Chapter 11:
Project Risk Management

Information Technology Project Management, Fourth Edition

Learning Objectives

- Understand what risk is and the importance of good project risk management.
- Discuss the elements involved in risk management planning and the contents of a risk management plan.
- List common sources of risks in information technology projects.

Learning Objectives (cont'd)

- Describe the risk identification process, tools, and techniques to help identify project risks, and the main output of risk identification, a risk register.

- Discuss the qualitative risk analysis process and explain how to calculate risk factors, create probability/impact matrixes, apply the Top Ten Risk Item Tracking technique, and use expert judgment to rank risks.

Learning Objectives (cont'd)

- Explain the quantitative risk analysis process and how to apply decision trees, simulation, and sensitivity analysis to quantify risks.
- Provide examples of using different risk response planning strategies to address both negative and positive risks.
- Discuss what is involved in risk monitoring and control.
- Describe how software can assist in project risk management.

The Importance of Project Risk Management

- 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.

Research Shows Need to Improve Project Risk Management

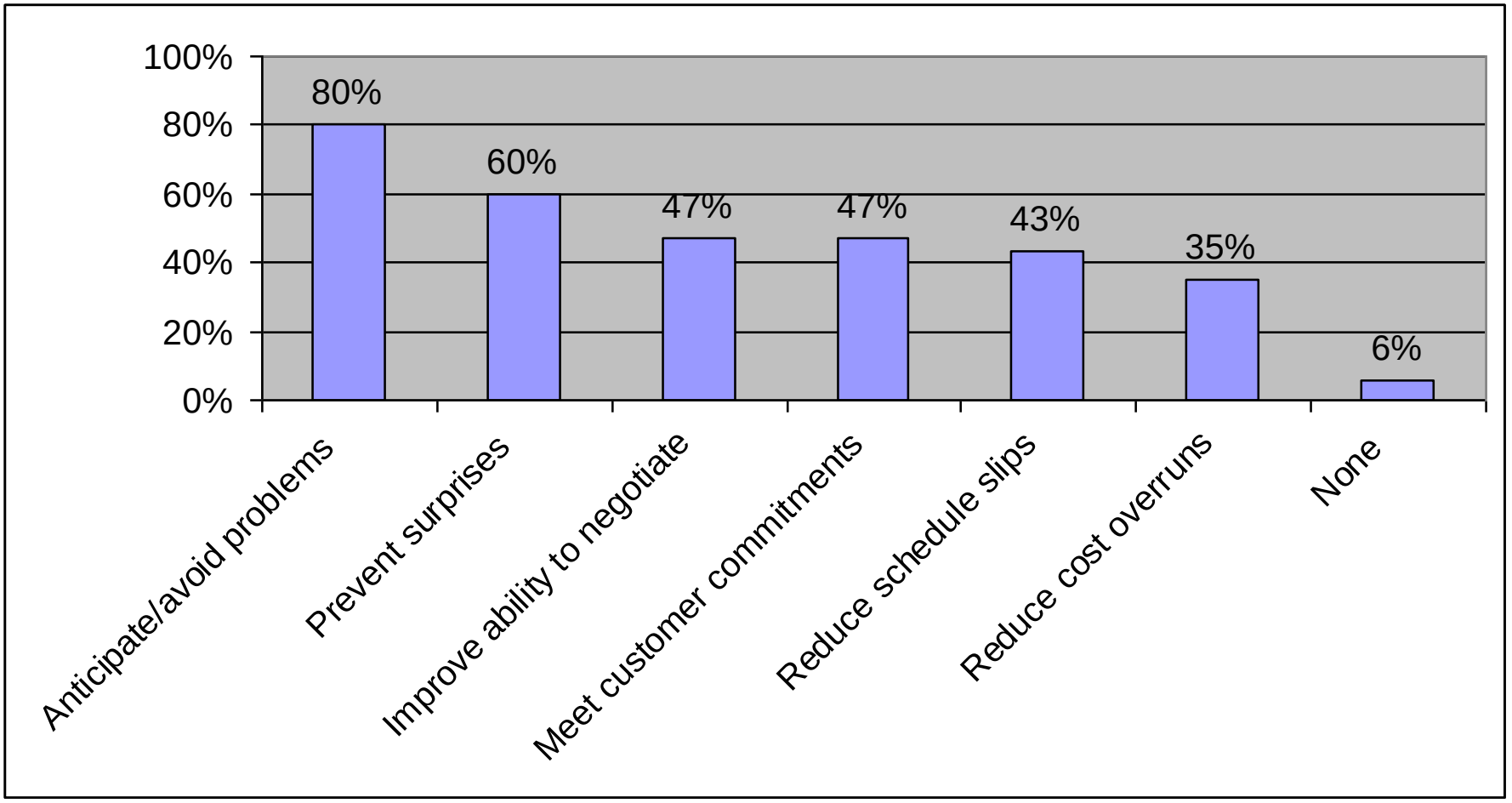
- Study by Ibbs and Kwak shows risk has the lowest maturity rating of all knowledge areas.
- KLCI study shows the benefits of following good software risk management practices.
- KPMG study found that 55 percent of **runaway projects**—projects that have significant cost or schedule overruns—did *no* risk management at all.

