Learning Objectives

- Explain the concept of risk as it relates to project management, and list the advantages of managing project risks according to best practices
- Discuss the elements of planning risk management and the contents of a risk management plan
- List common sources of risks on information technology (IT) projects
- Describe the process of identifying risks and create a risk register and risk report
- Discuss qualitative risk analysis and explain how to calculate risk factors, create probability/impact matrixes, and apply the Top Ten Risk Item Tracking technique to rank risks

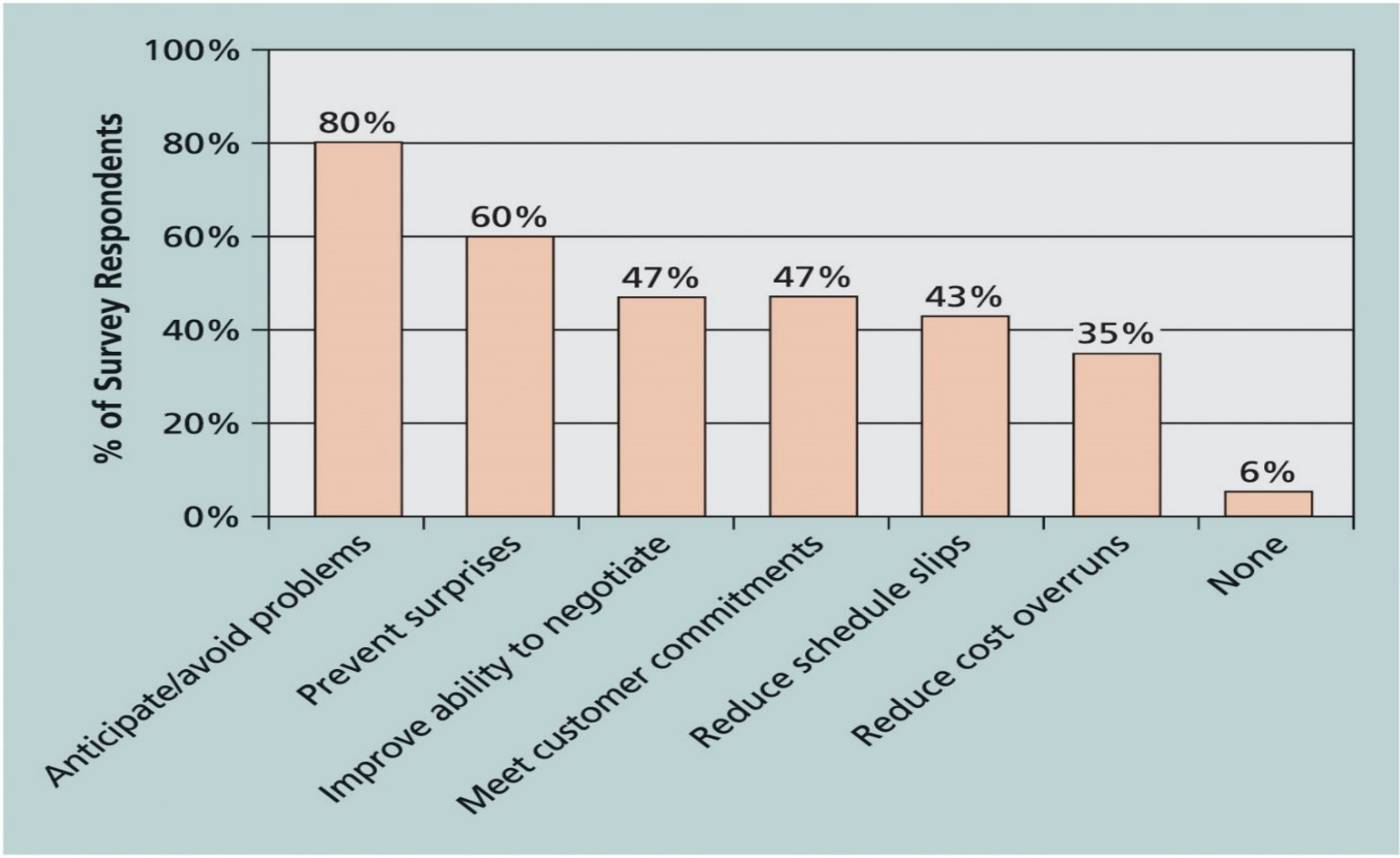
Learning Objectives

- Explain quantitative risk analysis 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 how to monitor risks
- Describe how software can assist in project risk management
- Discuss considerations for agile/adaptive environments

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

The Importance of Project Risk Management



Source: Kulik and Weber, KLCI Research Group

FIGURE 11-1 Benefits from software risk management practices

The Importance of Project Risk Management

- Risk utility 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
  - ***Risk-neutral*** approach achieves a balance between risk and payoff

