PMBOK 6th Edition - Project Risk Management

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Project risk will find you if you don’t find it first
Project Risk Management includes the processes of conducting risk management planning, identification, analysis, response planning, response implementation, and monitoring risk on a project.

The objectives of project risk management are to increase the probability and/or impact of positive risks and to decrease the probability and/or impact of negative risks, in order to optimize the chances of project success.
Project Risk Management

Key Concepts

All projects are risky!!!

**Individual project risk**: is an uncertain event or condition that, if it occurs, has a positive or negative effect on one or more project objectives.

**Overall project risk**: is the effect of uncertainty on the project as a whole, arising from all sources of uncertainty including individual risks, representing the exposure of stakeholders to the implications of variations in project outcome, both positive and negative.
Project Risk Perspective

Projects, Programs, Supply Chain

- **COST** (Budgets overruns)
- **SCOPE** (Achievement)
- **QUALITY** (Constraints & Assumptions)
- **SCHEDULE** (Slippage of time)
Program Risk Perspective

Business Units, Managers, Board of Directors

COMMUNICATION
(Targets, thresholds, escalation/delegation, reporting)

STRATEGY ALIGNMENT
(Common themes)

PERFORMANCE
(Objectives, Scope & Profitability)
Corporate Risk Perspective

Customers, Funders, Shareholders

- **INVESTMENT & FUNDING**
  (Return on Investment, Value for money)

- **MARKET PERCEPTION**
  (Share price, audit report)

- **GOVERNANCE & ASSURANCE**
  (Risk, Controls & Compliance)
Risk and Organizations

- **Risk Appetite** – degree of uncertainty an entity is willing to take in anticipation of a reward

- **Risk Tolerance** – degree, amount or volume of risk that an organization or individual will withstand

- **Risk Threshold** – risk will be accepted below a certain level of uncertainty or impact
Project Risk Management

Trends and emerging practices

• **Non-event risks**
  - Variability risks: uncertainty exists about some key characteristics of a planned event or activity or decision (productivity below or above target, number of errors found during testing, etc.)
  - Ambiguity risks: uncertainty exists about what might happen in the future (future development of regulatory frameworks, inherent complexity of the project, etc.)

• **Project Resilience**: the existence of emergent risk is becoming clear, with a growing awareness of so-called unknowable-unknowns
  - Right level of budget and schedule contingency for emergent risks
  - Flexible project processes
  - Empowered project team
  - Frequent review of early warning signs
  - Clear input from stakeholders to clarify areas where the project scope or strategy can be adjusted in response to emergent risks

• **Integrated risk management**: Projects exist in an organizational context, and they may form part of a program or portfolio. Risk exists at each of these levels, and risks should be owned and managed at the appropriate level
Project Risk Management

Tailoring considerations

- Project Size
- Project Complexity
- Project Importance
- Development Approach
Project Risk Management Data Diagram

- **Plan Risk Management**
- **Identify Risks**
- **Perform Quantitative Risk Analysis**
- **Perform Qualitative Risk Analysis**
- **Monitor Risks**
- **Implement Risk Responses**
- **Plan Risk Responses**
Where are we in the project management process groups?

### Project Risk Management Process Chart

<table>
<thead>
<tr>
<th>Knowledge Areas</th>
<th>Initiating</th>
<th>Planning</th>
<th>Executing</th>
<th>Monitoring and Controlling</th>
<th>Closing</th>
</tr>
</thead>
<tbody>
<tr>
<td>[4] Project Integration Management</td>
<td>4.1 Develop Project Charter</td>
<td>4.2 Develop Project Management Plan</td>
<td>4.3 Direct and Manage Project Work</td>
<td>4.4 Manage Project Knowledge</td>
<td>4.5 Monitor and Control Project Work</td>
</tr>
<tr>
<td>[5] Project Scope Management</td>
<td>5.1 Plan Scope Management</td>
<td>5.2 Collect Requirements</td>
<td>5.3 Define Scope</td>
<td>5.4 Create WBS</td>
<td>5.5 Validate Scope</td>
</tr>
<tr>
<td>[6] Project Schedule Management</td>
<td>6.1 Plan Schedule Management</td>
<td>6.2 Define Activities</td>
<td>6.3 Sequence Activities</td>
<td>6.4 Estimate Activity Durations</td>
<td>6.5 Develop Schedule</td>
</tr>
<tr>
<td>[8] Project Quality Management</td>
<td>8.1 Plan Quality Management</td>
<td>8.2 Manage Quality</td>
<td>8.3 Control Quality</td>
<td></td>
<td></td>
</tr>
<tr>
<td>[10] Project Communications Management</td>
<td>10.1 Plan Communications Management</td>
<td>10.2 Manage Communications</td>
<td>10.3 Monitor Communications</td>
<td></td>
<td></td>
</tr>
<tr>
<td>[12] Project Procurement Management</td>
<td>12.1 Plan Procurement Management</td>
<td>12.2 Conduct Procurements</td>
<td>12.3 Control Procurements</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Plan Risk Management is the process of defining how to conduct risk management activities for a project.
Plan Risk Management