Table 11-1. Project Management Maturity by Industry Group and Knowledge Area

KEY: 1 = LOWEST MATURITY RATING 5 = HIGHEST MATURITY RATING

Knowledge Area	**Engineering/ Construction**	**Telecommunications**	**Information Systems**	**Hi-Tech Manufacturing**
Scope	3.52	3.45	3.25	3.37
Time	3.55	3.41	3.03	3.50
Cost	3.74	3.22	3.20	3.97
Quality	2.91	3.22	2.88	3.26
Human Resources	3.18	3.20	2.93	3.18
Communications	3.53	3.53	3.21	3.48
Risk	**2.93**	**2.87**	**2.75**	**2.76**
Procurement	3.33	3.01	2.91	3.33

Figure 11-1. Benefits from Software Risk Management Practices



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.

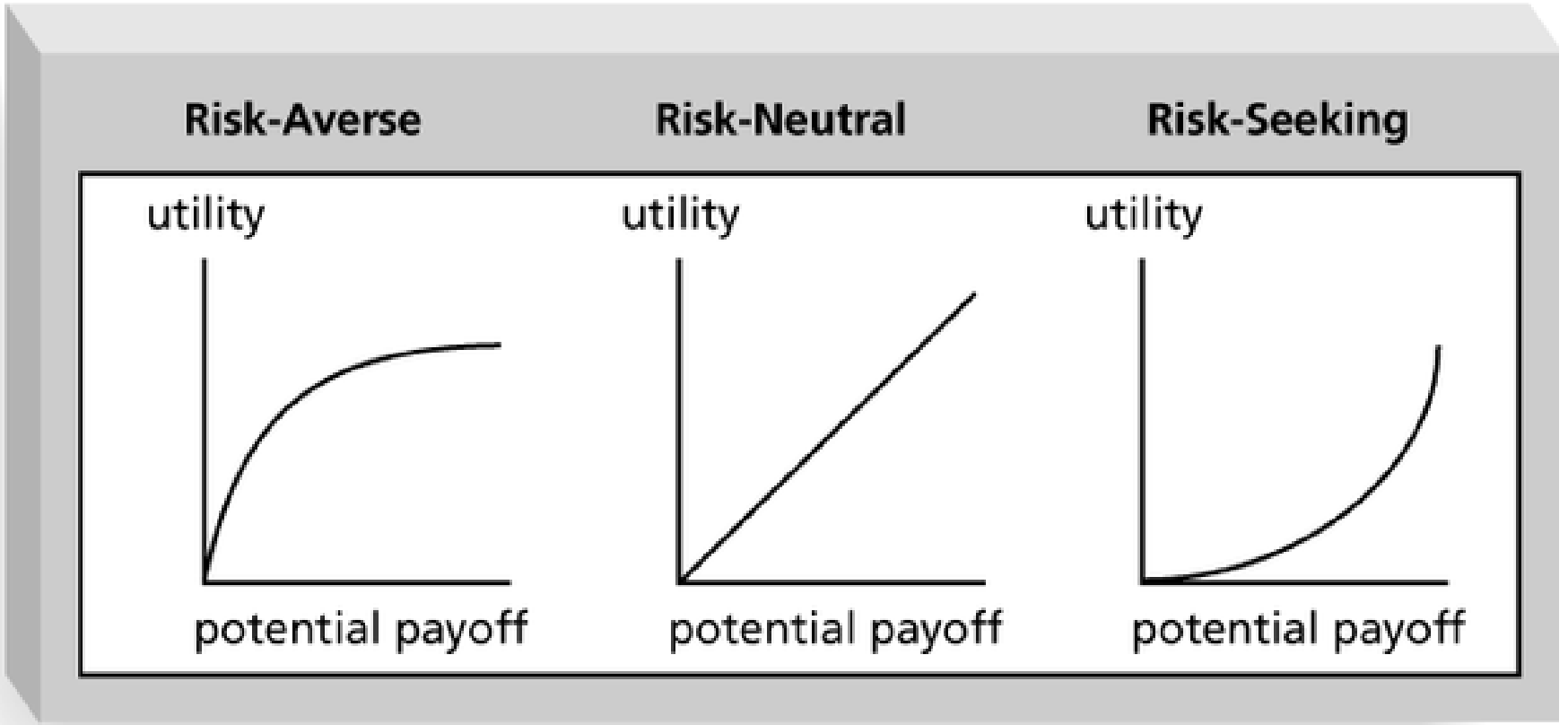
Risk Can Be Positive

- 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.

Figure 11-2. Risk Utility Function and Risk Preference



Project Risk Management 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.

Risk Management Planning

- 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.
- The level of detail will vary with the needs of the project.

Table 11-2. Topics Addressed in a Risk Management Plan

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

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.

Common Sources of Risk in Information Technology Projects

- Several studies show that IT projects share some common sources of risk.
- The Standish Group developed an IT success potential scoring sheet based on potential risks.
- Other broad categories of risk help identify potential risks.