The Importance of Project Risk Management

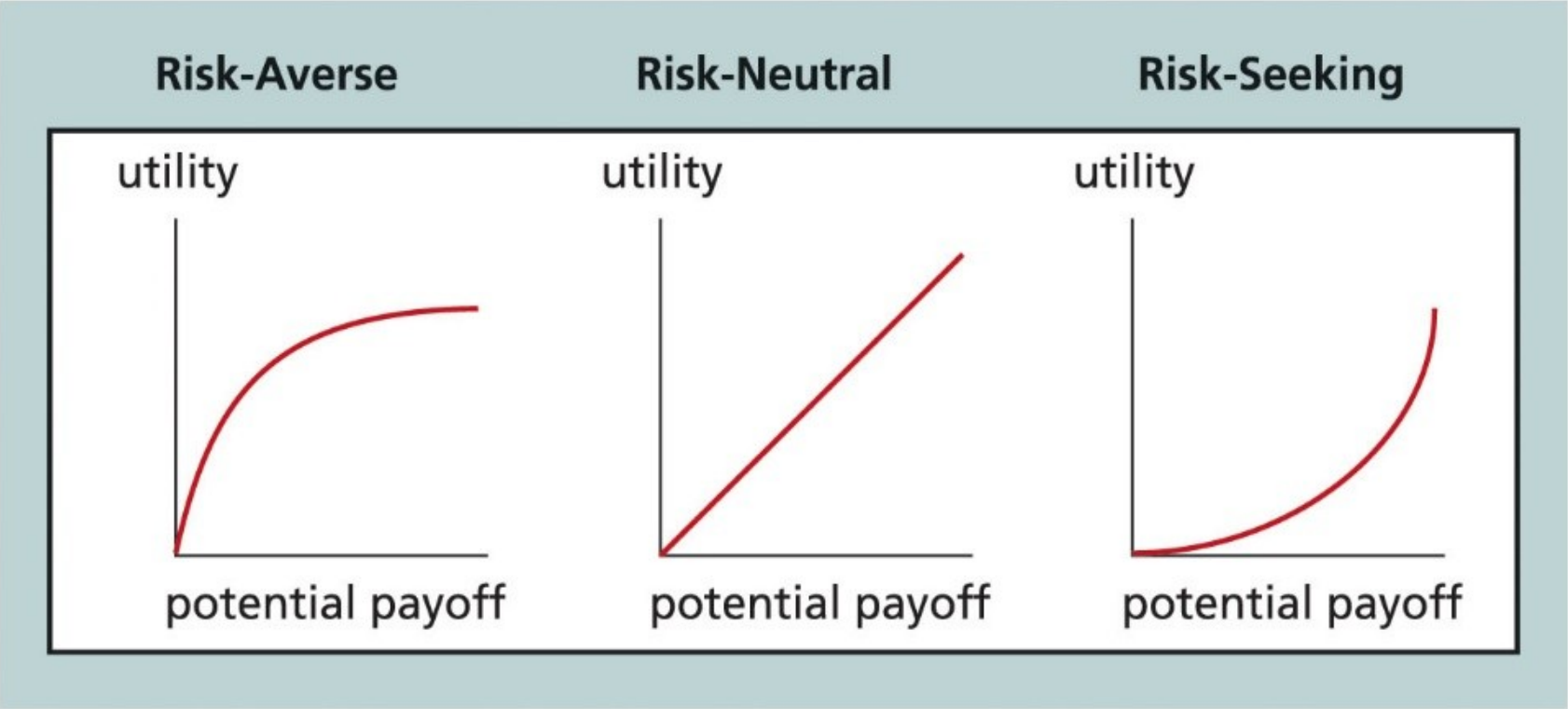


FIGURE 11-2 Risk utility function and risk preference

Are you choosing a **sure $50** or a **50% chance to win $100**?

Advice for Young Professionals

- Young project professionals are sometimes more willing to take risks with unique or untested approaches
- Take the time to find out what other, more experienced people might feel about the circumstances of a project before making up your mind about potential risks
- Then, taking other views into account, you can determine how best to plan for the impacts that might occur while balancing the rewards of a potential payoff from a unique or untested approach

The Importance of Project Risk Management

- Project risk management processes
  - ***Planning risk management***: deciding how to approach and plan the risk management activities for the project
  - ***Identifying risks***: determining which risks are likely to affect a project and documenting the characteristics of each
  - ***Performing qualitative risk analysis***: prioritizing risks based on their probability and impact of occurrence
  - ***Performing quantitative risk analysis***: numerically estimating the effects of risks on project objectives
  - ***Planning risk responses***: taking steps to enhance opportunities and reduce threats to meeting project objectives
  - ***Implementing risk responses***: implementing the risk response plans
  - ***Monitoring risk***: monitoring identified and residual risks, identifying new risks, carrying out risk response plans, and evaluating the effectiveness of risk strategies throughout

Planning Risk Management

- Main output of this process is a risk management plan
  - *Documents the procedures for managing risk throughout a project*
- The project team should review project documents as well as corporate risk management policies, risk categories, lessons-learned reports from past projects, and templates for creating a risk management plan
  - *It is also important to review the risk tolerances of various stakeholders*