Inputs
- Project Charter
- Project Management Plan
- Project Documents:
  - Stakeholder register
- Enterprise environmental factors
  - Overall risk thresholds

• Organizational Process Assets
  - Organizational risk policy
  - Risk categories, possibly organized into a risk breakdown structure
  - Common definitions of risk concepts and terms
  - Risk statement formats
  - Templates for the risk management plan, risk register, and risk report
  - Roles and responsibilities
  - Authority levels for decision making
  - Lessons learned repository from previous similar projects
Tools and techniques

• Expert Judgment:
  • Familiarity with the organization’s approach to managing risk, including enterprise risk management where this is performed
  • Tailoring risk management to the specific needs of a project
  • Types of risk that are likely to be encountered on projects in the same area

• Data analysis:
  • Stakeholder Analysis

• Meetings
Plan Risk Management

Outputs:
- Risk Management Plan
  - Risk strategy
  - Methodology
  - Roles and responsibilities
  - Funding
  - Timing
  - Risk Categories
  - Stakeholder risk appetite
  - Definitions of risk probability and impacts
  - Probability and impact matrix
  - Reporting formats
  - Tracking
# Risk breakdown structure

Plan Risk Management

Probability and impact scales

<table>
<thead>
<tr>
<th>SCALE</th>
<th>PROBABILITY</th>
<th>TIME</th>
<th>COST</th>
<th>QUALITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very High</td>
<td>&gt;70%</td>
<td>&gt;6 months</td>
<td>&gt;$5M</td>
<td>Very significant impact on overall functionality</td>
</tr>
<tr>
<td>High</td>
<td>51-70%</td>
<td>3-6 months</td>
<td>$1M-$5M</td>
<td>Significant impact on overall functionality</td>
</tr>
<tr>
<td>Medium</td>
<td>31-50%</td>
<td>1-3 months</td>
<td>$501K-$1M</td>
<td>Some impact in key functional areas</td>
</tr>
<tr>
<td>Low</td>
<td>11-30%</td>
<td>1-4 weeks</td>
<td>$100K-$500K</td>
<td>Minor impact on overall functionality</td>
</tr>
<tr>
<td>Very Low</td>
<td>1-10%</td>
<td>1 week</td>
<td>&lt;$100K</td>
<td>Minor impact on secondary functions</td>
</tr>
<tr>
<td>Nil</td>
<td>&lt;1%</td>
<td>No change</td>
<td>No change</td>
<td>No change in functionality</td>
</tr>
</tbody>
</table>

Identify Risks is the process of identifying individual project risks as well as sources of overall project risk, and documenting their characteristics.
Identify Risks

Inputs

- Project Management Plan
  - Requirements Management Plan
  - Schedule Management Plan
  - Cost Management Plan
  - Quality Management Plan
  - Resource Management Plan
  - Risk Management Plan
  - Scope Baseline
  - Schedule Baseline
  - Cost Baseline
- Agreements
- Procurement Documentation

• Project Documents
  - Assumption Log
  - Cost Estimates
  - Duration Estimates
  - Issue Log
  - Lessons Learned Register
  - Requirements Documentation
  - Resource Requirements
  - Stakeholder Register

• Enterprise Environmental Factors
  - Published material, including commercial risk databases or checklists, Academic studies. Benchmarking results, Industry studies of similar projects

• Organizational Process Assets
  - Project files including actual data, organizational and process controls, risk statement formats, checklists
Identify Risks

