

## Project Risk Management

### Lecture Topics

- Concepts regarding risk management
- Roles and responsibilities in risk management
- Risk management processes by PMBOK

## Risk Management Concepts

- **Risk:** is any uncertain event that impacts one or more project objectives. Risks that are detrimental to project objectives are also called threats or negative risks while risks that are beneficial to the project are called opportunities or positive risks.
- **Risk response:** these are the actions that will be taken prior to the risk taking place that reduce the probability or impact of a threat should it occur or increase the probability or impact of an opportunity
- **Root cause:** the factor(s) that is the source of the risk. We need to understand what factors generate the risk so that we can better develop plans to influence the risk
- **Trigger:** the signs, symptoms, or key event that warns us the risk is imminent or is now more likely to occur
- **Probability:** an assessment of how likely it is that the risk event will occur. Risk responses try to influence probability before the risk takes place –our goal is to reduce the probability of negative impacts from occurring and increasing the chances of positive risks
- **Impact:** the effect the risk will have, usually expressed in monetary, time, quality, or scope measures. Prior to the risk event taking place, our aim is to reduce or eliminate the impact a negative risk will have (should it take place) or to increase the beneficial impact of a positive risk
- **Contingency plan:** these are the actions that will be taken in response to a risk event that is imminent or which is occurring. Contingency plans aim to reduce the impact of a negative risk or increase the impact of an opportunity, and are used in combination with risk responses.
- **Fallback plan:** what actions will be taken if the contingency plan proves ineffective

## Roles and Responsibilities in Risk Management

- **Project manager:** the project manager is responsible for overall risk management and ensuring that it's properly coordinated with all other project management activities.

- **Risk manager:** the person responsible for establishing and overseeing risk management processes and coordinating them with the project manager. The risk manager monitors risks and regularly communicating the risk status to the project team and stakeholders. The risk manager will hold some level of decision-making authority, and where that authority begins and ends needs be documented in the risk management plan
- **Risk owner:** this is the person who has the skills and expertise necessary to best manage a particular risk. This role assists in developing the risk responses, contingency plans, risk actions, and monitors the risk.
- **Risk action owner or risk response owner:** the person responsible for carrying out risk response activities for a particular risk

## Risk Management Processes in PMBOK

The objective of project risk management is not to avoid risks entirely, but *to increase the probability and impact of positive events, and decrease the probability and impact of events adverse to the project*. Without risk-taking, new methods of efficiency, originality, and competitiveness can't be achieved, so the project risk processes make sure the costs of risks are weighed against the benefits they provide. The **Project Risk Management** knowledge area includes the processes that identify, evaluate, respond to, and monitor project risks. These processes are illustrated on the next figure:

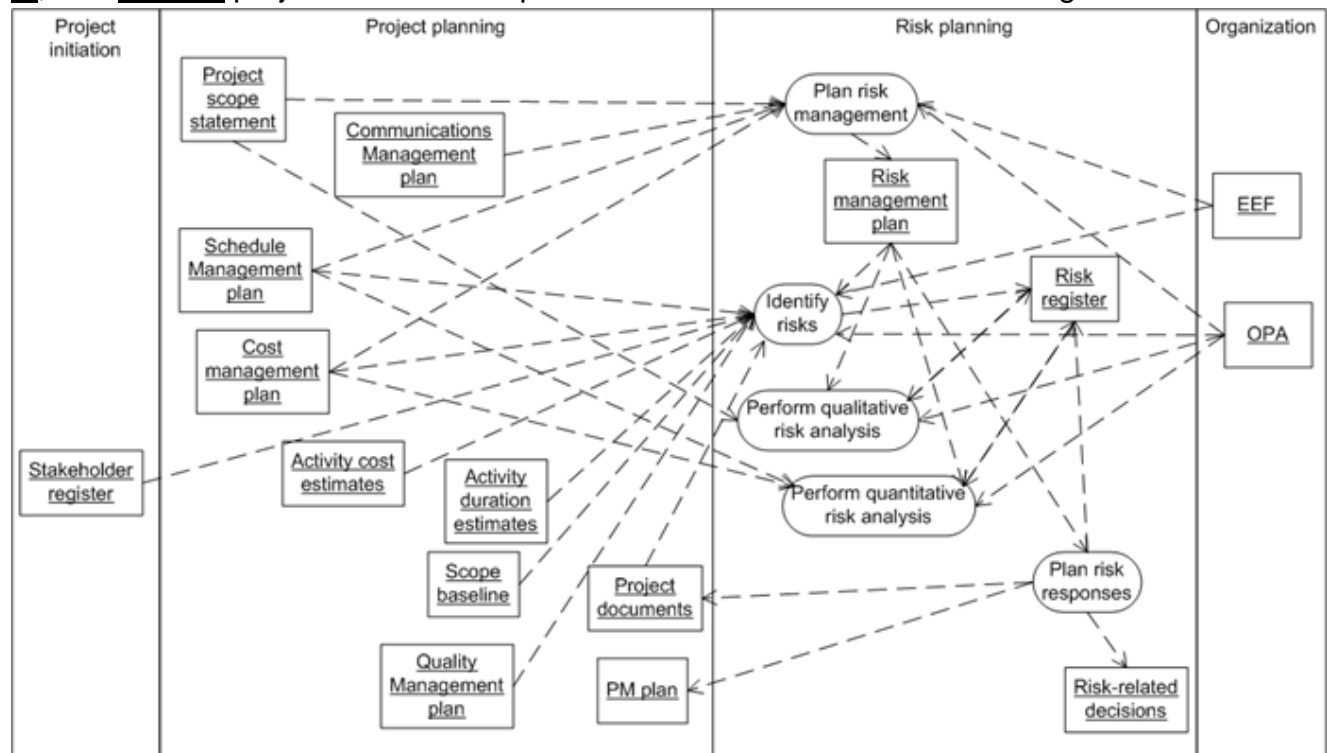


Figure 1. Risk Management Processes in PMBOK

### General Inputs to Risk Management Processes

- Project scope statement
- Cost and schedule management plan
- Quality management plan
- stakeholder register
- organizational process assets (risk categories; common definitions of concepts and terms; roles and responsibilities; templates; lessons learned)
- enterprise environmental factors (risk attitudes and tolerances that describe the degree of risk that an organization will withstand)

### General Outputs from Risk Management Processes

- risk management plan
- risk register

### Risk Management Processes (Steps)

1. risk management planning
2. risk identification
3. risk qualitative analysis
4. risk quantitative analysis
5. risk responses planning
6. risk monitoring and control

RM steps continue across the entire life cycle of the project. Managing risk is a discipline; it is important to follow the steps methodically and thoroughly.

## **Step 1 – Plan Risk Management**

Plan Risk Management is the process of defining how to conduct risk management activities for a project. It is important to :

- to ensure that the degree, type, and visibility of risk management are commensurate with both the risks and the importance of the project to the organization.
- to provide sufficient resources and time for risk management activities, and
- to establish an agreed-upon basis for evaluating risks.

The Plan Risk Management process should begin as a project is conceived and should be completed early during project planning.

Plan Risk Management involves:

- Defining what risk management activities will occur
- Establishing the allotted time and cost for risk management activities

- Assigning risk management responsibilities
- Deciding how risk probability and impact will be measured
- Deciding on acceptable risk thresholds and tolerances

The output of this process is risk management plan.

### Risk Management Plan

The risk management plan describes how risk management will be structured and performed on the project. It includes the following:

- Risk management methodology for the project, describing the approaches, tools, and techniques that'll govern how project risk management will occur
- Responsibilities for risk management activities. Defines the lead, support, and risk management team members for each type of activity in the risk management plan, and clarifies their responsibilities
- Budget, schedule, and frequency of risk management activities. Activities needed for risk management (and incorporated into the project schedule). Resources and costs allocated to risk management and risk activities as later defined and incorporated into project cost baseline
- Definitions of risk probability and impact
- Probability and impact matrix
- Revised stakeholder's tolerances
- Reporting formats and rules for tracking risk activities

## Step 2 – Risk Identification

Identify Risks is the process of determining which risks may affect the project and documenting their characteristics. Participants in risk identification activities can include the following:

project manager, project team members, risk management team (if assigned), customers, subject matter experts from outside the project team, end users, other project managers, stakeholders, and risk management experts.

