



# **Software Process & Project Management**

## **Chapter Seven : Risk Management**

# Outline

- Introduction
- Why Risk management?
- Risk Management Planning
- Project Risk identification
- Risk Monitoring and Control

# Learning Objectives

- Define project risk.
- Recognize the four key stages in project risk management & the steps necessary to manage risk.
- Explain the Project Risk Analysis & Management (PRAM) process.

# Why Risk Management?

- **Minimizes Negative Impacts:** Reduces the likelihood and severity of problems that can derail the project.
- **Maximizes Opportunities:** Helps identify and capitalize on potential benefits.
- **Improves Project Success Rates:** Increases the chances of meeting project objectives (on time, within budget, to the required quality).
- **Enhances Decision Making:** Provides better information for making informed choices throughout the project.
- **Increases Stakeholder Confidence:** Demonstrates proactive management and builds trust.
- **Reduces Surprises and Crises:** Allows for planning and preparation rather than reacting to unexpected events.
- **Optimizes Resource Allocation:** Helps focus resources on the most significant potential issues.
- **Supports Continuous Improvement:** Lessons learned from risk management can inform future projects.

# What is Project Risk?

- Projects operate in an environment composed of uncertainty.
  - *uncertainty regarding project funding, the availability of necessary resources, changing client expectations, potential technical problems, etc.*
- This uncertainty forms the basis for project risk & the need to engage in risk management.
- PMI defines **project risk** as “an uncertain event or condition that, if it occurs, has a positive or negative effect on one or more project objectives.”

# What is Project Risk management?

- **Risk management**

- The process of **identifying, analyzing, & responding** to risk factors throughout the life of a project & in the best interests of its objectives.
- Consists of anticipating, at the beginning of the project unexpected situations that may arise that are beyond the project manager's control.
- These situations have the capacity to severely undermine the success of a project.

# Process of Risk Management

- The process of risk management generally involves a series of steps designed to help organizations identify, assess, and mitigate potential risks.:
  - What is likely to happen (the probability & impact)?
  - What can be done to minimize the probability or impact of these events?
  - What clues will signal the need for such action (i.e., what clues should I actively look for)?
  - What are the likely outcomes of these problems & my anticipated reactions?

# What is Project Risk?

- **What Proper Planning Does Achieve:**
  - Proper planning significantly reduces the likelihood and impact of risks.
  - It enables project managers to develop contingency plans and mitigation strategies.
  - It improves communication and coordination among project stakeholders.
  - It provides a framework for monitoring and controlling risks throughout the project lifecycle

## **Managing Uncertainty:**

Flexibility and Adaptability, Contingency Planning

Information Gathering, Agile Methodologies

Scenario Planning



# What is Project Risk?

- Project risk is based on a simple equation:
  - ***Event Risk = (Probability of Event)(Consequences of Event)***
  - In other words, all risks must be evaluated in terms of two distinct elements: the **likelihood that the event is going to occur, & the consequences, or effect of its occurrence.**
- Risk & opportunity are opposite sides of the same coin—opportunity emerges from favorable project uncertainties, & negative consequences from unfavorable events.

# Risk Management: A Four-Stage Process

Risk management comprises four distinct steps:

- 1) **Risk Identification**—the process of determining the specific risk factors that can reasonably be expected to affect your project.
- 2) **Analysis of Probability & Consequences**—the potential impact of these risk factors, determined by how likely they are to occur & the effect they would have on the project if they did occur.
- 3) **Risk Mitigation Strategies**—steps taken to minimize the potential impact of those risk factors deemed sufficiently threatening to the project.
- 4) **Control & Documentation**—creating a knowledge base for future projects based on lessons learned.

# Risk Management: A Four-Stage Process

1) **RISK IDENTIFICATION** (This is the initial step, where potential risks are identified)

– **Technical Risks:**

- Problems with technology, such as hardware or software failures.
- Difficulties with software design or implementation.
- Challenges with integration or compatibility.

– **Schedule Risks:**

- Unrealistic deadlines.
- Inaccurate time estimations.
- Delays in receiving necessary resources.