Table 11-3. Information Technology Success Potential Scoring Sheet

Success Criterion	**Relative Importance**
User Involvement	19
Executive Management support	16
Clear Statement of Requirements	15
Proper Planning	11
Realistic Expectations	10
Smaller Project Milestones	9
Competent Staff	8
Ownership	6
Clear Visions and Objectives	3
Hard-Working, Focused Staff	3
Total	**100**

Broad Categories of Risk

- Market risk
- Financial risk
- Technology risk
- People risk
- Structure/process risk

Risk Breakdown Structure

- 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.

Figure 11-3. Sample Risk Breakdown Structure

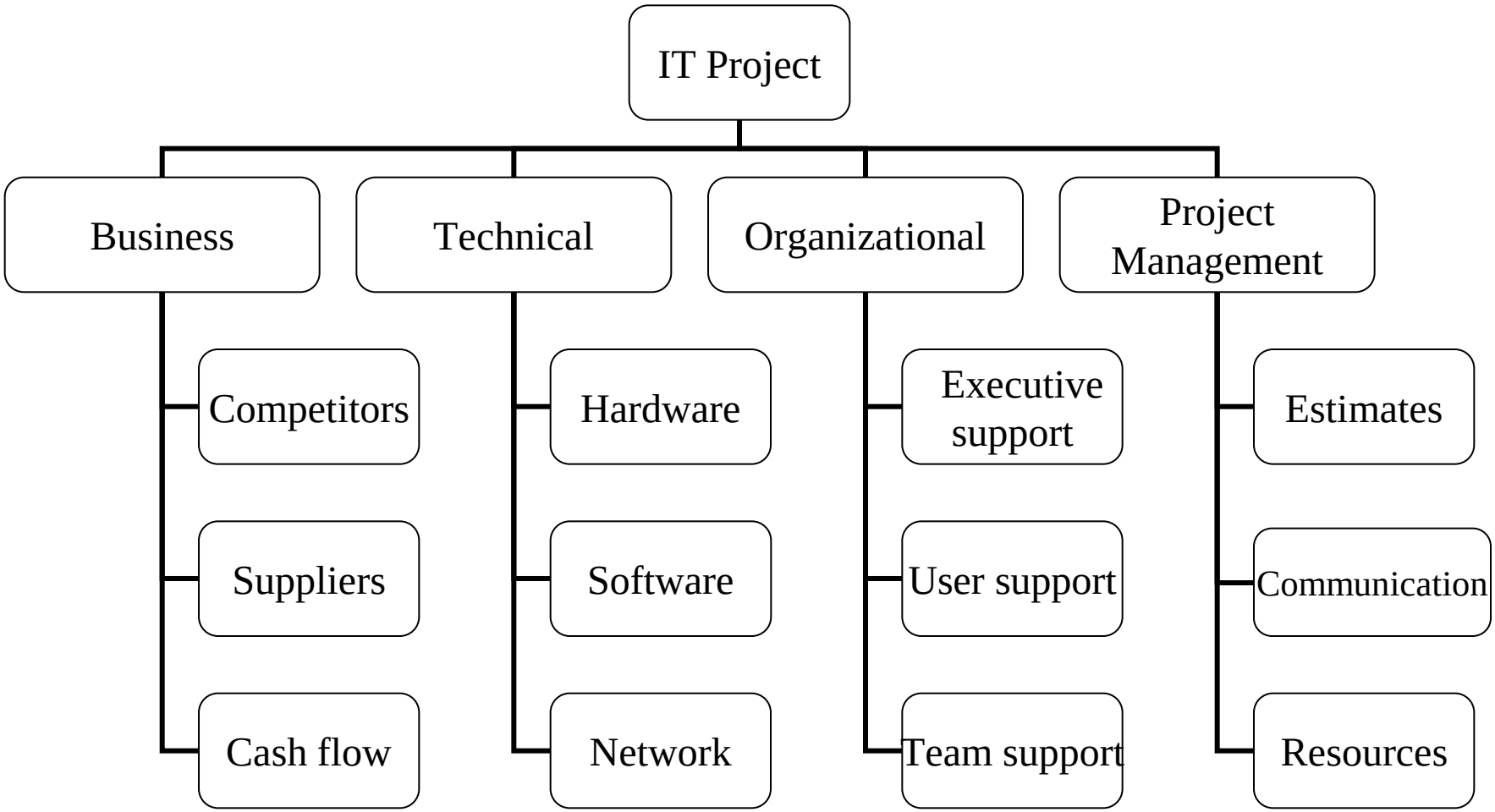


Table 11-4. Potential Negative Risk Conditions Associated With Each Knowledge Area

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

Risk Identification

- **Risk identification** is the process of understanding what potential events might hurt or enhance a particular project.
- Risk identification tools and techniques include:
  - Brainstorming
  - The Delphi Technique
  - Interviewing
  - SWOT analysis

Brainstorming

- **Brainstorming** is a technique by which a group attempts to generate ideas or find a solution for a specific problem by amassing ideas spontaneously and without judgment.
- An experienced facilitator should run the brainstorming session.
- Be careful not to overuse or misuse brainstorming.
  - Psychology literature shows that individuals produce a greater number of ideas working alone than they do through brainstorming in small, face-to-face groups.
  - Group effects often inhibit idea generation.

Delphi Technique

- The **Delphi Technique** is used to derive a consensus among a panel of experts who make predictions about future developments.
- Provides independent and anonymous input regarding future events.
- Uses repeated rounds of questioning and written responses and avoids the biasing effects possible in oral methods, such as brainstorming.