Identify Risks is an iterative process because new risks may evolve or become known as the project progresses through its life cycle. The frequency of iteration and who participates in each cycle will vary by situation. The format of the risk statements should be consistent to ensure the ability to compare the relative effect of one risk event against others on the project. The process should involve the project team so they can develop and maintain a sense of ownership and responsibility for the risks and

associated risk response actions. Stakeholders outside the project team may provide additional objective information.

### Risk Identification Techniques

- Documentation reviews
- Information gathering techniques (brainstorming; delphi technique; interviewing; root cause analysis)
- assumptions analysis;
- diagramming techniques (cause and effect diagrams; system or process flow charts; influence diagrams);
- SWOT analysis;
- Expert judgement

The output of risk identification process is risk register.

### Risk register

Dataset characterizing identified risks may contain the following attributes:

- **Risk:** The name, description, and a unique identifier for the risk
- **Risk Owner:** The risk owner is the person in charge of monitoring and controlling the risk
- **Risk category:** The categorization from the risk management plan that the risk falls within. Changes may be requested to the categories originally defined in the risk management plan as risks are identified and analyzed
- **Root cause:** The core factor(s) leading to the risk. A risk may have multiple causes as well as multiple impacts
- **Potential response:** Responses to risks are planned in Risk Response Planning, but potential responses may become obvious during risk identification and should be captured in the risk register
- **Impact:** The risk register contains the specific details about what will be effected should the risk occur
- **Probability:** The probability of the risk expressed as a percentage or on a scale as defined by the risk management plan
- **Symptoms/Warning Signs:** Any specific conditions likely to trigger the risk or symptoms that the risk is about to occur should be identified. This will help during risk monitoring.

- **Risk Score:** The probability and impact score for the risk. This is obtained from a formula (usually probability x impact) defined in the risk management plan and generated from the probability and impact matrix
- **Risk Ranking/Priority:** This is the prioritization or relative ranking for the risk that allows efforts to be spent more effectively on the higher priority risks.
- **Risk Response:** The strategies and activities that will be taken to encourage and exploit a positive risk, or address a negative risk
- **Risk Response Responsibilities:** The risk action owners are people who have risk response actions to take
- **Secondary Risks:** Risk responses can often raise new risks
- **Risk Response Budget:** This is the budgeted cost to implement approved risk responses
- **Risk Response Schedule:** The scheduled activities necessary to put the risk response into action
- **Contingency Plan:** These are the actions that will take place should the risk response fail. The contingency plan also establishes under what criteria it's to be enacted
- **Fallback Plan:** The fallback plan is a backup to the contingency plan should it fail

### Step 3 – Risk Qualitative Analysis

Perform Qualitative Risk Analysis is the process of prioritizing risks for further analysis or action by assessing and combining their probability of occurrence and impact. Perform Qualitative Risk Analysis assesses the priority of identified risks using their relative probability or likelihood of occurrence, the corresponding impact on project objectives if the risks occur, as well as other factors such as the time frame for response and the organization's risk tolerance associated with the project constraints of cost, schedule, scope, and quality. Such assessments reflect the attitude of the project team and other stakeholders to risk. This process contains following subprocesses or activities:

1. assessing of identified risks by their probability of occurrence;
2. assessing of identified risks by their impact;
3. calculating risk score
4. prioritizing risks by score

By calculating the score we can use different scales. The specific scale must be defined in the risk management plan.

**Table 1. Examples of Probability and Impact Scales**

Name	Example				
Relative (or ordinal) scale	Very Low	Low	Medium	High	Very High
Linear (or cardinal) scale (numeric, intervals between designations are equal)	1	2	3	4	5
Non-linear scale (numeric, but intervals between designations are not equal)	1	2	4	8	16

1. Assessing identified risks by probability of occurrence

As example is given table probability ranks:

**Table 2. Risks Probability Ranks**

Scale	Probability Rank	Numeric Equivalent
Very Low	Probability 10%	1
Low	Probability 30%	2
Medium	Probability 60%	3
High	Probability 80%	4
Very High	Probability 95%	5

An example of risks assessment results

**Table 3. Example of Risk Probabilities Assessment**

	Very Low	Low	Medium	High	Very High
Risk X			X		
Risk Y		X			
Risk Z				X	

Risk Y gets assessment result „2“.