--**Budget Risks:**

- Cost overruns due to unforeseen expenses and inaccurate budget estimations.
- Changes in project scope

# Risk Management: A Four-Stage Process

## 1) RISK IDENTIFICATION

### ■ Resource Risks:

- Lack of skilled personnel.
- Loss of key team members.
- Insufficient equipment or tools

### ■ Organizational Risks:

- Changes in priorities or management.
- Lack of communication or collaboration.
- Insufficient stakeholder support.
- Absenteeism
- Resignation
- Staff being pulled away by management

# Risk Management: A Four-Stage Process

## 1) RISK IDENTIFICATION

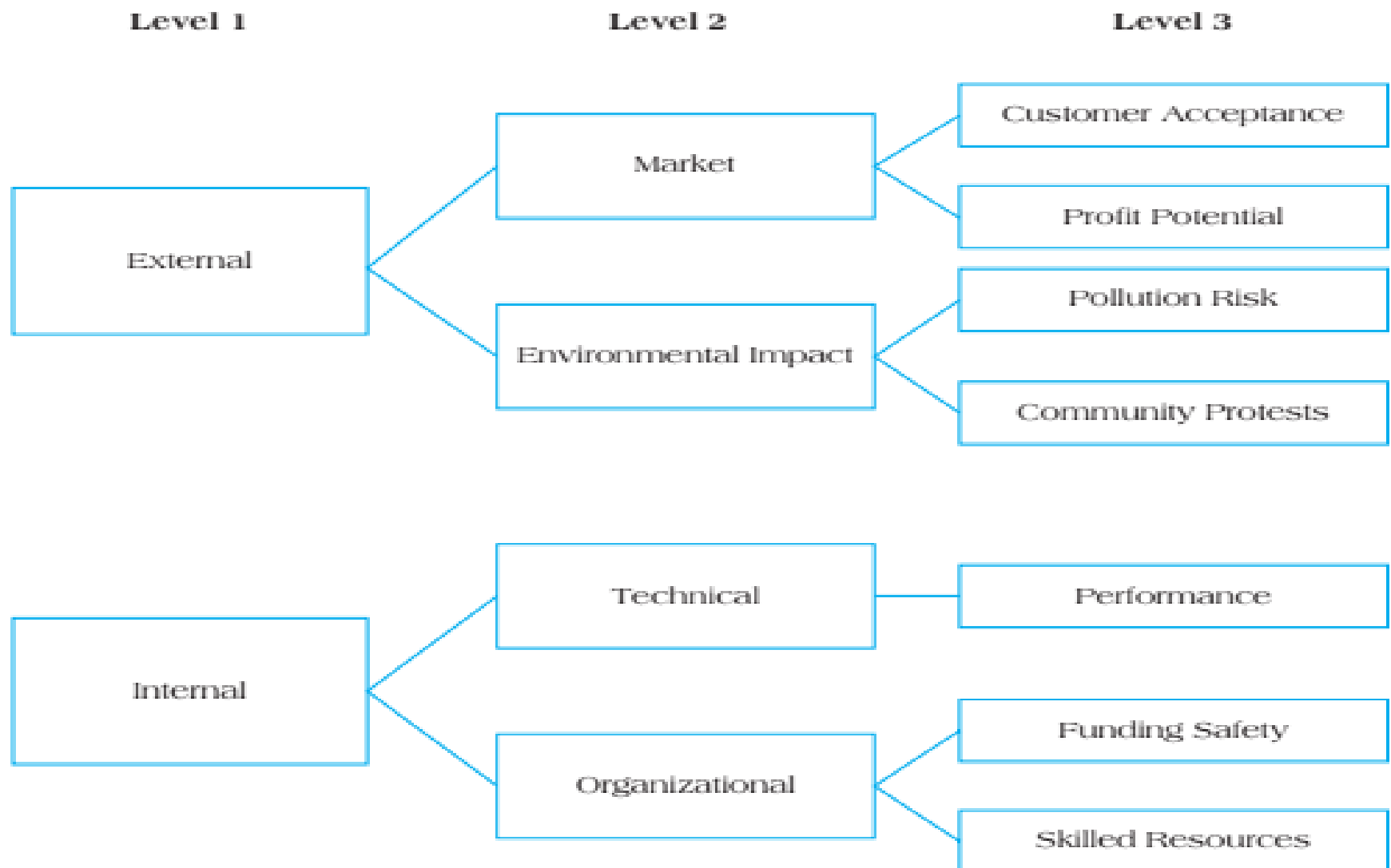
- **External Risks:**
  - Changes in market conditions.
  - Legal or regulatory changes.
  - Actions of third-party vendors.
- **Methods include: how to identify**
  - Brainstorming sessions
  - Reviewing historical data
  - Conducting interviews
  - Using checklists
  - Analyzing industry trends