Planning Risk Management

- Additional plans
  - ***Contingency plans***: predefined actions that the project team will take if an identified risk event occurs
  - ***Fallback plans***: 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***: funds included in the cost baseline that can be used to mitigate cost or schedule overruns if known risks occur
  - ***Management reserves***: funds held for unknown risks that are used for management control purposes

Planning Risk Management

Topics addressed in a risk management plan

Topic	Questions to Answer
Methodology	How will risk management be performed on this project? What tools and data sources are available and applicable?
Roles and responsibilities	Which people are responsible for implementing specific tasks and providing deliverables related to risk management?
Budget and schedule	What are the estimated costs and schedules for performing risk-related activities?
Risk categories	What are the main categories of risks that should be addressed on this project? Is there a risk breakdown structure for the project? (See the information on risk breakdown structures later in this chapter.)
Risk probability and impact	How will the probabilities and impacts of risk items be assessed? What scoring and interpretation methods will be used for the qualitative and quantitative analysis of risks? How will the probability and impact matrix be developed?
Revised stakeholders' tolerances	Have stakeholders' tolerances for risk changed? How will those changes affect the project?
Tracking	How will the team track risk management activities? How will lessons learned be documented and shared? How will risk management processes be audited?
Risk documentation	What reporting formats and processes will be used for risk management activities?

Common Sources of Risk on IT 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
  - ***Market risk***
  - ***Financial risk***
  - ***Technology risk***
  - ***People risk***
  - ***Structure/process risk***
- A risk breakdown structure is a hierarchy of potential risk categories for a project

Common Sources of Risk on IT Projects

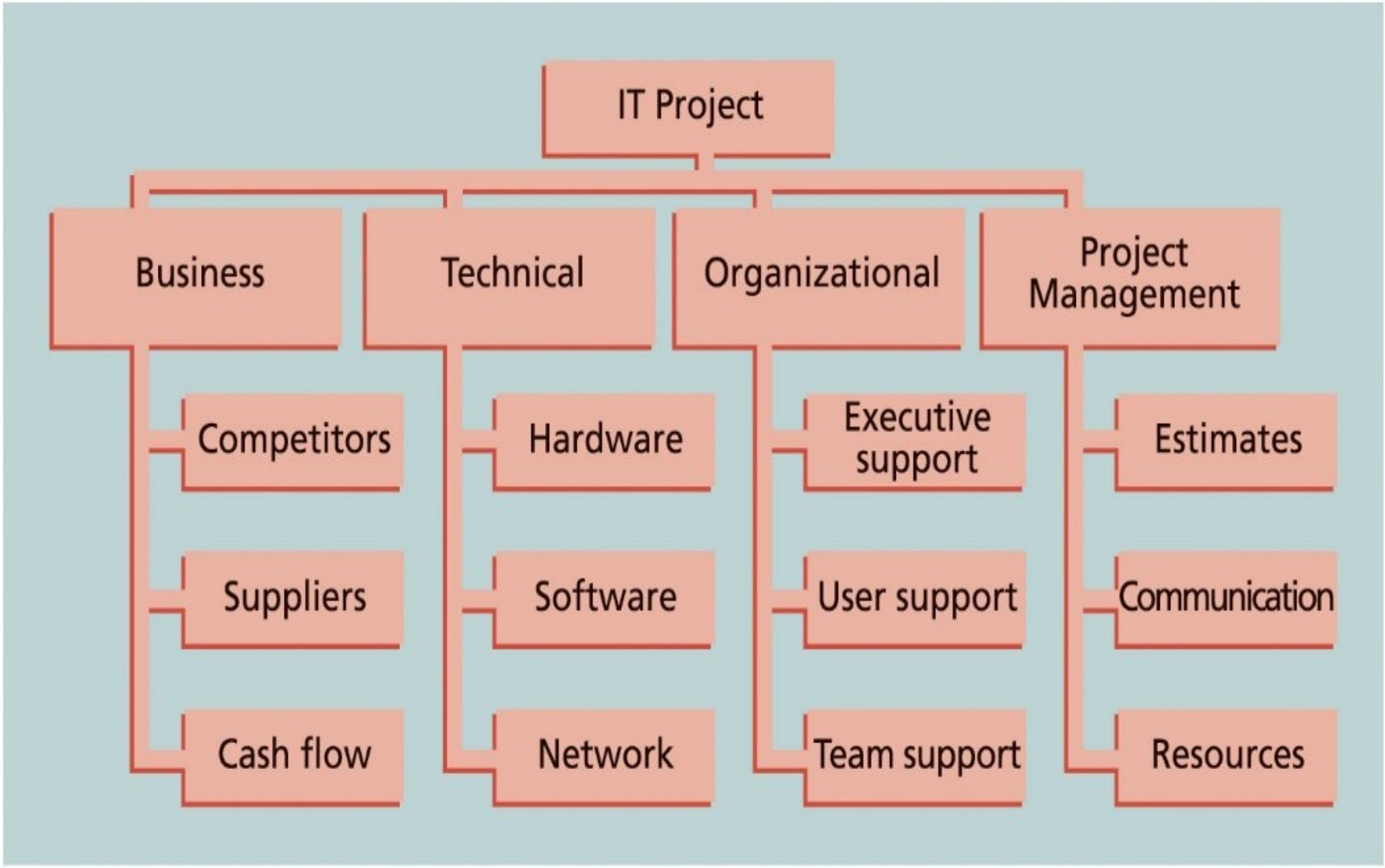


FIGURE 11-4 Sample risk breakdown structure

Common Sources of Risk on IT Projects

Potential negative risk conditions associated with each knowledge area. *Source: R.M. Wideman*

