications.
- Governance risk refers to the performance of the administration regarding the company's ethics and reputation.
- Strategic risks result from errors in strategy, such as choosing a technology that cannot be operated.
- Operational risk includes risks due to poor implementation and process problems, such as procurement, production, and distribution.
- Market risks include competition, foreign exchange, commodity markets, and interest rate risk, as well as liquidity and credit risks.
- Legal risks arise from legal and regulatory obligations, including contractual risks and litigation against the organization.
- Risks associated with external hazards, including storms, floods and earthquakes; vandalism, sabotage and terrorism; labour strikes; and civil unrest.

As indicated in these examples, project risks include both internal risks associated with the successful completion of each stage of the project, plus dangers that are beyond the control of the project team.

These latter types include external risks that arise from outside the organization but affect the final value to be derived from the project. In all cases, the severity of the risk depends on the nature and extent of the possible final consequences and their probabilities.

In addition to project risk, the risk of project deferral may be significant. The risk of delaying the project refers to the risks associated with the failure to carry out a project. As with project risk, the risk of project deferral may arise from any of the sources of the risk presented above. The risk of delaying the project may also arise if there is only a limited range of opportunities for project management; if the project is not done now, there may be a risk that it will never be possible to carry it out later.

Most environmental risk assessment methods are based on scoring and comparing with the average of the variables considered. Depending on the analysis indications, each method has applicability in a particular geographical area or country (Negulescu, 2015, p.194).

Often, external risks contribute more to portfolio risk, as they impact on several projects simultaneously. For example, the research and development project of a pharmaceutical company is affected by the uncertain results around the specific compound involved, but many projects could be affected by a change in regulations.

Similarly, the exploration project of an oil company depends on the uncertainty about the presence of oil in the given location, but the uncertainties regarding the market price of oil affect many projects. Also, a construction company could have many projects threatened by the external risk of rising steel or commodity prices.

2.3. Risk management in projects

Risk management focuses on identifying and evaluating risks for the project and managing their chances to minimize the impact on the project. There are no projects without risks because there is an infinite number of events that can have a negative effect on the project. Risk management does not refer to the elimination of risk, but the identification, evaluation, and management of risk.

Raz et al. (2002) studied risk management practices in hundreds of projects in a variety of industries. The results of this study suggested the following about risk management practices:

- Risk management is not widely used;
- The projects that most likely had a risk management plan were those that were perceived to be high risk;
- When the risk management practices were applied to the projects, they seemed to be positive concerning the success of the project;
- The risk management approach influenced the programs and objectives of the project costs, but exerted a smaller influence on the quality of the project products;
- Proper risk management increases the likelihood of a successful project.

3. The risk management process

The manager and members of the project team at different levels identify and manage risks in various forms (Lavanya&Malarvizhi, 2008). But this will be inefficient without a structured risk management framework, as this leads to incomplete impact assessment, which results in the loss of:

- Knowledge of the overall impact on the project objectives, such as scope, time, cost and quality;
- Identification of secondary or new risks resulting from the risks already identified;
- Lack of transparency and a communication gap within and outside the team.

According to the authors, it is very important for any project organization to establish an effective risk management framework. The establishment of such a practice as a culture of the project team ensures:

- Identifying and managing conscious and concentrated risk;
- The progress of the project as desired, with the least amount of deviations or surprises, and in accordance with the objectives of the organization and the project;
- Early and effective communication of project problems with project organizations and stakeholders;
- An efficient team-building tool, as the acquisition and acceptance of the team, is ensured.
- Risk management is an iterative process, and each facet of risk management should be planned and followed in each phase of the project. This process comprises four steps: risk identification, risks analysis or assessment, risks management, and risk control (figure 1).

Risks management plan

The organization's risk management framework is reviewed and adapted to define the project risk management plan at project initiation. The risks management plan includes the following guidelines:

- List of possible sources and categories of risk;
- Impact and probability matrix;
- Risk reduction and action plan;
- Intervention plan;
- Threshold and risk values;

- Identifying risks;
- Risk analysis;
- Risk management;
- Risk control;
- Feedback.