Interviewing

- **Interviewing** is a fact-finding technique for collecting information in face-to-face, phone, e-mail, or instant-messaging discussions.

- Interviewing people with similar project experience is an important tool for identifying potential risks.

SWOT Analysis

- SWOT analysis (strengths, weaknesses, opportunities, and threats) can also be used during risk identification.

- Helps identify the broad negative and positive risks that apply to a project.

Risk Register

- The main output of the risk identification process is a list of identified risks and other information needed to begin creating a risk register.
- A **risk register** is:
  - A document that contains the results of various risk management processes and that is often displayed in a table or spreadsheet format.
  - 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.

Risk Register Contents

- An identification number for each risk event.
- A rank for each risk event.
- The name of each risk event.
- A description of each risk event.
- The category under which each risk event falls.
- The root cause of each risk.

Risk Register Contents (cont'd)

- Triggers for each risk; **triggers** are indicators or symptoms of actual risk events.
- Potential responses to each risk.
- The **risk owner** or person who will own or take responsibility for each risk.
- The probability and impact of each risk occurring.
- The status of each risk.

Table 11-5. Sample Risk Register

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

Qualitative Risk Analysis

- Assess the likelihood and impact of identified risks to determine their magnitude and priority.
- Risk quantification tools and techniques include:
  - Probability/impact matrixes
  - The Top Ten Risk Item Tracking
  - Expert judgment

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.