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
Time	Errors in estimating time or resource availability; errors in determining the critical path; poor allocation and management of float; early release of competitive products
Cost	Estimating errors; inadequate productivity, cost, change, or contingency
Quality	Poor attitude toward quality; substandard design, materials, and workmanship; inadequate quality assurance program
Human resource	Poor conflict management; poor project organization and definition of responsibilities; absence of leadership
Communications	Carelessness in planning or communicating
Risk	Ignoring risk; unclear analysis of risk; poor insurance management
Procurement	Unenforceable conditions or contract clauses; adversarial relations
Stakeholders	Lack of consultation with key stakeholder; poor sponsor engagement

Identifying Risks

- Understanding what potential events might hurt or enhance a particular project

- Suggestions for identifying risks: tools and techniques
  - *Brainstorming*
  - *The Delphi Technique*
  - *Interviewing*
  - *SWOT analysis*

Identifying Risks

- Delphi Technique
  - 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

Identifying Risks

- Delphi Technique
  - Advantages of the Delphi Technique
  - ✔ Reduces bias since responses are anonymous.
    ✔ Encourages independent thinking without group pressure.
    ✔ Efficient for complex problems where expert judgment is essential.
    ✔ Can be conducted remotely, making it cost-effective.
  - Limitations of the Delphi Technique

    ✘ Time-consuming due to multiple rounds.
    ✘ Relies on expert selection, which may introduce bias.
    ✘ May not always achieve full consensus if opinions remain divided.

Identifying Risks

Interviewing

- Fact-finding technique for collecting information in face-to-face, phone, e-mail, or virtual discussions
- Interviewing people with similar project experience is an important tool for identifying potential risks

Identifying Risks

- SWOT analysis
  - Strengths, weaknesses, opportunities, and threats
  - Helps identify the broad negative and positive risks that apply to a project

The Risk Register

- Important output of the risk identification process
  - List of identified risks and other information needed to begin creating a risk register
    - Contains the results of various risk management processes and that is often displayed in a table or spreadsheet format
    - 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

Sample Risk Register

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

Sample Risk Register

1. No.: R44
2. Rank: 1
3. Risk: New customer
4. Description: We have never done a project for this organization before and don't know too much about them. One of our company's strengths is building
5. good customer relationships, which often leads to further projects with that customer. We might have trouble working with this customer because they are new to us.
6. Category: People risk
7. Root cause: We won a contract to work on a project without really getting to know the customer.
8. Triggers: The new customer asked a lot of questions in person and via e-mail that our existing customers would not, so we could easily misunderstand their needs and expectations.
9. Potential responses: Make sure the project manager is sensitive to the fact that this is a new customer and takes the time to understand them. Have the PM set up a meeting to get to know the customer and clarify their expectations. Have Cliff attend the meeting, too.
10. Risk owner: Project manager
11. Probability: Medium
12. Impact: High
13. Status: PM will set up the meeting within the week.

Performing Risk Analysis

- Qualitative: Assess the likelihood and impact of identified risks to determine their magnitude and priority

Example Application: A startup evaluating risks in a new market may use qualitative analysis to assess threats and prioritize them.

- Quantitative: A numerical approach that uses statistical methods and data to measure risk impact and probability.

Example Application: A bank calculating the probability of loan defaults will use quantitative analysis (Monte Carlo simulations, statistical modeling).

Performing Qualitative Risk Analysis

Feature	Qualitative Risk Analysis	Quantitative Risk Analysis
Definition	A subjective method of assessing risk based on expert judgment, experience, and predefined scales.	A numerical approach that uses statistical methods and data to measure risk impact and probability.
Focus	Prioritizing risks based on likelihood and impact categories.	Assigning numerical values to risks and calculating their financial or operational impact.
Data Used	Expert opinions, historical data, risk matrices, and categories (e.g., low, medium, high).	Statistical data, simulations, probability distributions, and financial figures.
Techniques	- Risk Matrix (Probability vs. Impact) - Expert Judgment - Delphi Technique - SWOT Analysis - Risk Ranking & Prioritization	- Monte Carlo Simulation - Sensitivity Analysis - Expected Monetary Value (EMV) - Fault Tree Analysis - Decision Tree Analysis
Accuracy	Subjective and may vary based on expert judgment.	More precise and data-driven, reducing biases.
Ease of Use	Quick, simple, and cost-effective.	Complex, requiring specialized tools and expertise.
Best for	Initial risk assessment, projects with limited data, and general risk categorization.	Projects with high uncertainty, financial modeling, and detailed risk evaluation.
Output	A prioritized list of risks categorized as low, medium, or high.	Specific numerical risk values, probabilities, and potential monetary impact.
Decision Making	Helps identify critical risks that require attention.	Provides a basis for cost-benefit analysis and financial decision-making.