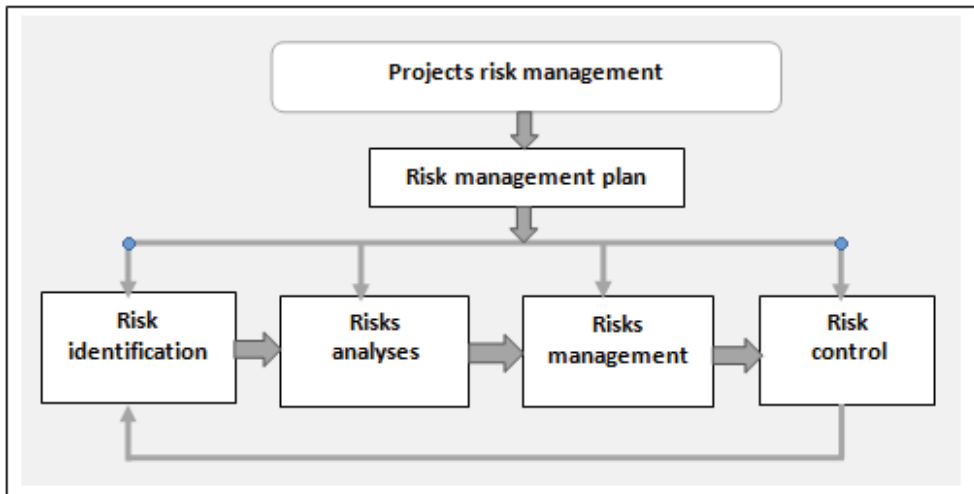


Figure no. 1. The risk management process

Source: upon Lavanya&Malarvizhi, 2008

Step 1 – Identification of risks

Risks should be identified and addressed as early as possible in the project. Risk identification is made throughout the life cycle of the project, with a particular focus on the key stages.

Risk identification is one of the critical topics in the normal state of the project and in reporting sessions. Some risks may be readily apparent to the project team (known risks); others will have more rigors to be discovered, but they are still predictable.

The tool for recording all the risks identified during the project is the risk register, which is stored in the central server of the project.

The following tools and guidelines are used to identify risks in a structured and disciplined manner, which ensures that no significant potential risks are overlooked:

- Risk repertoire: list of risks from history (other projects);
- List of possible risks;
- Expert judgment, using brainstorming;
- The status of the project, which includes progress reports;
- Classifying risks by categories.

The risk category provides a list of areas prone to risk events. The organization recommends standard categories at the high level, which should be extended according to the type of project, for example, technical, organizational, project management, and external factors.

Step 2-Risk analyses

Risk analysis or assessment involves examining how the project's results and objectives may change due to the impact of the risk event.

After identifying the risks, they are analysed to identify the qualitative and quantitative impact of the risk on the project, so that appropriate measures can be taken to mitigate them. The following guidelines are used to analyse risks: the likelihood of risk occurrence, the impact of the risk, the exposure to risk or risk score, and the period of occurrence of the risk.

1. Likelihood of risk occurrence

- High probability: ($80\% \leq x \leq 100\%$)
- Medium-high probability: ($60\% \leq x < 80\%$)
- Medium-low probability: ($30\% \leq x < 60\%$)
- Low probability: ($0\% < x < 30\%$)

2. The impact of the risk

- High – Catastrophic (rating A – 100)
- Medium – Critical (rating B – 50)
- Low – marginal (rating C – 10)

3. Exposure to risk or risk score

The risk exposure or risk score is the value determined by multiplying the impact rating with the risk probability, as shown in figure 2.

The urgency of risk response planning can be marked with different colours and determines the levels of reporting.

The score represents the lower thresholds for the classification of risks assuming "normal" conditions.

Rating/ Probability	1=high	2=medium- high	3=medium-low	4=low
A=100	Very high exposure	Very high exposure	High exposure	Moderate exposure
B=50	High exposure	Moderate exposure	Moderate exposure	Low exposure
C=10	Low exposure	Low exposure	Low exposure	Low exposure

Figure no.2. Exposure-probability matrix of risk in projects

Source: Lavanya&Malarvizhi, 2008

An update of the score at the next level or even the next + 1 is required if the risk is affected by critical factors such as:

- How important the specific client is;
- Whether the project is essential for the further development of the client relationship;
- The risk is already in the centre of the customer's attention;
- The specific sanctions for the deviations from the project targets are agreed upon in the contract with the client.