# Risk Management: A Four-Stage Process

- **RISK BREAKDOWN STRUCTURES (RBS)**

- Useful tool in identifying & categorizing project risks is defined as “a source-oriented grouping of project risks that organizes & defines the total risk exposure of the project.”
- is like WBS; however, in this case, our goal is to create a hierarchical representation of the project’s risks, starting at the higher, general level & breaking the risks down to more specific risks at lower levels.

# Risk Management: A Four-Stage Process



**FIGURE 7.4** Risk Breakdown Structure (RBS)

## **The RBS is divided into three main levels:**

### **1.Level 1:**

External: Risks that originate from outside the organization, such as market conditions, environmental factors, or political/social influences.

Internal: Risks that originate from within the organization, such as internal processes, resources, or management.

### **2.Level 2:**

Market: Risks related to the market, such as customer acceptance, profit potential, or competition.

Environmental Impact: Risks related to the project's or organization's environmental impact, such as pollution or community protests.

Technical: Risks related to the technical aspects of the project or organization, such as performance or funding safety.

Organizational: Risks related to the organizational structure, processes, and resources.

### **3.Level 3:**

Customer Acceptance: Risks related to customer acceptance of the product or service.

Profit Potential: Risks related to the project's or organization's ability to generate profit.

Pollution Risk: Risks related to the project's or organization's environmental impact and potential pollution.

Community Protests: Risks related to community opposition or protests.

Performance: Risks related to the technical performance of the project or organization.

Funding Safety: Risks related to the availability and security of funding.

Skilled Resources: Risks related to the availability and competence of skilled resources.



# Risk Management: A Four-Stage Process

## 2) ANALYSIS OF PROBABILITY & CONSEQUENCES

- construct a risk impact matrix as shown in Figure 7.5
- The matrix reflects all identified project risks, each prioritized according to the probability of its occurrence, along with the potential consequences for the project.

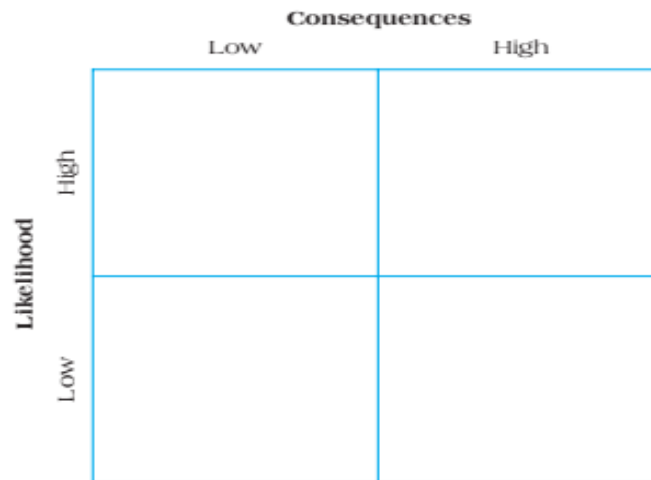


FIGURE 7.5 Risk Impact Matrix

# The matrix is divided into four quadrants:

1. **Low Likelihood, Low Consequences:** Risks that fall into this quadrant are considered low priority and may not require extensive risk management efforts.
2. **Low Likelihood, High Consequences:** Risks in this quadrant have a low probability of occurring but could have a significant impact if they do. These risks should be closely monitored and have contingency plans in place.
3. **High Likelihood, Low Consequences:** Risks in this quadrant are more likely to occur but have relatively minor consequences. These risks should be managed through proactive measures to reduce their likelihood.
4. **High Likelihood, High Consequences:** Risks that fall into this quadrant are considered the most critical and require the most attention. These high-priority risks should have comprehensive risk response strategies developed and implemented.