Using Probability/Impact Matrixes to Calculate Risk Factors

- Lists 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
  - *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*
- Calculates 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*

Using Probability/Impact Matrixes to Calculate Risk Factors

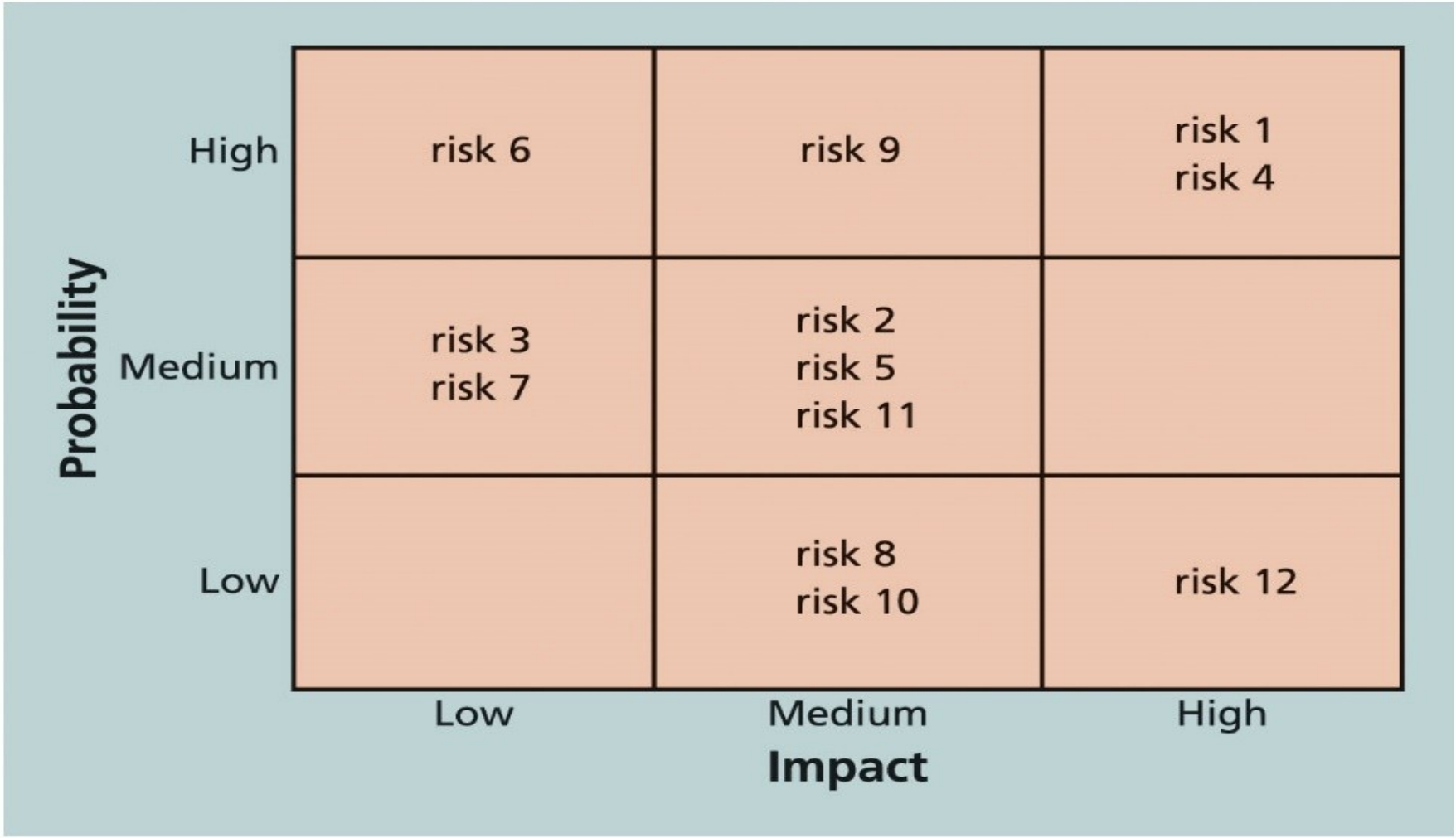


FIGURE 11-5 Sample probability/impact matrix

PROBABILITY/IMPACT MATRIX

		Impact				
		Trivial	Minor	Moderate	Major	Extreme
Probability	Rare	Low	Low	Low	Medium	Medium
	Unlikely	Low	Low	Medium	Medium	Medium
	Moderate	Low	Medium	Medium	Medium	High
	Likely	Medium	Medium	Medium	High	High
	Very Likely	Medium	Medium	High	High	High

PROBABILITY/IMPACT MATRIX

Risk Score for a Specific Risk					
Probability	**Risk Score = Probability x Impact**				
0.9	0.05	0.09	0.18	0.36	0.72
0.7	0.04	0.07	0.14	0.28	0.56
0.5	0.03	0.05	0.10	0.20	0.40
0.3	0.02	0.03	0.06	0.12	0.24
0.1	0.01	0.01	0.02	0.04	0.08
	0.05	0.10	0.20	0.40	0.80
	Impact on an Objective (e.g., cost, time or scope) (Ratio Scale)				

