

Project Management: Lecture 6

Project Risk Management

Introduction

- ▶ Risk management is concerned with identifying risks and drawing up plans to minimize their effect on a project.
- ▶ A risk is a probability that some adverse circumstance will occur
 - ❑ Project risks affect schedule or resources;
 - ❑ Product risks affect the quality or performance of the product being developed;
 - ❑ Business risks affect the organization developing or procuring the product.

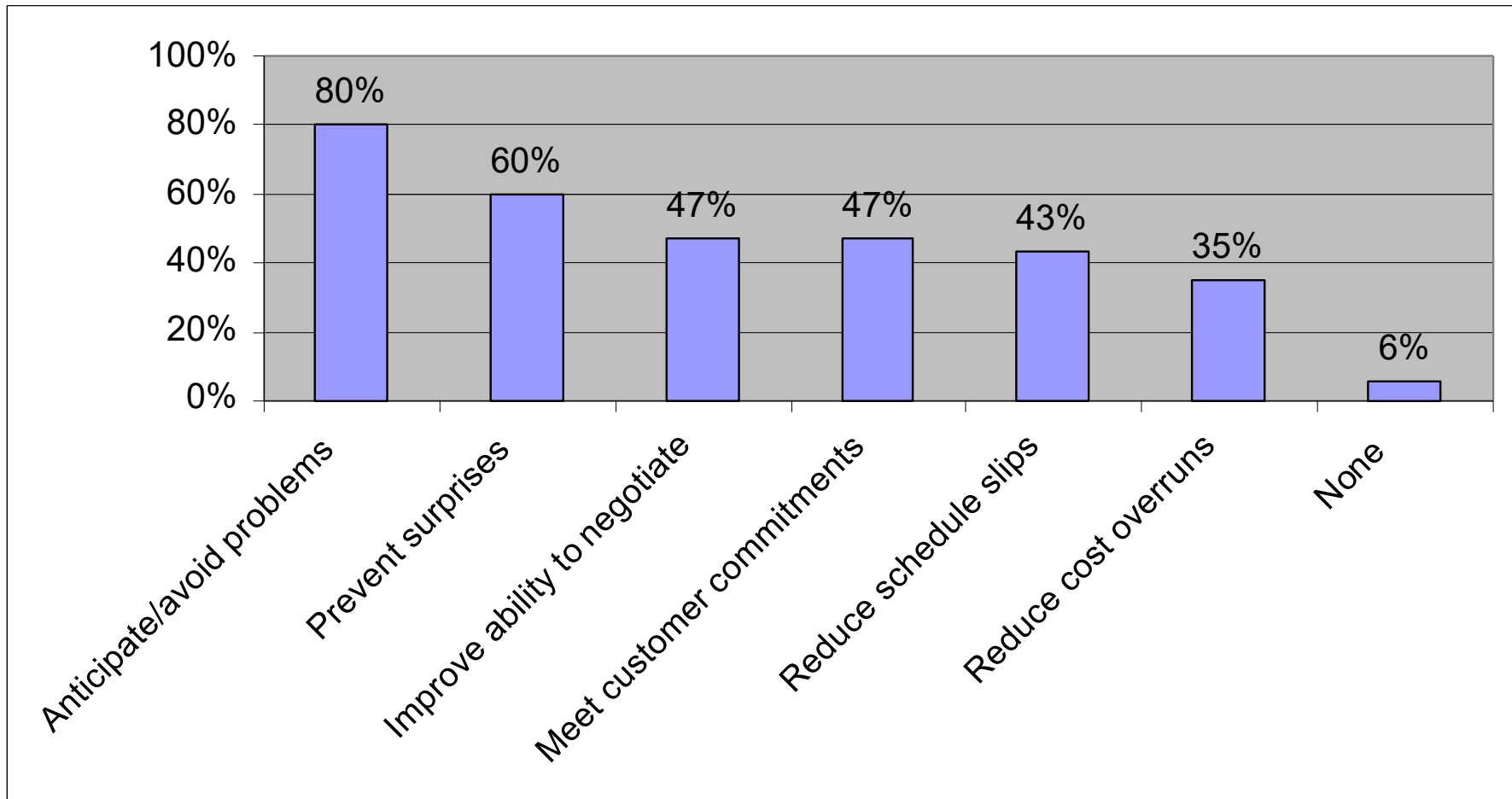
The Importance

- ❑ Project risk management is the art and science of identifying, analyzing, and responding to risk throughout the life of a project and in the best interests of meeting project objectives.
- ❑ Risk management is often overlooked in projects,
 - but it can help improve project success by helping select good projects,
 - determining project scope, and developing realistic estimates.
- ❑ Good project risk management often goes unnoticed, unlike crisis management, which indicates an obvious danger to the success of a project.
- ❑ The crisis, in turn, receives the intense interest of the entire project team.

The Importance

- ❑ Resolving a crisis has much greater visibility, often accompanied by rewards from management, than successful risk management.
- ❑ In contrast, when risk management is effective, it results in fewer problems, and for the few problems that exist, it results in more expeditious resolutions.
- ❑ It may be difficult for outside observers to tell whether risk management or luck was responsible for the smooth development of a new system, but project teams always know that their projects worked out better because of good risk management.

Benefits from Software Risk Management Practices*



*Kulik, Peter and Catherine Weber, "Software Risk Management Practices – 2001," KLCI Research Group (August 2001).

Negative Risk

- ❑ A dictionary definition of risk is “the possibility of loss or injury.”
- ❑ Negative risk involves understanding potential problems that might occur in the project and how they might impede project success.
- ❑ Negative risk management is like a form of insurance; it is an investment.
- ❑ Managing negative risks involves a number of possible actions that project managers can take to avoid, lessen, change, or accept the potential effects of risks on their projects.