Tools and techniques

- Expert Judgment
- Data Gathering
  - Brainstorming
  - Checklists
  - Interviews
- Data Analysis
  - Root cause analysis
  - Assumption and constraints analysis
  - Swot Analysis
  - Document Analysis
- Interpersonal and team skills
- Prompt lists
- Meetings
# Identify Risks

## Tools & Techniques

<table>
<thead>
<tr>
<th><strong>Strengths</strong></th>
<th><strong>Weaknesses</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural priorities that are obvious</td>
<td>Options potentially interesting</td>
</tr>
<tr>
<td>• What are your points of advantage?</td>
<td>• What could you improve?</td>
</tr>
<tr>
<td>• What do you do well?</td>
<td>• What do you do badly?</td>
</tr>
<tr>
<td>• What are the resources you can count on?</td>
<td>• What should you avoid?</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Opportunities</strong></th>
<th><strong>Threats</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Problems easy to defend and counter</td>
<td>Potentially high-risk situations</td>
</tr>
<tr>
<td>• What good deals are you facing?</td>
<td>• What obstacles did you face?</td>
</tr>
<tr>
<td>• What are the interesting trends you are familiar with?</td>
<td>• What are your competitors doing?</td>
</tr>
<tr>
<td>Good deals can result from such things as:</td>
<td>• The requirements and specifications of your business, products or services changing?</td>
</tr>
<tr>
<td>• Changes in technology or in the market on a large or small scale</td>
<td>• Changes in technology threaten your position?</td>
</tr>
</tbody>
</table>
Identify Risks

Tools & Techniques

ISHIKAWA Diagram –
Three phases of research
• Identification of the effect that you want to study
• Construction of cause and effect diagram
• Analysis of the cause-and-effect diagram constructed
Three phases to solve
• Surveys on probable causes
• Decide most appropriate corrective action
• Verification of the effectiveness of action

Information provided courtesy of Rush-Presbyterian-St. Luke’s Medical Center
Identify Risks

Outputs

- Risk Register
  - List of identified risks
  - Potential Risk Owners
  - List of potential risk responses
- Risk Report
  - Sources of overall project risk
  - Summary information on identified individual project risks

Project Documents Updates

- Assumption Log
- Issue Log
- Lessons Learned Register
Perform Qualitative Risk Analysis is the process of prioritizing individual project risks for further analysis or action by assessing their probability of occurrence and impact as well as other characteristics. The key benefit of this process is that it focuses efforts on high-priority risks.
Perform Qualitative Risk Analysis

**Inputs**
- **Project Management Plan**
  - Risk Management Plan
- **Project Documents**
  - Assumption log
  - Risk Register
  - Stakeholder register

**Enterprise Environmental Factors**
- Industry studies of similar projects
- Published material, including commercial risk databases or checklists

**Organizational Process Assets**
- Information from similar completed projects
## Tools and techniques

- **Expert Judgment**
  - Previous similar projects
  - Qualitative risk analysis

- **Data Gathering**
  - Interviews

- **Data Analysis**
  - Risk Data Quality Assessment
  - Risk Probability and Impact Assessment
  - Assessment of other risk parameters:
    - Urgency, proximity, dormancy, etc.

- **Interpersonal and team skills**
  - Facilitation

- **Risk Categorization**

## Enterprise Environmental Factors

- Probability and impact matrix
- Hierarchical charts

- **Meetings**
Perform Qualitative Risk Analysis

Probability and impact matrix

Perform Qualitative Risk Analysis

Outputs

- Project Documents Updates
  - Assumption log
  - Issue log
  - Risk register
  - Risk report
Perform Quantitative Risk Analysis is the process of numerically analyzing the combined effect of identified individual project risks and other sources of uncertainty on overall project objectives. The key benefit of this process is that it quantifies overall project risk exposure, and it can also provide additional quantitative risk information to support risk response planning.
Perform Quantitative Risk Analysis

Inputs

- Project Management Plan
  - Risk Management Plan
  - Scope Baseline
  - Schedule Baseline
  - Cost Baseline
- Project Documents
  - Assumption log
  - Basis of estimates
  - Cost estimates
  - Cost forecasts
  - Duration estimates
  - Milestone list
  - Resource requirements
  - Risk register
  - Risk report
  - Schedule forecast