Each risk is rated on its probability of occurring and impact if it does occur. The organization's thresholds for low (gray), moderate (gold) or high (red) as shown in the matrix determines the risk's score. (#)

Adopted from PMI's PMBOK® Guide

Using Probability/Impact Matrixes to Calculate Risk Factors

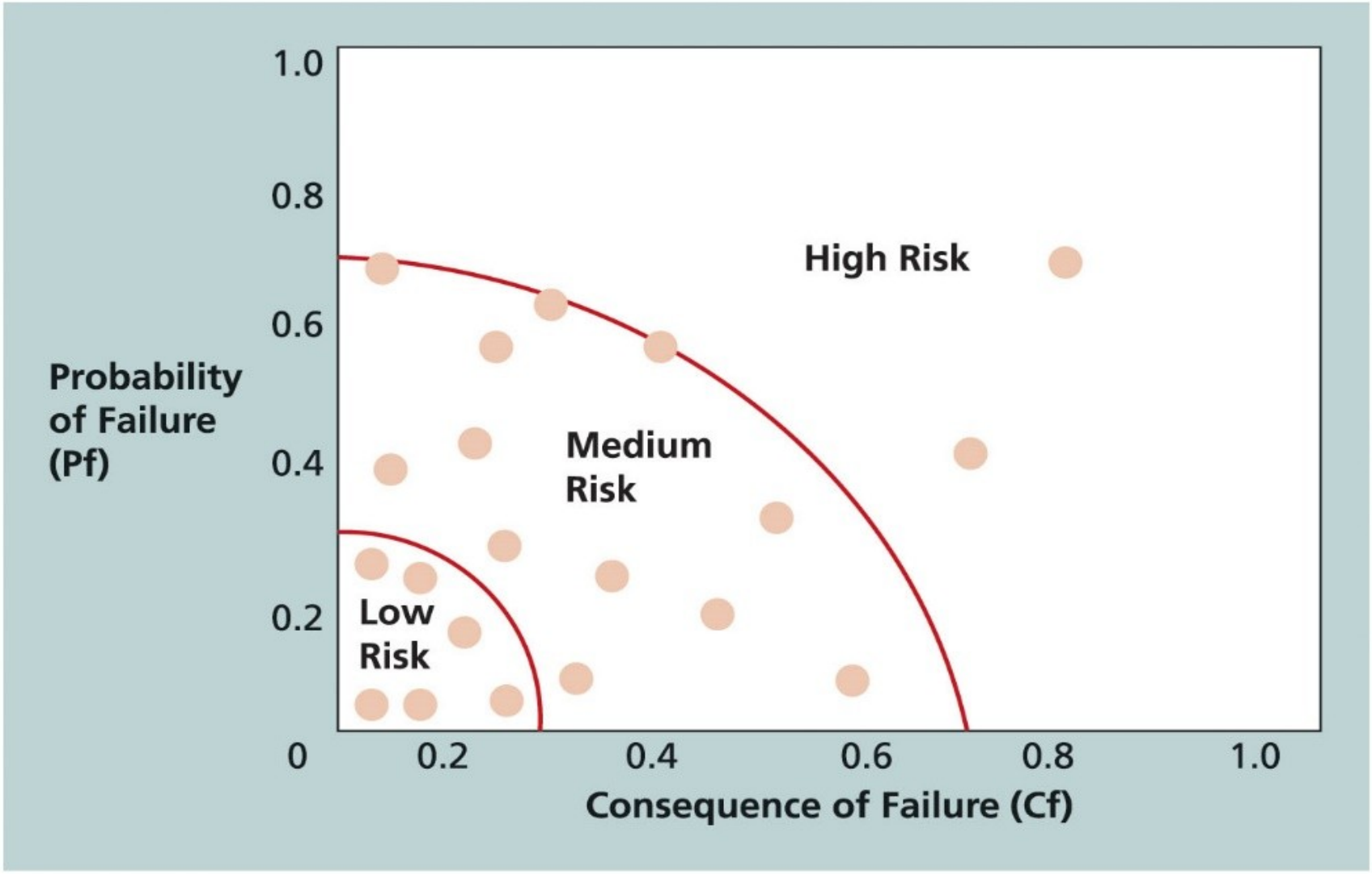


FIGURE 11-6 Chart showing high-, medium-, and low-risk technologies

Top Ten Risk Item Tracking

- Qualitative risk analysis tool that helps to identify risks and maintain an awareness of risks throughout the life of a project
  - *Involves establishing a periodic review of the top ten project risk items*
  - *Includes 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*
- A watch list is a list of risks that are low priority, but are still identified as potential risks
  - *Qualitative analysis can also identify risks that should be evaluated quantitatively*

Top Ten Risk Item Tracking

Example of top ten risk item tracking

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

Performing 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
  - *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