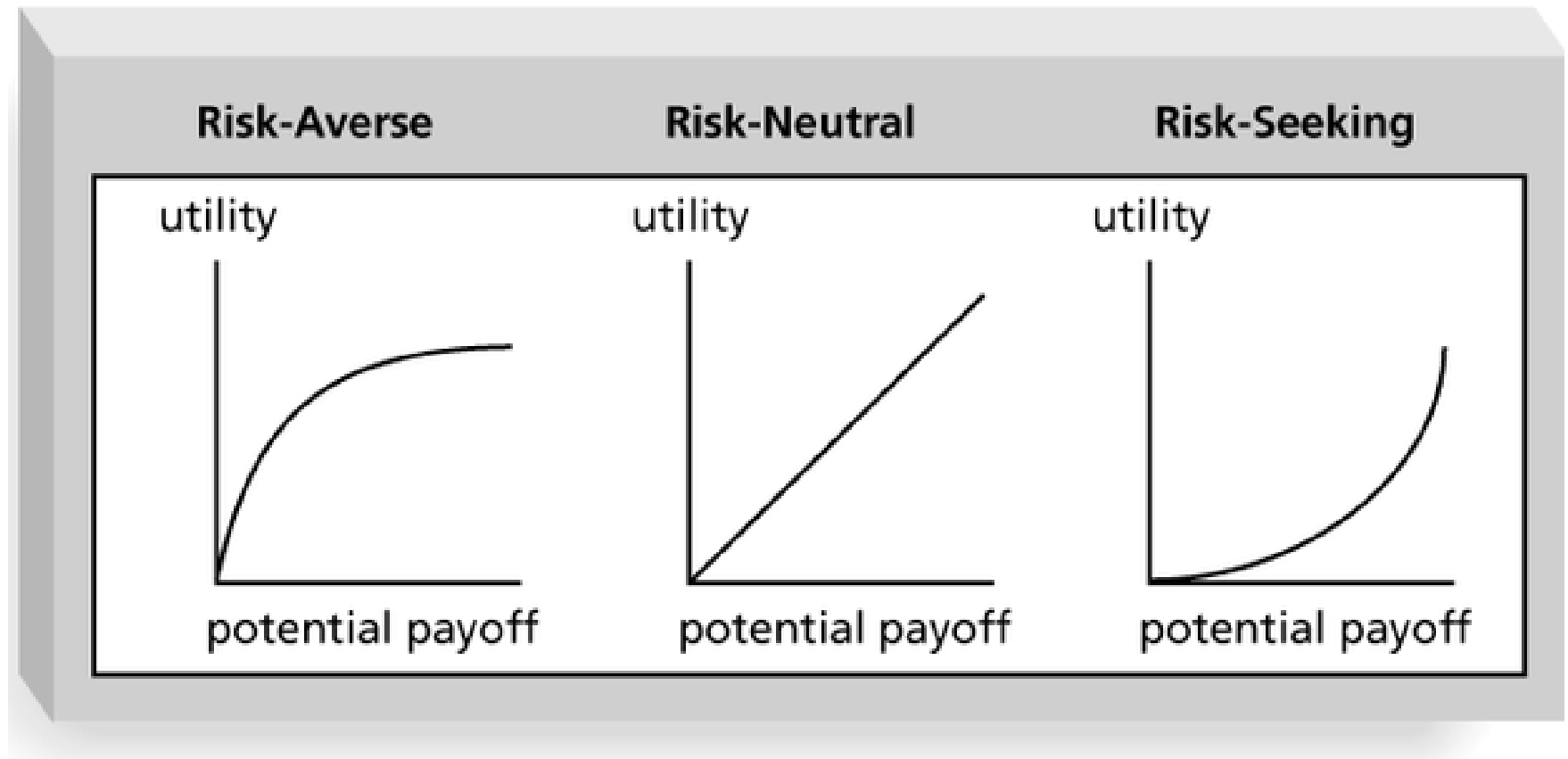
Risk Can Be Positive

- ❑ Positive risks are risks that result in good things happening; sometimes called opportunities.
- ❑ A general definition of project **risk** is an **uncertainty that can have a negative or positive effect** on meeting project objectives.
- ❑ The goal of project risk management is to minimize potential negative risks while maximizing potential positive risks.

Risk Utility

- ❑ Risk utility or risk tolerance is the amount of satisfaction or pleasure received from a potential payoff.
- ❑ Utility rises at a decreasing rate for people who are risk-averse.
- ❑ Those who are risk-seeking have a higher tolerance for risk and their satisfaction increases when more payoff is at stake.
- ❑ The risk-neutral approach achieves a balance between risk and payoff.

Risk Utility Function and Risk Preference



Examples of Risks for Software Projects

Risk	Affects	Description
Staff turnover	Project	Experienced staff will leave the project before it is finished.
Management change	Project	There will be a change of organisational management with different priorities.
Hardware unavailability	Project	Hardware that is essential for the project will not be delivered on schedule.
Requirements change	Project and product	There will be a larger number of changes to the requirements than anticipated.
Specification delays	Project and product	Specifications of essential interfaces are not available on schedule
Size underestimate	Project and product	The size of the system has been underestimated.
CASE tool under-performance	Product	CASE tools which support the project do not perform as anticipated
Technology change	Business	The underlying technology on which the system is built is superseded by new technology.
Product competition	Business	A competitive product is marketed before the system is completed.

Project Risk Management Processes

The goal of project risk management can be viewed as **minimizing potential negative risks** while **maximizing potential positive risks**.