2. Assessing identified risks by their impacts

Example of impact rating criteria are presented in the following table:

**Table 4. Example of Impact Rating Criteria**

	Very Low	Low	Medium	High	Very High
Time	3 days or less	7 days or less	10 days or less	14 days or less	15 days or less
Time Numeric Equivalent	1	2	3	4	5
Scope	< 10 hrs effort	< 20 hrs effort	< 30 hrs effort	< 40 hrs effort	> 40 hrs effort
Scope Numeric Equivalent	1	2	3	4	5
Cost	< 1000 eur	< 1500 eur	< 2000 eur	< 2500 eur	> 2500 eur
Cost Numeric Equivalent	1	2	4	8	16

Risks impact calculation example is presented in the following table:

**Table 5. Risks Impact Calculation Example**

	Time					Scope					Cost					Impact Rating
	Very Low	Low	Medium	High	Very High	Very Low	Low	Medium	High	Very High	Very Low	Low	Medium	High	Very High	
	1	2	3	4	5	1	2	3	4	5	1	2	4	8	16	
Risk X		X				X					X					4
Risk Y	x					x								X		10
Risk Z		x					X					x				8



Risk Y gets impact rating „10“.

### 3. Calculating risk score

Score is the product of probability assessment result and impact rating. By the example of Risk Y the score is  $2 \times 10 = 20$

### 4. Risks prioritizing

Risks prioritizing is based on Risk Probability and Impact Matrix presented in the following table:

**Table 6. Risks Probability and Impact Matrix**

15	30	50	80	130
12	24	40	64	104
9	18	30	48	78
6	12	20	32	50
3	6	10	16	26

Interpretation of this table is as follows:

- $\geq 75$  = very high priority risk
- $\geq 35$  ja  $< 75$  = high priority risk
- $\geq 18$  ja  $< 35$  = medium priority risk
- $\geq 9$  ja  $< 18$  = low priority risk
- $< 9$  = very low priority risk

By this matrix the priority of risk y is „medium“.

## **Step 4 – Risk Quantitative Analysis**

Perform Quantitative Risk Analysis is the process of numerically analyzing the effect of identified risks on overall project objectives. This process is performed on risks that have been prioritized by the Perform Qualitative Risk Analysis process as potentially and substantially impacting the project's competing demands. The Perform Quantitative Risk Analysis process analyzes the effect of those risk events. It may be used to assign a numerical rating to those risks individually or to evaluate the aggregate effect of all risks affecting the project. It also presents a quantitative approach to making decisions in the presence of uncertainty.

Techniques used in quantitative risk analysis are the following:

- Sensitivity analysis
- Expected monetary value analysis
- Modeling and simulations

## Step 5 – Risk Response Planning

Plan Risk Responses is the process of developing options and actions to enhance opportunities and to reduce threats to project objectives. It follows the Perform Qualitative Risk Analysis process and the Perform Quantitative Risk Analysis process (if used). It includes the identification and assignment of one person (the “risk response owner”) to take responsibility for each agreed-to and funded risk response. Plan Risk Responses addresses the risks by their priority, inserting resources and activities into the budget, schedule and project management plan as needed.

Planned risk responses must be appropriate to the significance of the risk, cost effective in meeting the challenge, realistic within the project context, agreed upon by all parties involved, and owned by a responsible person. They must also be timely. Selecting the best risk response from several options is often required.