# Risk Management: A Four-Stage Process

- **RISK BREAKDOWN STRUCTURES (RBS)**
  - Useful tool in identifying & categorizing project risks is defined as “a source-oriented grouping of project risks that organizes & defines the total risk exposure of the project.”
  - Comprehensive Risk Identification.
  - Improved Risk Categorization and Analysis:
  - Enhanced Communication and Collaboration.
  - Effective Risk Response Planning.
  - Enhanced Risk Monitoring and Control
  - Visual Representation:

TABLE 7.1 Determining Likely Risks and Consequences				
Probability of Failure ( $P_f$ )				
Score	Maturity	Complexity	Dependency	
Low (0.1)	Existing software	Simple design	Not limited to existing system or clients. No external or uncontrollable events are likely to have an impact on the project.	
Minor (0.3)	Minor redesign	Minor increase in complexity	Schedule or performance depends on an existing system. Effect on cost or schedule is minor.	
Moderate (0.5)	Major change	Moderate increase	Moderate risk to schedule or performance due to dependence on existing system, facility, or processes. Effect on cost is moderate.	
Significant (0.7)	Technology is available, but complex design	Significant increase	Schedule or performance depends on new system or process. Significant cost or schedule risk.	
Major (0.9)	State of art, some research complete	Extremely complex	Schedule and performance depend on new system and process. Very high cost or schedule risk.	
Consequence of Failure ( $C_f$ )				
Score	Cost	Schedule	Reliability	Performance
Low (0.1)	Budget estimate not exceeded	Negligible impact on program, no impact on critical path	Minimal or no reliability consequence	Minimal or no performance consequence.
Minor (0.3)	Cost estimate exceeds budget by < 5%	Minor slip in schedule (less than 5%)	Small reduction in reliability	Small reduction in system performance.
Moderate (0.5)	Cost estimate exceeds budget by < 15%	Small slip in schedule starting to impact critical path	Some reduction in reliability	Some reduction in system performance. May require moderate debugging.
Significant (0.7)	Cost estimate exceeds budget by < 30%	Development time slips in excess of 1 month, requires readjustment of critical path	Significant degradation in reliability	Significant degradation in system performance. Guarantees are at risk. Serious debugging required.
Major (0.9)	Cost estimate exceeds budget by > 50%	Large schedule slips ensure the system will miss client time frame	Reliability goals cannot be achieved under current plan	Performance goals cannot be achieved. Results may not be usable.

# Risk Management: A Four-Stage Process

**TABLE 7.2** Calculating a Project Risk Factor

1. Use the project team's consensus to determine the scores for each Probability of Failure category: Maturity ( $P_m$ ), Complexity ( $P_c$ ), Dependency ( $P_d$ ).
2. Calculate  $P_f$  by adding the three categories and dividing by 3:

$$P_f = (P_m + P_c + P_d)/3$$

3. Use the project team's consensus to determine the scores for each Consequence of Failure category: Cost ( $C_c$ ), Schedule ( $C_s$ ), Reliability ( $C_r$ ), Performance ( $C_p$ ).
4. Calculate  $C_f$  by adding the four categories and dividing by 4:

$$C_f = (C_c + C_s + C_r + C_p)/4$$

5. Calculate Overall Risk Factor for the project by using the formula:

$$RF = P_f + C_f - (P_f)(C_f)$$

## Rule of Thumb:

Low risk	$RF < .30$
Medium risk	$RF = .30 \text{ to } .70$
High risk	$RF > .70$

# Risk Management: A Four-Stage Process

## 3) RISK MITIGATION STRATEGIES

- **ACCEPT RISK** : risks of a relatively minor nature may be present in a project. However, because the likelihood of their occurrence is so small or the consequences of their impact are so minor, they may be judged acceptable.
- **MINIMIZE RISK**: Design strategies to minimize risk
- **Avoidance**, if the project plan or other project conditions are changed in such
- a way that the risk will not occur.
- **TRANSFER RISK**: when it is impossible to change the nature of the risk either through elimination or minimization, it may be possible to shift the risks bound up in a project to another party.