The term known risks is sometimes used to describe risks that the project team has identified and analyzed.

Known risks can be managed proactively. However, unknown risks, or risks that have not been identified and analyzed, cannot be managed. Consists of the following processes:

- ❑ **Risk management planning:** Deciding how to approach and plan the risk management activities for the project.
- ❑ **Risk identification:** Determining which risks are likely to affect a project and documenting the characteristics of each.
- ❑ **Qualitative risk analysis:** Prioritizing risks based on their probability and impact of occurrence.

Project Risk Management Processes(Cont'd..)

- ❑ **Quantitative risk analysis:** Numerically estimating the effects of risks on project objectives.
- ❑ **Risk response planning:** Taking steps to enhance opportunities and reduce threats to meeting project objectives.
- ❑ **Risk monitoring and control:** Monitoring identified and residual risks, identifying new risks, carrying out risk response plans, and evaluating the effectiveness of risk strategies throughout the life of the project.

Project Risk Management Summary

Planning

Process: **Plan risk management**

Output: Risk management plan

Process: **Identify risks**

Output: Risk register

Process: **Perform qualitative risk analysis**

Output: Risk register updates

Process: **Perform quantitative risk analysis**

Output: Risk register updates

Process: **Plan risk responses**

Outputs: Risk register updates, risk-related contract decisions,
project management plan updates, project document updates

Monitoring and Controlling

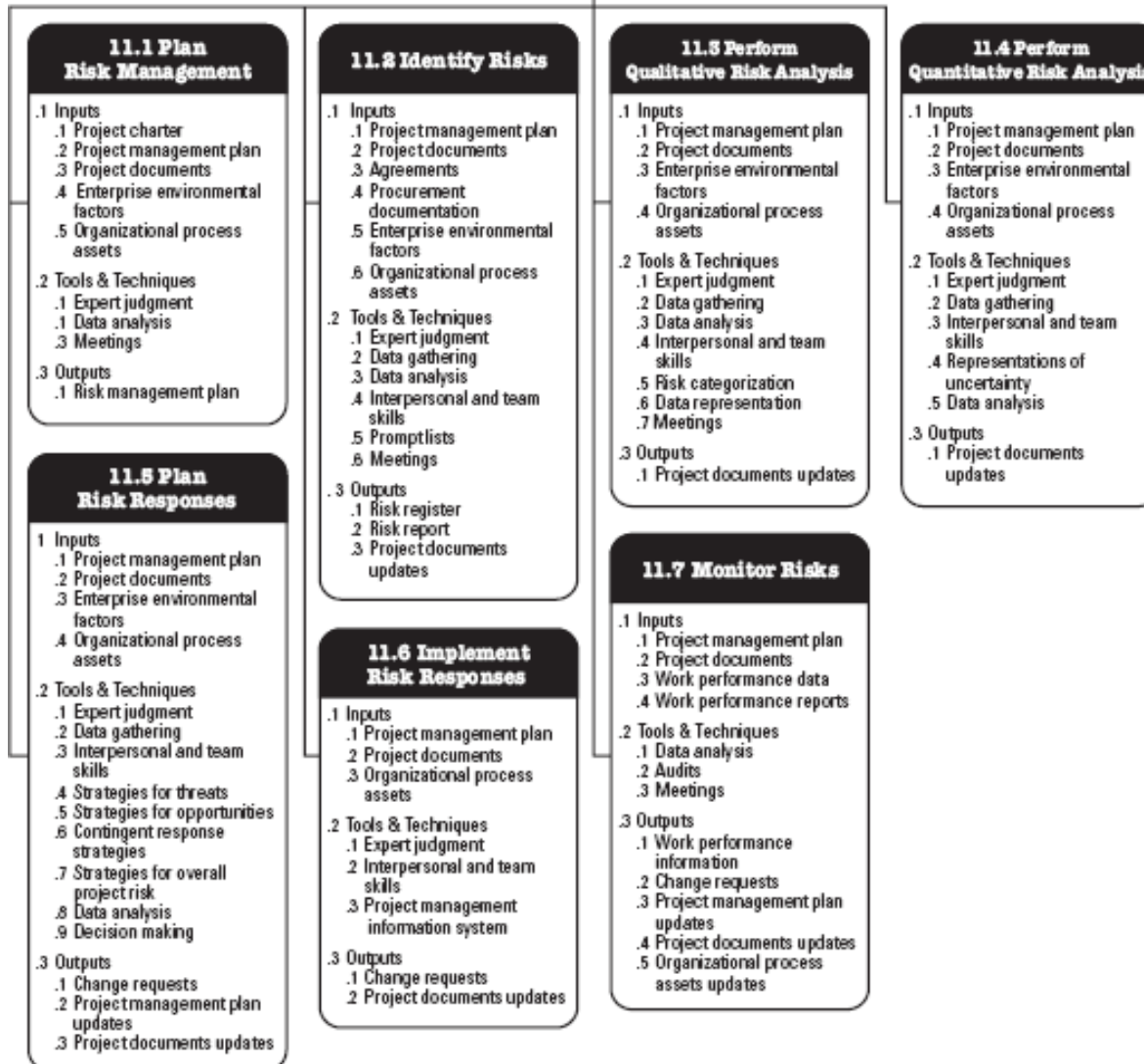
Process: **Monitor and control risks**

Outputs: Risk register updates, organizational process assets updates,
change requests, project management plan updates,
project document updates