Figure 11-4. Sample Probability/Impact Matrix

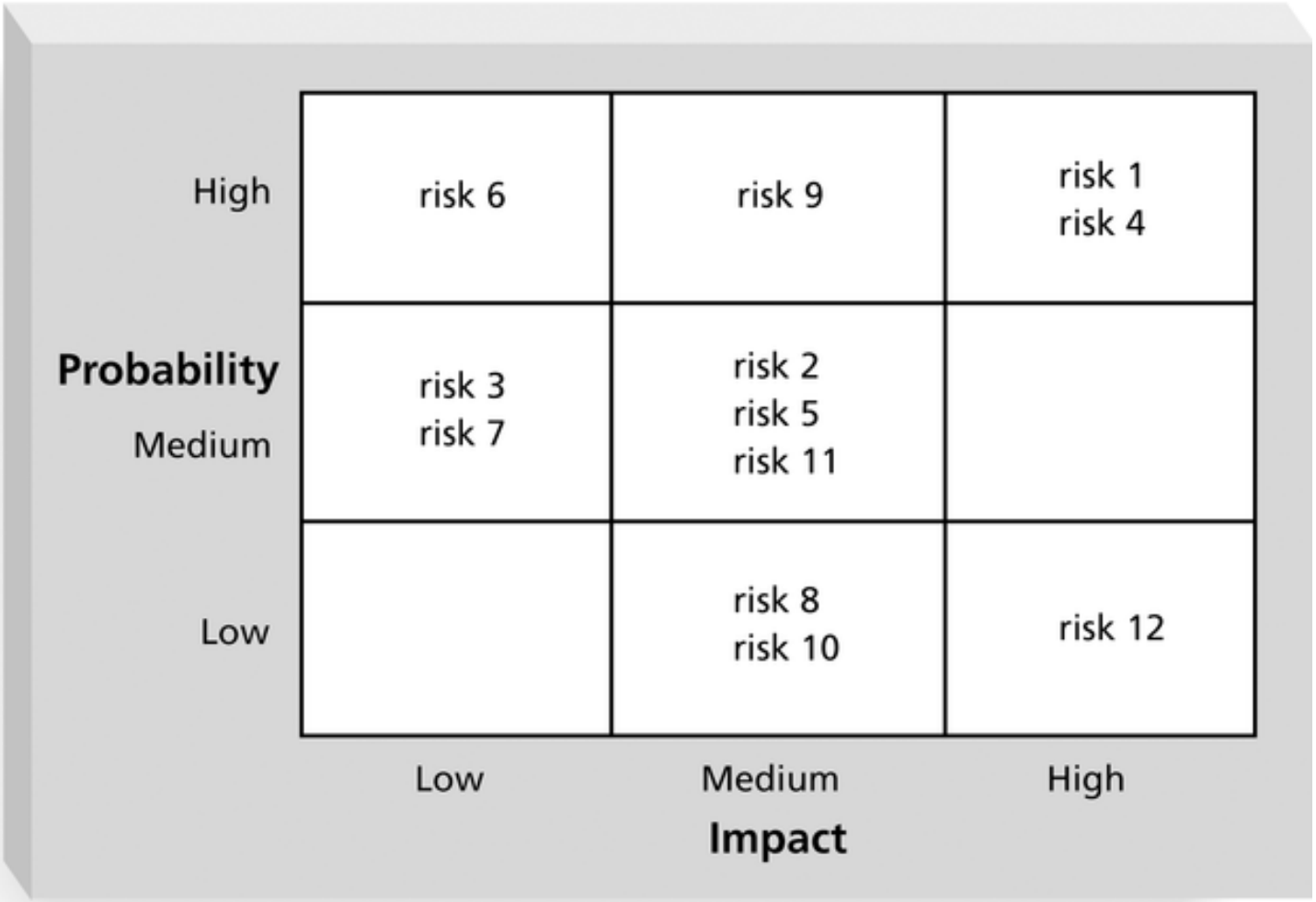


Table 11-6. Sample Probability/Impact Matrix for Qualitative Risk Assessment

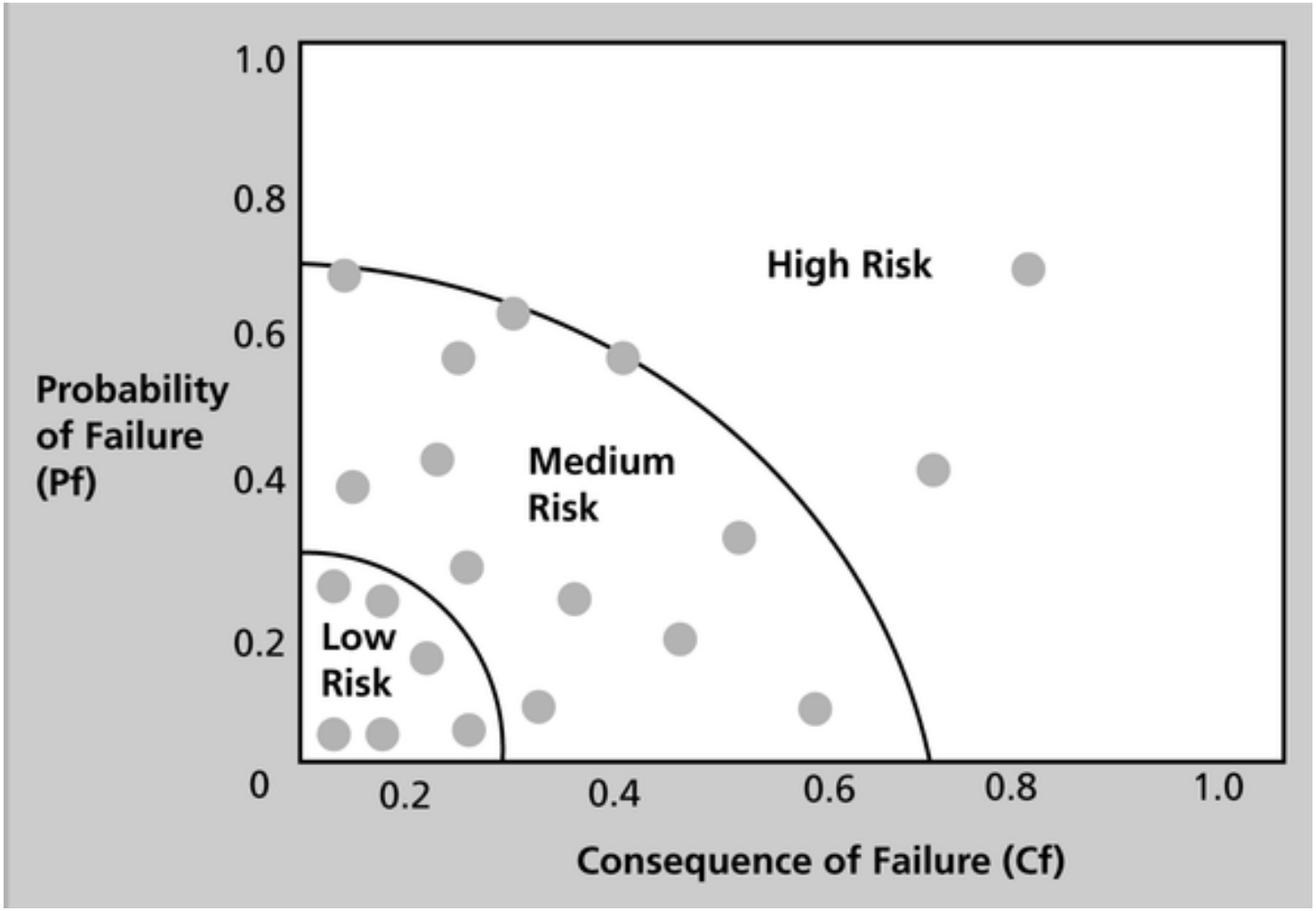
PROBABILITY OF FAILURE (P_F) ATTRIBUTES OF SUGGESTED TECHNOLOGY

Value	Maturity Hardware/Software	Complexity Hardware/Software	Support Base
0.1	Existing	Simple Design	Multiple Programs And Services
0.3	Minor Redesign	Somewhat Complex	Multiple Programs
0.5	Major Change Feasible	Fairly Complex	Several Parallel Programs
0.7	Complex HW Design/ New SW Similar to Existing	Very Complex	At Least One Other Program
0.9	Some Research Completed/ Never Done Before	Extremely Complex	No Additional Programs

CONSEQUENCE OF FAILURE (C_F) ATTRIBUTES OF SUGGESTED TECHNOLOGY

Value	Fallback Solutions	Life Cycle Cost (LCC) Factor	Schedule Factor (Initial Operational Capability = IOC)	Downtime (DT) Factor
0.1	Several Acceptable Alternatives	Highly Confident Will Reduce LCC	90—100% Confident Will Meet IOC Significantly	Highly Confident Will Reduce DT
0.3	A Few Known Alternatives	Fairly Confident Will Reduce LCC	75—90% Confident Will Meet IOC	Fairly Confident Will Reduce DT Significantly
0.5	Single Acceptable Alternative	LCC Will Not Change Much	50—75% Confident Will Meet IOC	Highly Confident Will Reduce DT Somewhat
0.7	Some Possible Alternatives	Fairly Confident Will Increase LCC	25—50% Confident Will Meet IOC	Fairly Confident Will Reduce DT Somewhat
0.9	No Acceptable Alternatives	Highly Confident Will Increase LCC	0—25% Confident Will Meet IOC	DT May Not Be Reduced Much

Figure 11-5. 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.