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# Risk Management: A Four-Stage Process

## 4) CONTROL & DOCUMENTATION

- help managers classify & codify the various risks the firm faces, its responses to these risks, & the outcome of its response strategies.

**TABLE 7.3** Sample Risk Management Report Form

Customer: _____	Project Name: _____
Budget Number: _____	Project Team: _____
Date of Most Recent Evaluation: _____	
Risk Description: _____	
_____	
_____	
_____	
Risk Assessment: _____	Risk Factor: _____
Discussion: _____	
_____	
_____	
Risk Reduction Plan: _____	Owner: _____
_____	
Time Frame to Next Assessment: _____	
Expected Outcome: _____	
_____	
_____	

# Risk Management: A Four-Stage Process

## 4) CONTROL & DOCUMENTATION

- The sample risk management report form shown in Table 7.3 includes the important elements in change management. To be effective, the report must offer
  - a comprehensive analysis of the problem,
  - the plan for its minimization,
  - a target date, &
  - the expected outcome once the mitigation strategy has been implemented.
- In short, as a useful control document, a report form must coherently identify the key information of what, who, when, why, & how.



# Risk Management: A Four-Stage Process

## 4) CONTROL & DOCUMENTATION

- ***What***—Identify the source of risk.
- ***Who***—Assign a project team member direct responsibility for following this issue & maintaining ownership regarding its resolution.
- ***When***—Establish a time frame, that will determine when the expected mitigation is to occur.
- ***Why***—Pinpoint the most likely reasons for the risk
- ***How***—Create a detailed plan for how the risk is to be abated.

# Risk Monitoring and Control

Risk monitoring and control is a continuous process of tracking identified risks, identifying new ones, and ensuring that risk response plans are implemented effectively throughout the project.

It involves reassessing risks (likelihood and consequences), monitoring the performance of the risk response plan, and reporting the results. The goal is to mitigate and eliminate risks that could derail a project or impact a company.

## 2. Key Activities in Risk Monitoring and Control

### a. Risk Tracking

- **Regular Reviews:** Conduct regular meetings to review risk status.
- **Risk Register Updates:** Update the risk register with new information, including emerging risks and changes in risk status.

### b. Risk Assessment

- **Re-evaluation:** Periodically reassess risks to determine if their likelihood or impact has changed.
- **Quantitative Analysis:** Use quantitative methods to measure the potential impact of risks on project objectives.

### c. Risk Response Implementation

- **Monitor Responses:** Evaluate the effectiveness of risk response strategies.
- **Adjustments:** Modify risk responses as necessary based on monitoring outcomes.

### d. Reporting

- **Status Reports:** Create regular risk status reports for stakeholders, summarizing current risks, response effectiveness, and any new risks identified.
- **Communication Plans:** Ensure that communication about risks is clear and timely.

### 3. Tools and Techniques for Risk Monitoring

- a. **Risk Register:** A living document that captures all identified risks, their status, and the effectiveness of responses.
- b. **Risk Audits:** Conduct periodic audits to assess the risk management process and its effectiveness.
- c. **Performance Metrics:** Use key performance indicators (KPIs) to measure the impact of risks on project performance.
- d. **Risk Management Software:** Utilize specialized software tools for tracking and reporting risks.

# Review Questions

- 1) Do you agree with the following statement: “With proper planning, it is possible to eliminate most/all risks from a project”? Why or why not?
- 2) Discuss the advantages of using the risk breakdown structure as a tool to organize risks on a project.
- 3) Discuss risk management process .

# Review Questions

Probability of Failure	Consequences of Failure
Maturity = .3	Cost = .1
Complexity = .3	Schedule = .7
Dependency = .5	Performance = .5

add the reliability .1, Calculate the overall risk factor for this project. Would you assess this level of risk as low, moderate, or high? Why?