Project Start

Project Finish

Project Risk Management Overview



Project Quality Management Overview

Tools and Techniques

- ❑ Planning meetings
 - ❑ Planning meetings to develop risk management plan.
 - ❑ Attendees :
 - ❑ project manager,
 - ❑ project team leaders,
 - ❑ anyone in the organization with responsibility to manage the risk planning and execution activities,
 - ❑ key stakeholders,
 - ❑ others
 - ❑ Use templates or other inputs as appropriate

Step 1: Risk Management Planning

- ❑ Planning risk management is the process of deciding how to approach risk management activities and plan for them in a project.
- ❑ The main output of risk management planning is a **risk management plan**—a plan that documents the procedures for managing risk throughout a project.
- ❑ The project team should review project documents and understand the organization's and the sponsor's approaches to risk.
- ❑ It is also important to review the risk tolerances of various stakeholders. For example, if the project sponsor is risk-averse, the project might require a different approach to risk management than if the project sponsor were a risk seeker.
- ❑ The level of detail will vary with the needs of the project.

Topics Addressed in a Risk Management Plan

- ❑ Methodology
- ❑ Roles and responsibilities
- ❑ Budget and schedule
- ❑ Risk categories
- ❑ Risk probability and impact
- ❑ Risk documentation

In addition to a risk management plan, many projects also include contingency plans, fallback plans, contingency reserves, and management reserves.

Contingency and Fallback Plans, Contingency Reserves

- ❑ **Contingency plans** are predefined actions that the project team will take if an identified risk event occurs.
- ❑ **Fallback plans** are developed for risks that have a high impact on meeting project objectives, and are put into effect if attempts to reduce the risk are not effective.
- ❑ **Contingency reserves** or **allowances** are provisions held by the project sponsor or organization to reduce the risk of cost or schedule overruns to an acceptable level.
- ❑ **Management Reserve** are funds held for unknown risks that are used for management control purposes.

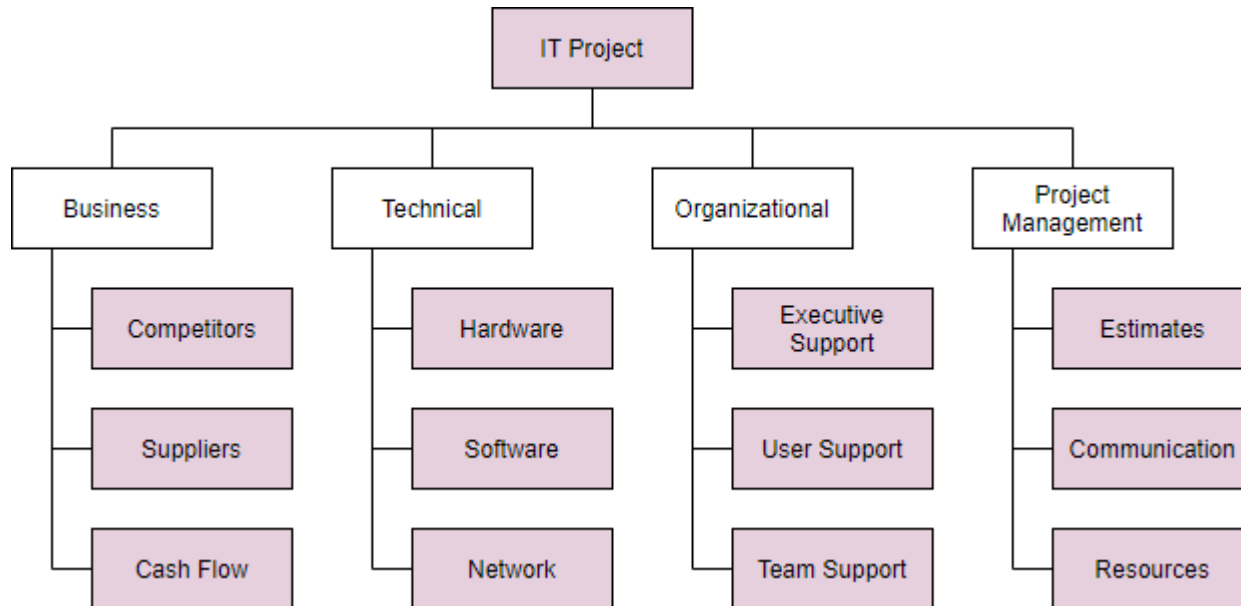
Broad Categories of Risk

- ❑ **Market risk:** If the IT project will create a new product or service, will it be useful to the organization or marketable to others?
- ❑ **Financial risk:** Can the organization afford to undertake the project? How confident are stakeholders in the financial projections? Will the project meet NPV, ROI, and payback estimates?
- ❑ **Technology risk:** Is the project technically feasible? Will it use mature, leading-edge, or bleeding-edge technologies? When will decisions be made on which technology to use? Will hardware, software, and networks function properly?
- ❑ **People risk:** Does the organization have people with appropriate skills to complete the project successfully? If not, can the organization find such people? Do people have the proper managerial and technical skills?
- ❑ **Structure/process risk:** What degree of change will the new project introduce into user areas and business procedures? How many distinct user groups does the project need to satisfy?

Risk Breakdown Structure

- ❑ It is also useful to review the work breakdown structure (WBS) for a project to see if there might be specific risks by WBS categories.
- ❑ For example, if an item on the WBS involves preparing a press release and no one on the project team has ever written one, it could be a negative risk if the release is not handled professionally.
- ❑ A **risk breakdown structure** is a hierarchy of potential risk categories for a project.
- ❑ Similar to a work breakdown structure but used to identify and categorize risks.