Period of occurrence of the risk

The time frame in which this risk will have an impact is identified. It is classified in one of the following:

- Appropriate (now or within 1 month);
- Medium: the next 2-6 months;
- Large: over 6 months.

In addition to classifying risks according to the guidelines above, it is also necessary to describe the impact on cost, schedule, scope, and quality in as much detail as possible, based on the nature of the risk.

Step 3-Risk management

Risk management involves: planning the risk response, identifying the risk triggers, and establishing the person responsible for resolving the risk.

Planning the risk response

There may not be quick solutions to reduce or eliminate all the risks that a project faces. Some risks may be needed and strategically managed over more extended periods. Therefore, action plans should be developed to reduce these risks. These action plans should include:

- Description of risk with risk assessment;

- Description of the risk reduction action;
- Owner of the risk action;
- A committed completion date of the risk action.

All risk action plans should be allocated to the person identified to carry out the action plan (responsible). For each risk, a risk response must be recorded in the risk register, in agreement with the stakeholders. This should be provided by the project manager.

The risk response plans are aimed at the following objectives:

- Elimination of risk;
- Decreased probability of occurrence of risk;
- Reducing the impact of risk on the project objectives.

Risk response plans usually have an impact on time and costs. Therefore, it is mandatory that the time and cost of the defined response plan be calculated as accurately as possible. This also helps to select a response plan from the alternatives and to check if the response plan is more expensive or has more impact on one of the project objectives than the risk itself.

Risk triggers

For each risk, a trigger must be recorded in the risk register. The trigger identifies the risk symptoms or warning signs. This indicates that risk has occurred or is about to occur. The risk trigger also shows when a certain risk is expected to occur. Following the successful implementation of a set of response plans, the risk score could be reduced following consultation with stakeholders.

Risk responsibility

The basic rule is that the project manager is responsible for managing all the risks in the project.

Based on this basic rule, a Risk Owner (which is not necessarily the project manager) must be determined and named in the Risk Register. The risk owner usually is the one who may best monitor the risk trigger, but it can also be the one that can best manage the defined measurement measures. The risk owner is responsible for the immediate reporting of any change in the status of the risk trigger and for conducting the defined countermeasures.

Step 4-Risk monitoring and control

Risk monitoring and control include:

- Identifying new risks and planning for them;
- Track existing risks to verify that:
 - Reassessment of risks is necessary, and
 - Any risk conditions have been triggered;
- Monitor any risks that may become more critical over time;
- Addressing other risks that require a long-term, planned, and managed approach with risk action plans.

Reclassification of risks

For the risks that cannot be closed, the criticism must decrease over a while due to the implementation of the action plan. If this is not the case, then the action plan may not be valid and should be reviewed.

Risk reporting

The risk register is continuously updated, from the identification of the risk by planning the risk response and updating the status during the monitoring and control of risks. This project risk register is the primary risk reporting tool and is available on the central project server, which is accessible to all stakeholders.

Risk monitoring and risk control or review is an iterative process that uses progress, and delivery status reports to monitor and control risks. This is activated by various status reports, such as quality reports, progress reports, tracking reports, etc.

Risk reviews are a compulsory element of landmark meetings and or regular project meetings, but can also be carried out at risk assessments scheduled separately. These risk analyses should be performed on a regular basis. The frequency could also be determined based on the overall risk level of a project.

Therefore, the risks of a project must be anticipated, identified, and recorded. The risks that may arise are anticipated during the project design and planning phase (table 1).

During the project course, the anticipated risks are verified and recorded, having the aim of reducing or resolving them. The practical action is to add four more columns in the table 1 pattern: actions to be taken, progress

(at what stage the work is), status (action is taken, ongoing, not started), and resources allocated.

Table no. 1.
The pattern to record the anticipated risks of the project

Nr.	Date	Issue description	Likelihood*	Risk impact*	Severity*	Responsible	Actions to be taken
1							
2							
...							

*Note: * low, medium or high; Severity is based on probability and impact*

Source: <https://www.stakeholdermap.com/risk/register-common-project-risks.html#download>.