Decision Trees and Expected Monetary Value (EMV)

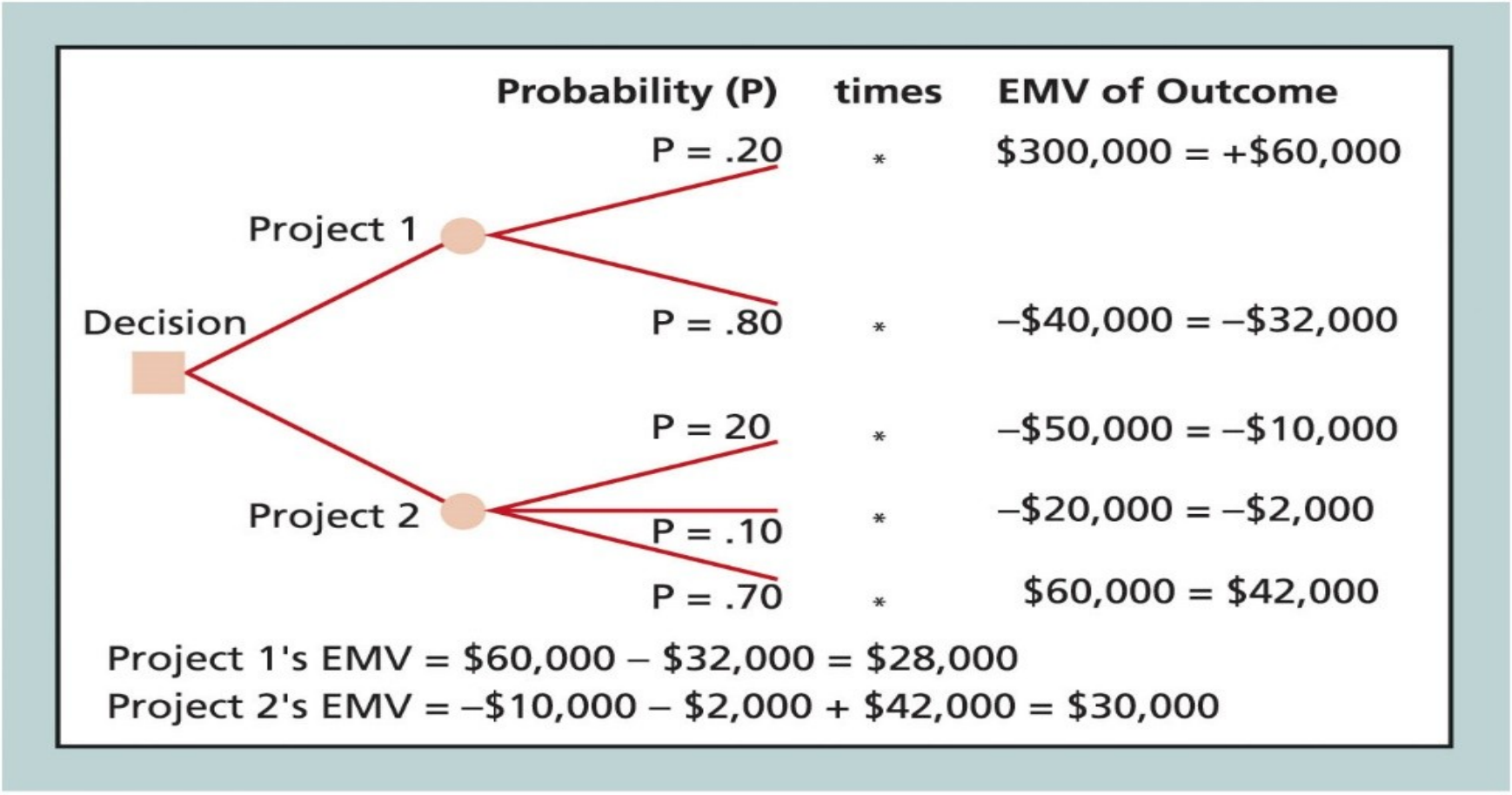


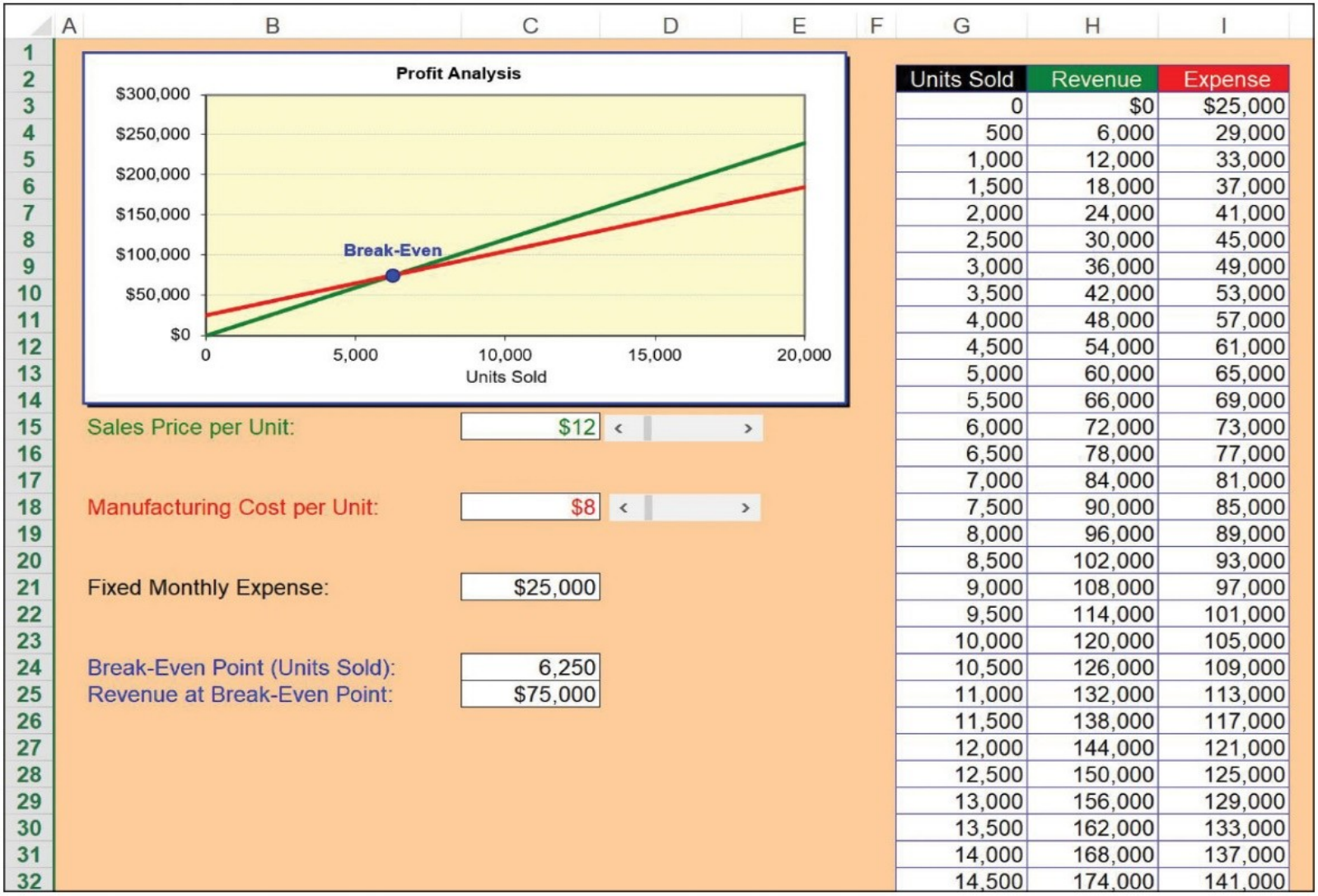
FIGURE 11-7 Expected monetary value (EMV) example

EMV=(Probability×Outcome)+(Probability×Outcome)

Sensitivity Analysis

- 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
- Spreadsheet software, such as Microsoft Excel, is a common tool for performing sensitivity analysis

Sensitivity Analysis



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

FIGURE 11-9 Sample sensitivity analysis for determining break-even point

Planning Risk Responses

- After identifying and quantifying risks, the organization must decide how to respond to them
  - Basic response strategies for negative risks
    - ***Risk avoidance***
    - ***Risk acceptance***
    - ***Risk transference***
    - ***Risk mitigation***
    - ***Risk escalation***
  - Basic response strategies for positive risks
    - ***Risk exploitation***
    - ***Risk sharing***
    - ***Risk enhancement***
    - ***Risk acceptance***

Planning Risk Responses

General risk mitigation strategies for technical, cost, and schedule risks. **Source: J. Couillard*

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, understanding of project goals, and team support	Select the most experienced project manager
Increase the frequency of project monitoring	Increase project manager authority	
Use WBS and CPM		

Monitoring Risks

- Involves ensuring the appropriate risk responses are performed, tracking identified risks, identifying and analyzing new risk, and evaluating effectiveness of risk management throughout the entire project
  - *Project risk management does not stop with the initial risk analysis*
- Carrying out individual risk management plans involves monitoring risks based on defined milestones and making decisions regarding risks and their response strategies
  - *Project teams sometimes use workarounds—unplanned responses to risk events—when they do not have contingency plans in place*

Using Software to Assist in Project Risk Management

- Risk registers can be created in a simple Microsoft Word or Excel file or as part of a sophisticated database
  - More sophisticated risk management software, such as Monte Carlo simulation tools, help develop models and use simulations to analyze and respond to various risks

Chapter Summary

- Risk is an uncertainty that can have a negative or positive effect on meeting project objectives
  - *Many organizations do a poor job of project risk management, if they do any at all*
  - *Successful organizations realize the value of good project risk management*
- Risk management is an investment
  - *Costs are associated with identifying risks, analyzing those risks, and establishing plans to address them*
- Implementing risk responses involves putting the appropriate risk response plans into action
  - *Monitoring risks involves monitoring implementation of risk response plans, tracking*