Risk Breakdown Structure: Example



Potential Negative Risk Conditions Associated With Each Knowledge Area

Knowledge Area	Risk Conditions
Integration	Inadequate planning; poor resource allocation; poor integration management; lack of post-project review
Scope	Poor definition of scope or work packages; incomplete definition of quality requirements; inadequate scope control
Time	Errors in estimating time or resource availability; poor allocation and management of float; early release of competitive products
Cost	Estimating errors; inadequate productivity, cost, change, or contingency control; poor maintenance, security, purchasing, etc.
Quality	Poor attitude toward quality; substandard design/materials/workmanship; inadequate quality assurance program
Human Resources	Poor conflict management; poor project organization and definition of responsibilities; absence of leadership
Communications	Carelessness in planning or communicating; lack of consultation with key stakeholders
Risk	Ignoring risk; unclear assignment of risk; poor insurance management
Procurement	Unenforceable conditions or contract clauses; adversarial relations

Step 2: Risk Identification

- ❑ Involves determining which risks might affect the project and documenting their characteristics
- ❑ It is important to identify potential risks early, but you must also continue to identify risks based on the changing project environment.
- ❑ You cannot manage risks if you do not identify them first.
- ❑ Participants:
Project team, risk management team, subject matter experts, customers, end users, other project manager, stakeholders and outside experts
- ❑ Iterative process involving different parties in each iteration cycle
- ❑ Simple and effective risk responses can be developed and implemented as soon as the risk is identified

Risk Identification Tools and Techniques

- ❑ After identifying potential risks at the initial meeting, the project team might then use different information-gathering techniques to further identify risks.
- ❑ Some common techniques include
 - Brainstorming
 - The Delphi technique,
 - Interviewing,
 - Root cause analysis, and
 - SWOT analysis.

Risk Identification - Output

- ❑ One important output of risk identification is a list of identified risks and other information needed to begin creating a risk register.
- ❑ **A risk register** is a document that contains results of various risk management processes; it is often displayed in a table or spreadsheet format.
- ❑ A risk register is a tool for documenting potential risk events and related information.
- ❑ **Risk events** refer to specific, uncertain events that may occur to the detriment or enhancement of the project.
- ❑ Elements of a risk register include the following:
 1. An identification number for each risk event
 2. A rank for each risk event
 3. The name of the risk events
 4. A description of the risk event
 5. The category under which risk falls
 6. The root cause of risk
 7. Triggers for each risk
 8. Potential response to each risk
 9. The risk owner
 10. The probability of the risk occurring
 11. The impact of the project if the risk occurs
 12. The status of the risk

Risk Matrix

No.	Rank	Risk Description	Category	Root Cause	Triggers	Potential Responses	Risk Owner	Probability	Impact	Status
R44	1									
R21	2									
R7	3									

		RISK ELEMENTS		
REF	BUSINESS PROCESSES RISKS	IMPACT	PROBABILITY	RISK RATING
DA	DEVELOP/ACQUIRE PRODUCT			
DA1	DESIGN	M	L	M
DA2	PRODUCTION (MANUFACTURING)	M	H	M
DA3	MERCHANDISING	M	H	H
PD	PRODUCE & DELIVER PRODUCT			
PD1	SOURCING	L	L	L
PD2	DISTRIBUTION NETWORK	H	L	M
PD3	PLANNING & ALLOCATION	L	L	L
M	MARKET & SELL PRODUCT			
M1	ESTABLISH AND DELIVER MARKETING STRATEGY	L	H	L
M2	VISUAL COMMUNICATION	L	L	L
S	STORES & CUSTOMER SERVICE			
S1	REAL ESTATE & CONSTRUCTION	L	L	L
S2	MANAGE RETAIL FIELD OPERATIONS	L	M	L
S3	ECOMMERCE	L	L	M
IT	MANAGE INFORMATION RESOURCES AND TECHNOLOGY			
IT1	MANAGE AND LEVERAGE INFORMATION RESOURCES (Records and Documents)	L	L	L
IT2	IT STRATEGY & DEVELOPMENT	H	L	L
IT3	USER SUPPORT	L	L	L
IT4	MANAGE TECHNICAL ENVIRONMENT	L	L	L
IT5	MANAGE SECURITY	L	L	L
F	MANAGE FINANCIAL & PHYSICAL RESOURCES			
F1	BUDGETS & FORECASTING	L	L	L
F2	CASH MANAGEMENT/CREDIT & COLLECTIONS	L	M	M
F3	CAPITAL PLANNING	H	L	M
F4	PROCUREMENT & ACCOUNTS PAYABLE	L	L	L
F5	INVENTORY CONTROL	M	L	H
F6	PAYROLL	L	L	L
F7	HUMAN RESOURCES	L	L	M
F8	FINANCIAL CLOSING & REPORTING (Internal and External)	L	L	L
F9	TAX	L	L	L
F10	PHYSICAL ASSET & FACILITIES MANAGEMENT	L	L	M
F11	LOSS PREVENTION	L	L	L
F12	INTERNAL AUDIT	L	L	L
C	CORPORATE MANAGEMENT			
C1	CORPORATE GOVERNANCE	L	L	L
C2	NEW CONCEPT	L	L	L
C3	DOCUMENT RETENTION	L	L	L

RISK RATING KEY	
	LOW
	MEDIUM
	HIGH

Step 3:Qualitative Risk Analysis

- ❑ Assess the likelihood and impact of identified risks to determine their magnitude and priority.
- ❑ Prioritizes risks according to their potential effect on project objectives
- ❑ Requires that the probability and consequences of the risks be evaluated using established qualitative-analysis method and tools
- ❑ Lead to further analysis in quantitative risk analysis or directly to risk response planning

Tools and Techniques

Risk quantification tools and techniques include:

- Probability/impact matrixes
- The Top Ten Risk Item Tracking
- Expert judgment

Risk probability and impact

- Risk probability – likelihood that a risk will occur
- Risk consequence (impact) – effect on project objectives if the risk event occurs
- Applied to specific risk events
- Helps to identify those risks that should be managed aggressively

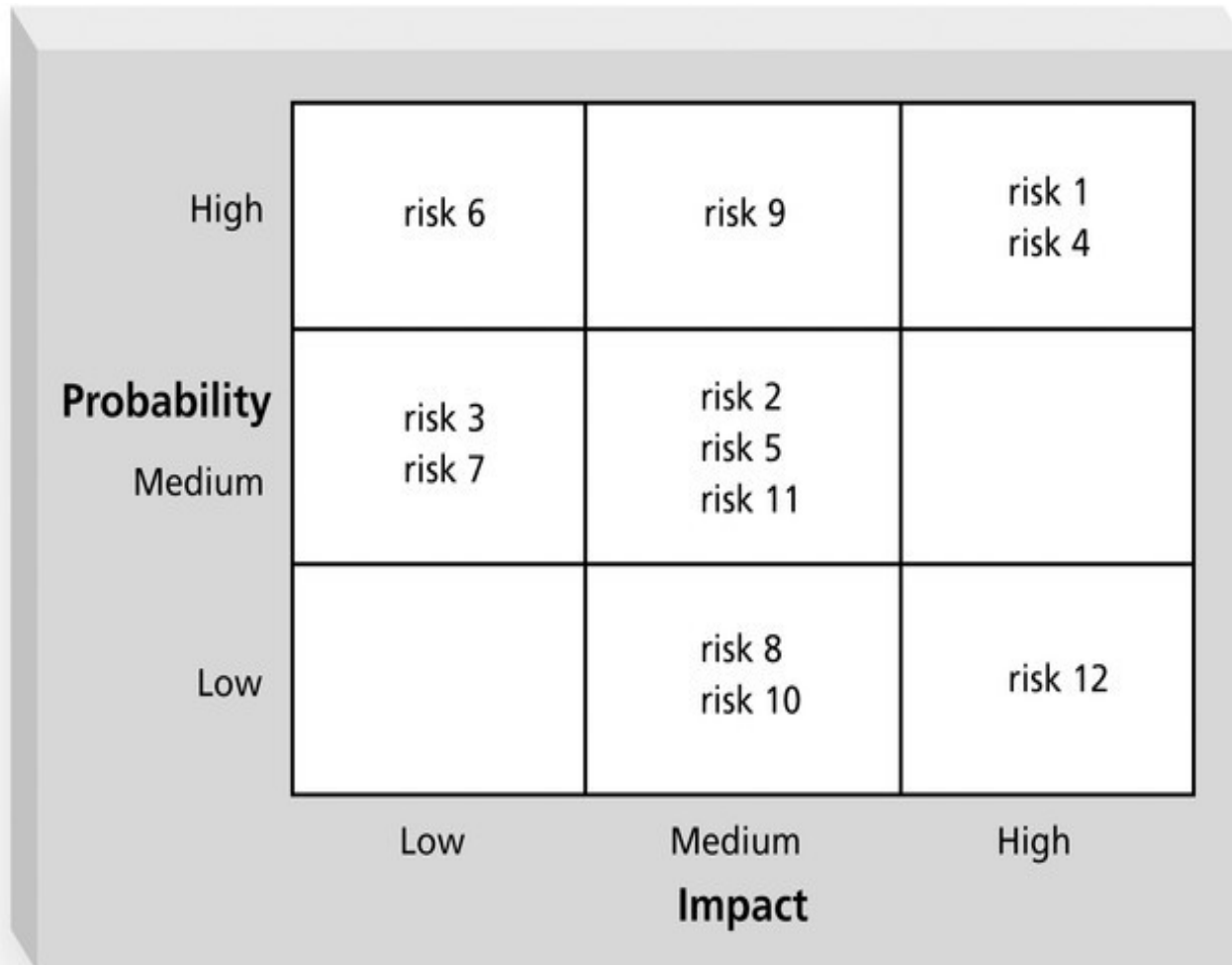
Probability/impact risk rating matrix

- ❑ Risk rating – very low, low, moderate, high and very high – based on combining probability and impact scales
- ❑ Probability scale – 0.0 (no probability) and 1.0 (certainty)
- ❑ Impact scale – severity of its effect on the project objective
 - ❑ Ordinal scales – rank-ordered values (very low, low, moderate, high and very high)
 - ❑ Cardinal scales – assign values to these impacts

Probability/Impact Matrix

- ❑ A **probability/impact matrix** or chart lists the relative probability of a risk occurring on one side of a matrix or axis on a chart and the relative impact of the risk occurring on the other.
- ❑ List the risks and then label each one as high, medium, or low in terms of its probability of occurrence and its impact if it did occur.
- ❑ Can also calculate **risk factors**:
 - Numbers that represent the overall risk of specific events based on their probability of occurring and the consequences to the project if they do occur.