The followings are some examples of anticipated risks (www.stakeholdermap.com/risk):

- The purpose and need of the project are not well defined;
- The design and definition of the delivery are incomplete;
- The project program is not clearly defined or understood;
- There is no control over staff priorities;
- Delays of the consultant or contractor;
- Errors in estimation and or planning;
- Unplanned activities that must be taken into account;
- Lack of communication, causing a lack of clarity and confusion;
- The pressure to arbitrarily reduce task durations and run tasks in parallel, which would increase the risk of errors;
- Unsolved project conflicts on time;
- The business becomes obsolete, or is undermined by external or internal changes;
- Delay in the previous phases of the project endangers the ability to be fulfilled on the set date. For example, delivery of materials on time, for a conference, or at the time of launch.
- Increased workload or time requirements due to new directions or policies were added;
- Inadequate customer testing leads to an extensive list of customers accessing them.
- The project is delayed due to legal action;

- The client refuses to approve deliveries/benchmarks or delays the approval, putting pressure on the project manager to "work in a risky situation";
- Theft of materials, intellectual property or equipment;
- Emergency, such as extreme weather, which leads to loss of resources, materials, spaces, etc.
- Stakeholder actions delay the project.

Other aspects regarding risk management are risk threshold, risk efficiency measurement, and risk audit (Lavanya&Malarvizhi, 2008).

Risk threshold

Risk priorities need to be set to focus directly on where it is most critical. The highest priorities are the risks with the highest degree of risk exposure. Low exposure risks can be eliminated from mitigation plans but should be reviewed later in the project.

The organizational mandate is that if the projects have at least a "very high" risk or more than 3 "high" risks, guidance must be sought from the management of the organization and stakeholders, as the project may have a high risk of failure. This is the recommended risk threshold. Projects can customize the threshold according to the needs of the project.

Measuring risk efficiency

The efficiency of risk analysis and management is measured by capturing the following values during project closure. The results of the analysis are used to decipher the lessons learned, which is updated in the database of lessons learned organization.

- Number of risks encountered / Number of identified risks;
- Was the risk impact as severe as initially thought?
- How many risks have reappeared?
- How are the real problems and problems differentiated by a project from the anticipated risks?

Risk audit

Risk audit is an independent analysis of risk experts, with recommendations to increase the maturity or effectiveness of risk management in the organization. It evaluates:

- How good are we at identifying risks?

- Exhaustion and granularity of the identified risks;
- The effectiveness of the mitigation or intervention plan.

The link between project risks and organizational risks

This link is not a "process adherence" audit, but rather an aid for improving the quality of risk identification and risk analysis. The link is also used as a forum for assessing and identifying good risk management practices within the various projects in the organization.

The risk audit is performed by a group of independent fields or technical experts by reviewing the documentation and interviews. The main results of this risk audit are:

- Customized checklist for assessing the risks of a project;
- Identifying the areas of importance for risk analysis for a project (risk taxonomy);
- Risk radar or risk-prone areas of the product group;
- Potential additional risks identified based on the review;
- Top 10 risks in the organization from crucial projects that require management's attention.

When using software, risk management becomes the most challenging aspect of project management. Although we can never predict the future with certainty, we can apply a simple and efficient risk management process to predict project uncertainties and minimize the occurrence or impact of these uncertainties.

Not only does risk management help to avoid crises, but it also helps us to remember and learn from past mistakes. This action enhances the chance of successful completion of the project and reduces the consequences of these risks.

Conclusions

One of the essential activities in project management is project risk management. Different risks may arise at each stage of a project. They must be identified, defined, registered, and reported to the stakeholders. Also, these risks must be managed responsibly so that the projects are not in danger of being closed; to record costs higher than those budgeted; not to complete the deliverables or not to have delivered the project on time.

However, the project manager can use several tools, such as „the Exposure-probability matrix of risk in projects” and „the pattern to record the anticipated risks of the project” for ease of risk management. It may also use guidelines to analyze risks: the likelihood of risk occurrence, the impact of the risk, the exposure to risk or risk score, and the period of appearance of the risk, to take appropriate measures can be made to mitigate them.

To reduce the risks of the projects, they need effective risk management approaching a specific process, which comprises four main stages; risk identification, risk analysis or assessment, risk management, and risk control.

Risk management is not the end of the activity in terms of efficient risk management. It is a constant learning process for project managers to continually improve their practices to increase the efficiency of the process.

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