• Enterprise Environmental Factors
  - Industry studies of similar projects
  - Published material, including commercial risk databases or checklists

• Organizational Process Assets
  - Information from similar completed projects
Perform Quantitative Risk Analysis

Tools and techniques

- Expert Judgment
  - Numeric inputs (three values estimates)
  - Representation of uncertainty
  - Modeling techniques
  - Best tools
  - Output interpretation

- Data Gathering
  - Interviews (three values estimates)

- Interpersonal and team skills
  - Facilitation

- Representation of uncertainty
  - Probability distribution

Data Analysis

- Simulation (Monte Carlo)
- Sensitivity analysis (Tornado diagram)
- Decision tree analysis
# Perform Quantitative Risk Analysis

<table>
<thead>
<tr>
<th>Risk</th>
<th>Probability</th>
<th>Impact €</th>
<th>EMV €</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>15%</td>
<td>2000</td>
<td>300</td>
</tr>
<tr>
<td>2</td>
<td>40%</td>
<td>5000</td>
<td>2000</td>
</tr>
<tr>
<td>3</td>
<td>30%</td>
<td>1000</td>
<td>300</td>
</tr>
<tr>
<td>4</td>
<td>55%</td>
<td>-4000</td>
<td>-2200</td>
</tr>
<tr>
<td>5</td>
<td>20%</td>
<td>6000</td>
<td>1200</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>10000</td>
<td>1600</td>
</tr>
</tbody>
</table>
Perform Quantitative Risk Analysis

![Distribution Graph](chart.png)

**Engineering, Procurement, Construction sample**

**A180 - Construction : Finish Date**

<table>
<thead>
<tr>
<th>Distribution (start of interval)</th>
</tr>
</thead>
<tbody>
<tr>
<td>17 Aug 07</td>
</tr>
<tr>
<td>0.0</td>
</tr>
<tr>
<td>40.0</td>
</tr>
<tr>
<td>Hits</td>
</tr>
</tbody>
</table>

**Data**
- Finish Date of: A180 - Construction
- Analysis:
  - Simulation: Latin Hypercube
  - Iterations: 1000
- Convergence at mean
  - Converged in 200 iterations
    - (variation < 1% over 100 iterations)
- Mean Total Plan Cost:
  - Converged in 200 iterations
    - (variation < 1% over 100 iterations)
- Statistics:
  - Minimum: 06 Aug 07
  - Maximum: 14 Jan 08
  - Mean: 18 Oct 07
  - Std Deviation: 30.46
  - Bar Width: week
Perform Quantitative Risk Analysis

Activity or Risk Driving Projection Duration

- Activity B12.3  Manufacture reactors
- Risk 5.2  DCS may fail installation test
- Risk 5.7  Duplicate test may not be required
- Activity A3.12  Construct control room
- Risk 4.6  Piling contractor may deliver early
- Activity A7.1  Provide temporary facilities
- Activity D1.9  Install Equipment
- Risk 7.2  Hydrotstein may find fewer faults

Correlation with Project Duration

Perform Quantitative Risk Analysis

<table>
<thead>
<tr>
<th>Decision Definition</th>
<th>Decision Node</th>
<th>Chance Node</th>
<th>Net Path Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Decision to be Made</td>
<td>Input: Cost of Each Decision</td>
<td>Input: Scenario Probability, Reward if it Occurs</td>
<td>Computed: Payoffs minus Costs along Path</td>
</tr>
<tr>
<td></td>
<td>Output: Decision Made</td>
<td>Output: Expected Monetary Value (EMV)</td>
<td></td>
</tr>
<tr>
<td>Build or Upgrade?</td>
<td>Build New Plant (Invest $120M)</td>
<td>Strong Demand ($200M)</td>
<td>$80M = $200M - $120M</td>
</tr>
<tr>
<td></td>
<td>$36M = .60 ($80M) + .40 ($-30M)</td>
<td>Weak Demand ($90M)</td>
<td>$-30M = $90M - $120M</td>
</tr>
<tr>
<td></td>
<td>EMV (before costs) of Build New Plant considering demand</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Upgrade Plant (Invest $50M)</td>
<td>Strong Demand ($120M)</td>
<td>$70M = $120M - $50M</td>
</tr>
<tr>
<td></td>
<td>$46M = .60 ($70M) + .40 ($10M)</td>
<td>Weak Demand ($60M)</td>
<td>$10M = $60M - $50M</td>
</tr>
<tr>
<td></td>
<td>EMV (before costs) of Upgrade Plant considering demand</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Perform Quantitative Risk Analysis