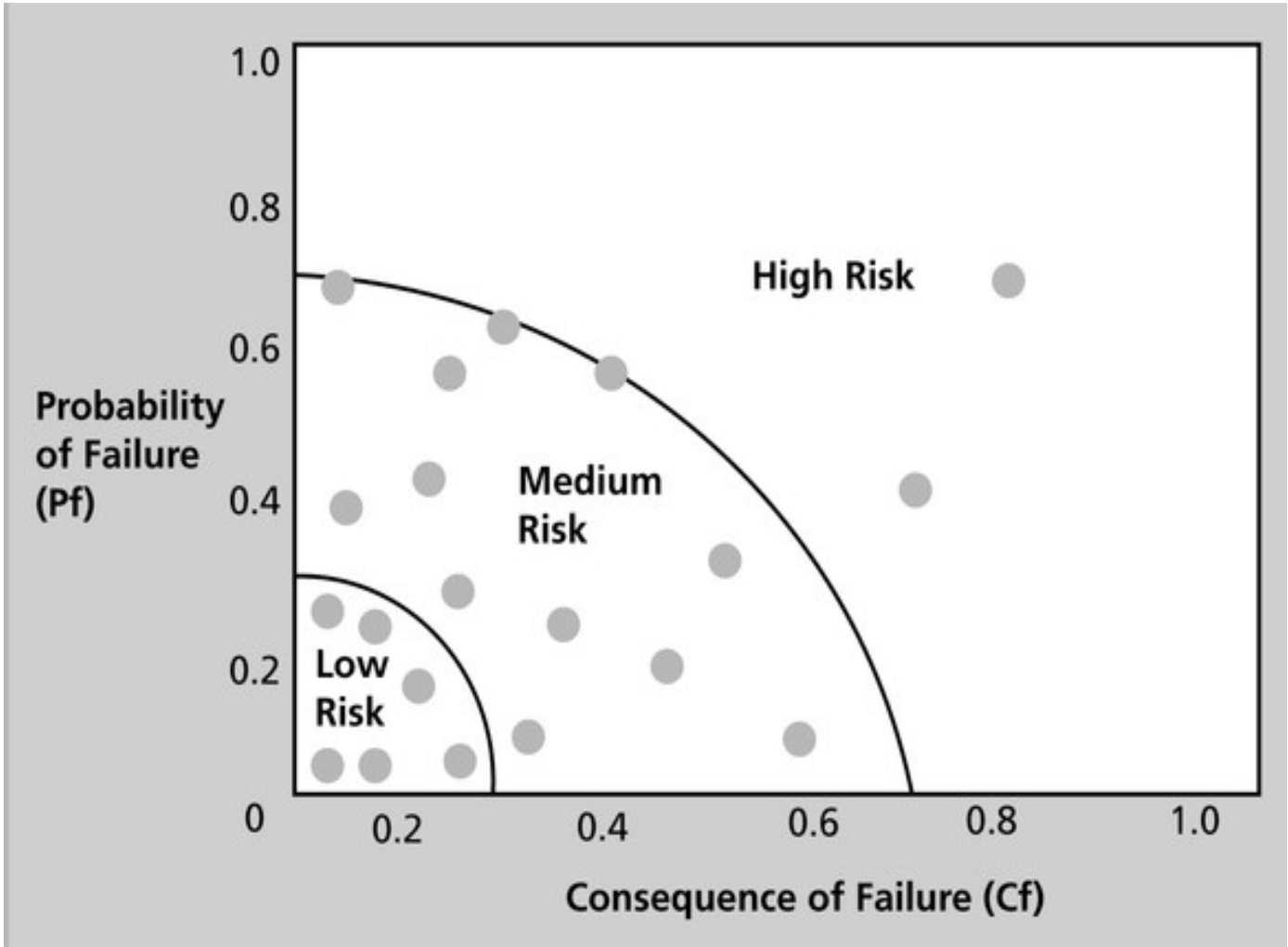
Sample Probability/Impact Matrix



The diagram is a 3D-style matrix with a grey background. The vertical axis is labeled 'Probability' with levels 'High', 'Medium', and 'Low'. The horizontal axis is labeled 'Impact' with levels 'Low', 'Medium', and 'High'. The matrix contains 12 risk items distributed across the cells:

	Low	Medium	High
High	risk 6	risk 9	risk 1 risk 4
Medium	risk 3 risk 7	risk 2 risk 5 risk 11	
Low		risk 8 risk 10	risk 12

Chart Showing High-, Medium-, and Low-Risk Technologies



Top Ten Risk Item Tracking

- ❑ **Top Ten Risk Item Tracking** is a qualitative risk analysis tool that helps to identify risks and maintain an awareness of risks throughout the life of a project.
- ❑ Establish a periodic review of the top ten project risk items.
- ❑ List the current ranking, previous ranking, number of times the risk appears on the list over a period of time, and a summary of progress made in resolving the risk item.

Example of Top Ten Risk Item Tracking

	Monthly Ranking			
Risk Item	This Month	Last Month	Number of Months	Risk Resolution Progress
Inadequate planning	1	2	4	Working on revising the entire project plan
Poor definition of scope	2	3	3	Holding meetings with project customer and sponsor to clarify scope
Absence of leadership	3	1	2	Just assigned a new project manager to lead the project after old one quit
Poor cost estimates	4	4	3	Revising cost estimates
Poor time estimates	5	5	3	Revising schedule estimates

Expert Judgment

- ❑ Many organizations rely on the intuitive feelings and past experience of experts to help identify potential project risks.
- ❑ Experts can categorize risks as high, medium, or low with or without more sophisticated techniques.
- ❑ Can also help create and monitor a **watch list**, a list of risks that are low priority, but are still identified as potential risks.