Table 11-7. 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.

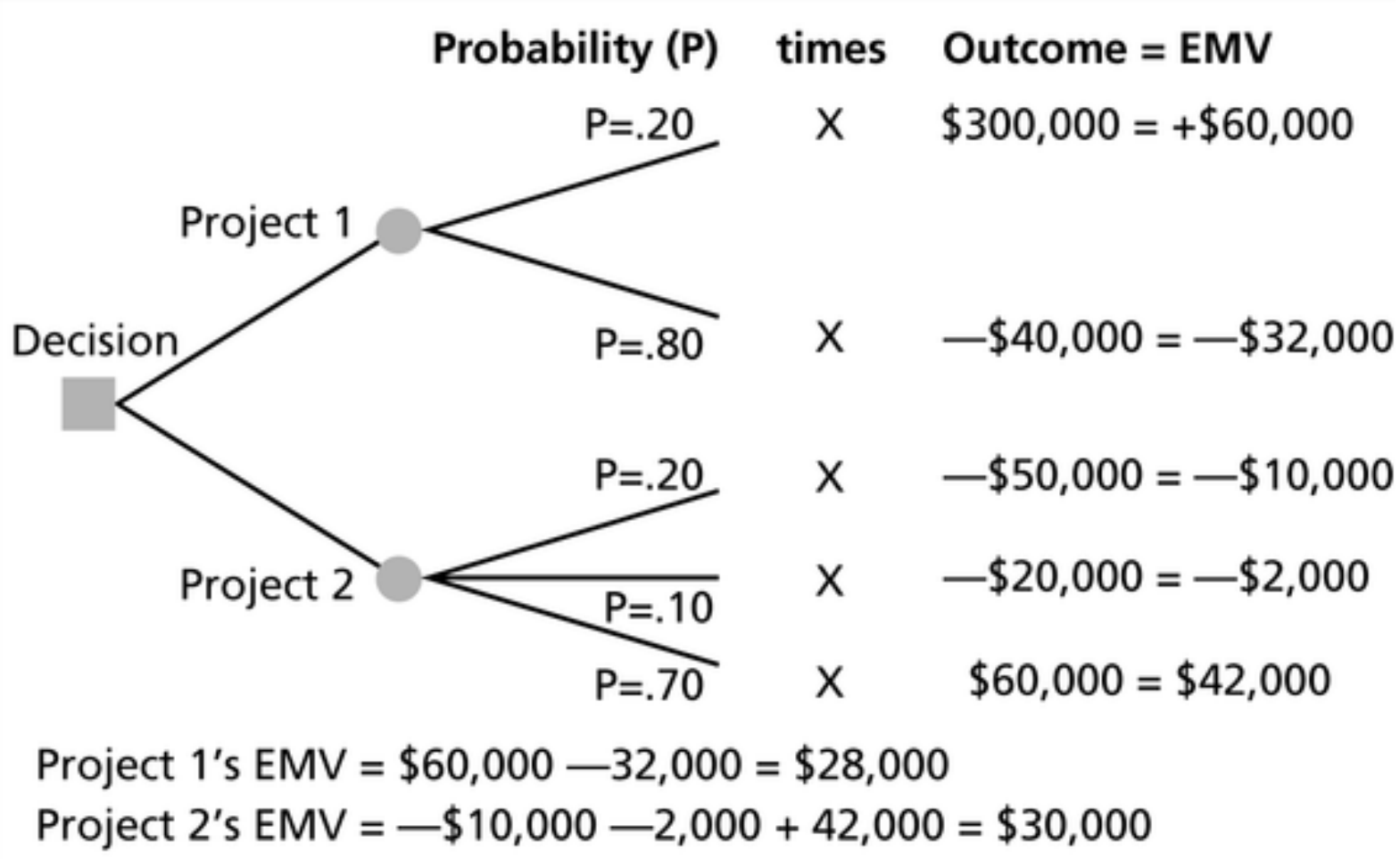
Quantitative Risk Analysis

- 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

Decision Trees and Expected Monetary Value (EMV)

- A **decision tree** is a diagramming analysis technique used to help select the best course of action in situations in which future outcomes are uncertain.
- **Estimated monetary value (EMV)** is the product of a risk event probability and the risk event's monetary value.
- You can draw a decision tree to help find the EMV.