Outputs

- Project Documents Updates
  - Risk report:
    - Assessment of overall risk exposure
    - Detailed probabilistic analysis of the project
    - Prioritized list of individual project list
    - Trends in quantitative risk analysis results
    - Recommended risk responses
Plan Risk Responses is the process of developing options, selecting strategies, and agreeing on actions to address overall project risk exposure, as well as to treat individual project risks.
# Plan Risk Responses

## Inputs
- **Project Management Plan**
  - Resource Management Plan
  - Risk Management Plan
  - Cost Baseline
- **Project Documents**
  - Lessons learned register
  - Project schedule
  - Project team assignments
  - Resource calendars
  - Risk register
  - Risk report
  - Stakeholder register

## Enterprise Environmental Factors
- Risk appetite and thresholds of key stakeholders

## Organizational Process Assets
- Templates for the risk management plan, risk register, and risk report
- Historical databases
- Lessons learned repositories from similar projects
Plan Risk Responses

Tools and techniques

• Expert Judgment
  • Threat response strategies
  • Opportunity response strategies
  • Contingent response strategies
  • Overall project risk response strategies

• Data gathering
  • Interviews

• Interpersonal and team skills
  • Facilitation

• Strategies for threats
  • Escalate
  • Avoid
  • Transfer
  • Mitigate
  • Accept

• Strategies for opportunities
  • Escalate
  • Exploit
  • Share
  • Enhance
  • Accept

• Contingent response strategies
  • Contingency plans

• Strategies for overall project risks
  • As above

• Data analysis
  • Alternative analysis
  • Cost-benefit analysis

• Decision making
  • Multi criteria decision analysis
Plan Risk Responses

Outputs

- Change requests
- Project Management Plan Updates
  - Schedule management plan
  - Cost management plan
  - Quality management plan
  - Resource management plan
  - Procurement management plan
  - Scope baseline
  - Schedule baseline
  - Cost baseline

Project Documents Updates

- Assumption log
- Cost forecasts
- Lessons learned register
- Project schedule
- Project team assignments
- Risk register
- Risk report
Implement Risk Responses is the process of implementing agreed-upon risk response plans
Implement Risk Responses

**Inputs**

- **Project Management Plan**
  - Risk Management Plan
- **Project Documents**
  - Lessons learned register
  - Risk register
  - Risk report
- **Organizational Process Assets**
  - Lessons learned repositories from similar projects
Implement Risk Responses

Tools and Techniques

• Expert Judgment
  • Response implementation
• Interpersonal and team skills
  • Influencing
• Project management information system (PMIS)
Implement Risk Responses

Outputs

- Change requests
  - Response implementation
- Project documents updates
  - Issue log
  - Lessons learned register
  - Project team assignments
  - Risk register
  - Risk report
Monitor Risks is the process of monitoring the implementation of agreed-upon risk response plans, tracking identified risks, identifying and analyzing new risks, and evaluating risk process effectiveness throughout the project.
Monitor Risks

Inputs

- Project Management Plan
  - Risk Management Plan
- Project Documents
  - Issue log
  - Lesson learned register
  - Risk register
  - Risk report
- Work performance data
- Work performance report
Monitor Risks

Tools and techniques

- Data analysis
  - Technical performance analysis
  - Reserve analysis
- Audits
- Meetings
Monitor Risks

**Outputs**
- Work Performance Information
- Change Requests
- Project Management Plan Updates
- Project Document Updates
  - Assumption log
  - Issue log
  - Lessons learned register
  - Risk register
  - Risk Report

**Organizational Process Assets Updates**
- Templates for the risk management plan, risk register, and risk report
- Risk breakdown structure
References

✓ References

✓ PMI, PMBoK Guide 6\textsuperscript{th} Edition
✓ PMI, Practice standard for project risk management, 2009
Grazie per l’attenzione!

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