Outputs

Overall risk ranking for the project

- ❑ Indicate the overall risk position of a project relative to other projects by comparing the risk scores. Can be used to
 - ❑ assign personnel or other resources to project with different risk rankings
 - ❑ Make a benefit-cost analysis decision about the project
 - ❑ Support a recommendation for project initiation, continuation or cancellation

Step 4: Quantitative Risk Analysis

- Aims to analyze numerically the probability of each risk and its consequence on project objectives as well as the extent of overall project risk
 - Determine the probability of achieving a specific project objective
 - Quantify the risk exposure for the project, and determine the size of cost and schedule contingency reserves that may be needed
 - Identify risks requiring the most attention by quantifying their relative contribution to project risk
 - Identify realistic and achievable cost, schedule or scope targets

Quantitative Risk Analysis

- ❑ Often follows qualitative risk analysis, but both can be done together.
- ❑ Large, complex projects involving leading edge technologies often require extensive quantitative risk analysis.
- ❑ Main techniques include:
 - ❑ Decision tree analysis
 - ❑ Simulation
 - ❑ Sensitivity analysis

Quantitative Risks Analysis (example)

Asset	Risk	Asset Value	Potential Loss (SLE)	Annualized Frequency (ARO)	Annual Loss Expectancy (ALE)
Facility	Fire	\$560,000	\$230,000	.25	\$57,500
Trade Secret	Stolen	\$43,500	\$40,000	.75	\$30,000
File Server	Failed	\$11,500	\$11,500	.5	\$5,750
Data	Virus	\$8,900	\$6,500	.8	\$5,200
Customer Credit Card Info	Stolen	\$323,500	\$300,000	.65	\$195,000

- SLE (Single Loss Expectancy): money expected to be lost if the incident occurs one time.
- ARO (Annual Rate of Occurrence): how many times in a one-year interval the incident is expected to occur.
- ALE (Annual Loss Expectancy): money expected to be lost in one year considering SLE and ARO ($ALE = SLE * ARO$). For quantitative risk assessment, this is the risk value

Step 5&6: Risk Response Planning

- ❑ Process of developing options and determining actions to enhance opportunities and reduce threats to the project's objectives
 - i.e. After identifying and quantifying risks, you must decide how to respond to them.
- ❑ Includes identification and assignment of individuals or parties to take responsibility for each agreed response
- ❑ Process ensures that identified risks are properly addressed
- ❑ Effectiveness of response planning will directly determine whether risk increases or decreases for the project

Risk Response Planning

Risk response planning must:

- ❑ Appropriate to the severity of the risk
- ❑ Cost effective in meeting the challenge
- ❑ Timely to be successful
- ❑ Realistics within the project context
- ❑ Agreed upon by all parties involved
- ❑ Owned by a responsible person

Risk avoidance

- ❑ Changing the project plan to eliminate the risks or condition or to protect the project objectives from its impact
- ❑ Early risk in the project can be dealt with by
 - ❑ clarifying requirements
 - ❑ Obtaining information
 - ❑ Improving
 - ❑ communication
 - ❑ Or acquiring expertise
- ❑ Other Examples
 - ❑ Reducing scope to avoid high-risk activities
 - ❑ Adding resources or time
 - ❑ Adopting a familiar approach instead of an innovative one
 - ❑ Avoiding an unfamiliar subcontractor

Risk Transference

- ❑ Seeking to shift the consequence of a risk to a third party together with ownership of response
- ❑ Transferring risk does not eliminate it but shifting the responsibility
- ❑ Involves payment of a risk premium
- ❑ Include the use of insurance, performance bonds, warranties and guarantees
- ❑ Contracts may be used to transfer liability for specified risk to another party

Risk mitigation

- ❑ Seeks to reduce the probability and/or consequences of an adverse risk event to an acceptable threshold
- ❑ Eg implementing a new course of action that will reduce the problem
 - ❑ Adopting less complex processes
 - ❑ Conducting more seismic or engineering tests
 - ❑ Choosing a more stable seller
- ❑ Changing conditions so that the probability of the risk occurring is reduced
 - ❑ Adding resource or time to the schedule

Risk acceptance

- ❑ Indicates that the project team has decided not to change the project plan to deal with a risk or is unable to identify any other suitable response strategy
- ❑ **Active acceptance** - Developing a contingency plan to execute, should a risk occur
- ❑ **Passive acceptance** - No action, leaving the project team to deal with the risk as they occur
- ❑ **Contingency plan** – plan in advance, may reduce the cost of an action should risk occur
- ❑ **Fallback plan** – developed if the risk has a high impact, or if the selected strategy may not be fully effective
- ❑ **Contingency allowance** – reserve, including amounts of time, money, or resources to account for risks

General Risk Mitigation Strategies for Technical, Cost, and Schedule Risks

TECHNICAL RISKS	COST RISKS	SCHEDULE RISKS
Emphasize team support and avoid stand-alone project structure	Increase the frequency of project monitoring	Increase the frequency of project monitoring
Increase project manager authority	Use WBS and CPM	Use WBS and CPM
Improve problem handling and communication	Improve communication, project goals understanding, and team support	Select the most experienced project manager
Increase the frequency of project monitoring	Increase project manager authority	
Use WBS and CPM		

Residual and Secondary Risks

- It's also important to identify residual and secondary risks.
- **Residual risks** are risks that remain after all of the response strategies have been implemented.
- **Secondary risks** are a direct result of implementing a risk response.

Step 7: Risk Monitoring and Control

- Process of
 - keeping track of the identified risks,
 - monitoring residual risks and identifying new risks,
 - ensuring the execution of risk plans, and
 - evaluating their effectiveness in reducing risk
- Purpose is to determine if:
 - Risk responses have been implemented as planned
 - Risk response actions are as effective as expected, or if new responses should be developed
 - Project assumptions are still valid
 - Risk exposure has changed from its prior state, with analysis of trends
 - A risk trigger has occurred
 - Proper policies and procedures are followed
 - Risks have occurred or arisen that were not previously identified



Thank you