Figure 11-6. Expected Monetary Value (EMV) Example



Project 1's EMV = $60,000 —32,000 = $28,000

Project 2's EMV = —$10,000 —2,000 + 42,000 = $30,000

Simulation

- Simulation uses a representation or model of a system to analyze the expected behavior or performance of the system.
- **Monte Carlo analysis** simulates a model's outcome many times to provide a statistical distribution of the calculated results.
- To use a Monte Carlo simulation, you must have three estimates (most likely, pessimistic, and optimistic) plus an estimate of the likelihood of the estimate being between the most likely and optimistic values.

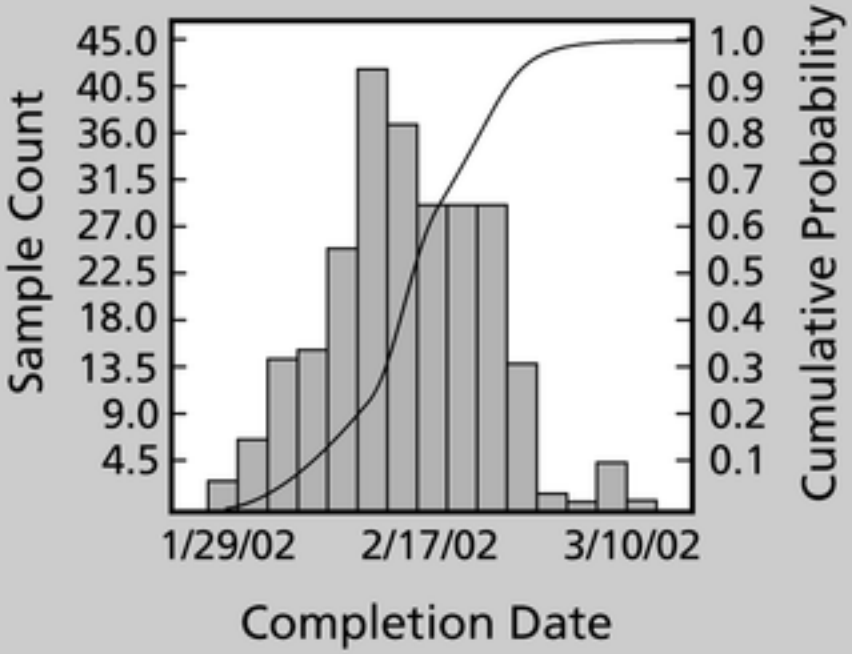
Steps of a Monte Carlo Analysis

1. Assess the range for the variables being considered.
2. Determine the probability distribution of each variable.
3. For each variable, select a random value based on the probability distribution.
4. Run a deterministic analysis or one pass through the model.
5. Repeat steps 3 and 4 many times to obtain the probability distribution of the model's results.

Figure 11-7. Sample Monte Carlo Simulation Results for Project Schedule

Date: 4/14/02 11:13:56 AM
Number of Samples: 250
Unique ID: 1
Name: Widget

Completion Std Deviation: 5.2d
95% Confidence Interval: 0.6d
Each bar represents 2d