### Risk Response Strategies

There are 4 classifications of response strategies – **proactive** behavior:

- Eliminate uncertainty
- Allocate ownership
- Modify exposure
- Include in baseline

### **Eliminate uncertainty**

Threat response – avoid. Risk avoidance involves changing the project management plan

- to eliminate the threat posed by an adverse risk
- to isolate the project objectives from the risk's impact
- to relax the objective that is in jeopardy

Opportunity response – exploit. This strategy seeks to eliminate the uncertainty associated with a particular upside risk by making the opportunity definitely happen

### **2. Allocate ownership**

Threat response – transfer. Risk transference requires shifting the negative impact of a threat, along with ownership of the response, to a third party

Opportunity response – share. Sharing a positive risk involves allocating ownership to a third party who is best able to capture the opportunity for the benefit of the project

### 3. Modify exposure

Threat response – mitigate. Risk mitigation implies a reduction in the probability and/or impact of adverse risk event to an acceptable threshold

Opportunity response – enhance. Modifies the size of an opportunity by increasing probability and/or positive impacts and by identifying and maximizing key drivers of these positive-impact risks

### 4. Include in baseline

Threat response – accept. Indicates that the project team has decided not to change the project management plan to deal with a risk or is unable to identify any other suitable response strategy

Opportunity response – ignore. The same as for threat

### Contingency Strategy

A contingent response involves a **contingency plan**, which will be put into effect should the risk response fail. The contingent response identifies the exact situation and circumstances (triggers) in which the contingency plan can be put into effect and when it can be discontinued. This response type is used in combination with another risk response, such as mitigation.

Regardless of the primary risk response strategy, a contingency plan should be in place for all but the lowest priority risks (and even those depending upon what objectives they can impact).

The fallback plan kicks in if the contingency plan fails. It can be looked at as a contingency plan for the contingency plan. The fallback plan spells out steps will be taken to recover if the contingency plan fails, and it specifies under what situations and circumstances it is activated and subsequently deactivated

## Step 6 – Risk Monitoring and Control

Monitor and Control Risks is the process of implementing risk response plans, tracking identified risks, monitoring residual risks, identifying new risks, and evaluating risk process effectiveness throughout the project. Planned risk responses that are included in the project management plan are executed during the life cycle of the project, but the project work should be continuously monitored for new, changing, and outdated risks.

The Monitor and Control Risks process applies techniques, such as variance and trend analysis, which require the use of performance information generated during project execution. Other purposes of the Monitor and Control Risks process are to determine if:

- Project assumptions are still valid,
- Analysis shows an assessed risk has changed or can be retired,
- Risk management policies and procedures are being followed, and
- Contingency reserves of cost or schedule should be modified in alignment with the current risk assessment.

Monitor and Control Risks can involve choosing alternative strategies, executing a contingency or fallback plan, taking corrective action, and modifying the project management plan. The risk response owner reports periodically to the project manager on the effectiveness of the plan, any unanticipated effects, and any correction needed to handle the risk appropriately. Monitor and Control Risks also includes updating the organizational process assets, including project lessons learned databases and risk management templates, for the benefit of future projects.

## Used Literature

- Project Management Institute, A Guide to the Project Management Body of Knowledge (PMBOK® Guide) - Fourth Edition
- David Hillson, „Effective Strategies for Exploiting Opportunities“, <http://www.risk-doctor.com/pdf-files/opp1101.pdf>
- Simon Wallace, The ePMbook, [www.epmbook.com](http://www.epmbook.com)
- LING Zong, Ph. D. Advanced IT Project Management, IBM Software Group  
öppematerjal
- Richard E. Fairley, Software Risk Management. Software engineering glossary  
<http://ieeexplore.ieee.org/stamp/stamp.jsp?arnumber=01438337>
- Risk Assessment and Allocation for Highway Construction Management.  
[http://international.fhwa.dot.gov/riskassess/risk\\_hcm06\\_04.cfm#sfig17](http://international.fhwa.dot.gov/riskassess/risk_hcm06_04.cfm#sfig17)
- Caltran Project Risk Management Handbook,  
[http://www.dot.ca.gov/hq/projmgmt/documents/prmhb/caltrans\\_project\\_risk\\_management\\_handbook\\_20070502.pdf](http://www.dot.ca.gov/hq/projmgmt/documents/prmhb/caltrans_project_risk_management_handbook_20070502.pdf)