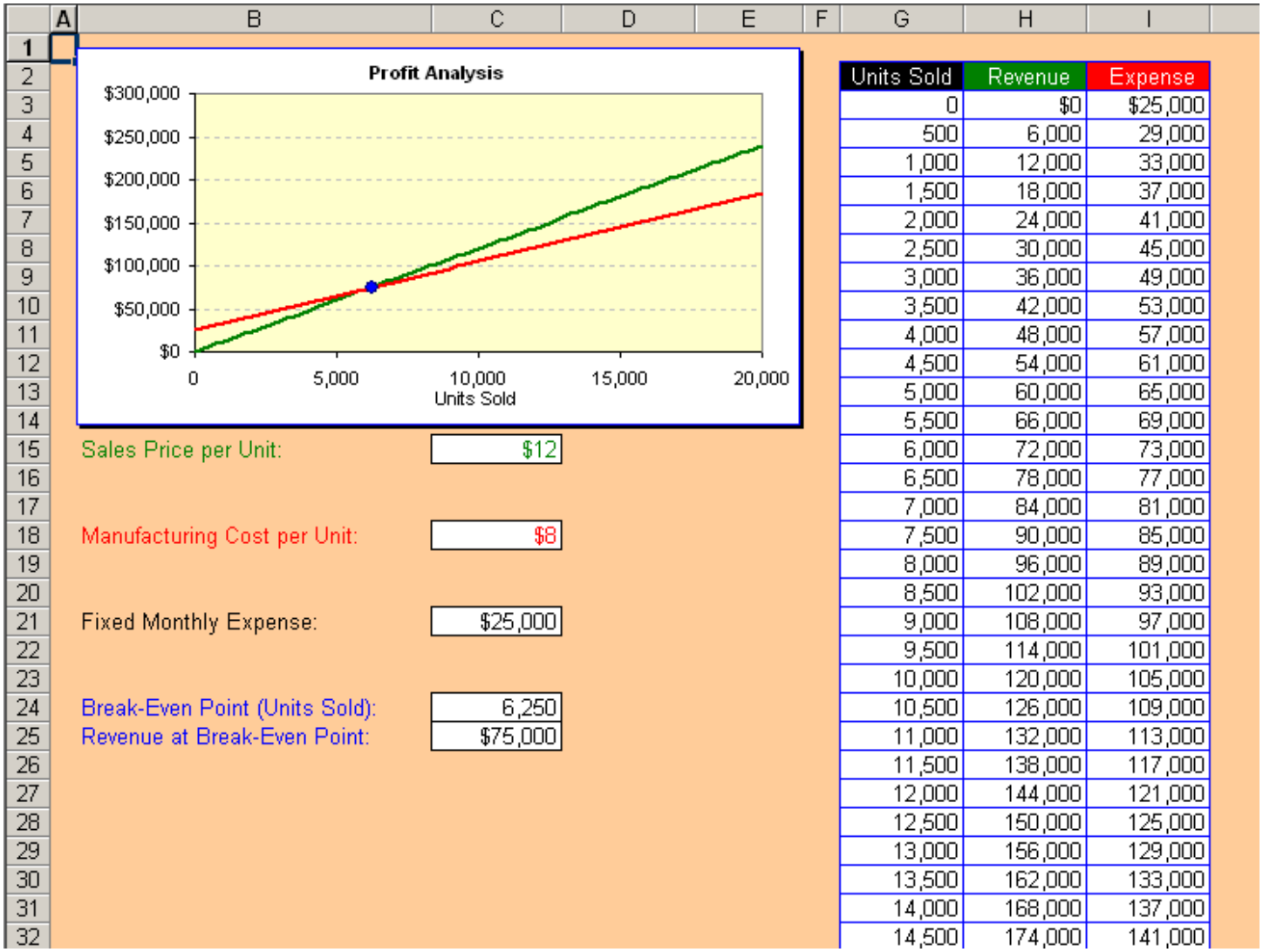
Completion Probability Table

Prob	Date	Prob	Date
0.05	2/4/02	0.55	2/17/02
0.10	2/8/02	0.60	2/18/02
0.15	2/9/02	0.65	2/19/02
0.20	2/10/02	0.70	2/22/02
0.25	2/11/02	0.75	2/22/02
0.30	2/12/02	0.80	2/23/02
0.35	2/15/02	0.85	2/24/02
0.40	2/15/02	0.90	2/25/02
0.45	2/16/02	0.95	2/26/02
0.50	2/17/02	1.00	3/10/02

Sensitivity Analysis

- **Sensitivity analysis** is a technique used to show the effects of changing one or more variables on an outcome.
- For example, many people use it to determine what the monthly payments for a loan will be given different interest rates or periods of the loan, or for determining break-even points based on different assumptions.
- Spreadsheet software, such as Excel, is a common tool for performing sensitivity analysis.

Figure 11-8. Sample Sensitivity Analysis for Determining Break-Even Point



Sales Price per Unit:	$12
Manufacturing Cost per Unit:	$8
Fixed Monthly Expense:	$25,000
Break-Even Point (Units Sold):	6,250
Revenue at Break-Even Point:	$75,000

Units Sold	Revenue	Expense
0	$0	$25,000
500	6,000	29,000
1,000	12,000	33,000
1,500	18,000	37,000
2,000	24,000	41,000
2,500	30,000	45,000
3,000	36,000	49,000
3,500	42,000	53,000
4,000	48,000	57,000
4,500	54,000	61,000
5,000	60,000	65,000
5,500	66,000	69,000
6,000	72,000	73,000
6,500	78,000	77,000
7,000	84,000	81,000
7,500	90,000	85,000
8,000	96,000	89,000
8,500	102,000	93,000
9,000	108,000	97,000
9,500	114,000	101,000
10,000	120,000	105,000
10,500	126,000	109,000
11,000	132,000	113,000
11,500	138,000	117,000
12,000	144,000	121,000
12,500	150,000	125,000
13,000	156,000	129,000
13,500	162,000	133,000
14,000	168,000	137,000
14,500	174,000	141,000

Risk Response Planning

- After identifying and quantifying risks, you must decide how to respond to them.
- Four main response strategies for negative risks:
  - Risk avoidance
  - Risk acceptance
  - Risk transference
  - Risk mitigation

Table 11-8. 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		

Response Strategies for Positive Risks

- Risk exploitation
- Risk sharing
- Risk enhancement
- Risk acceptance

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.

Risk Monitoring and Control

- Involves executing the risk management process to respond to risk events.
- **Workarounds** are unplanned responses to risk events that must be done when there are no contingency plans.
- Main outputs of risk monitoring and control are:
  - Requested changes.
  - Recommended corrective and preventive actions.
  - Updates to the risk register, project management plan, and organizational process assets.

Using Software to Assist in Project Risk Management

- Risk registers can be created in a simple Word or Excel file or as part of a database.
- More sophisticated risk management software, such as Monte Carlo simulation tools, help in analyzing project risks.
- The PMI Risk Specific Interest Group's Web site at *www.risksig.com* has a detailed list of software products to assist in risk management.

Results of Good Project Risk Management

- Unlike crisis management, good project risk management often goes unnoticed.
- Well-run projects appear to be almost effortless, but a lot of work goes into running a project well.
- Project managers should strive to make their jobs look easy to reflect the results of well-run projects.

Chapter Summary

- 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.
- Main processes include:
  - Risk management planning
  - Risk identification
  - Qualitative risk analysis
  - Quantitative risk analysis
  - Risk response planning
  - Risk monitoring and control