Project Risk Management

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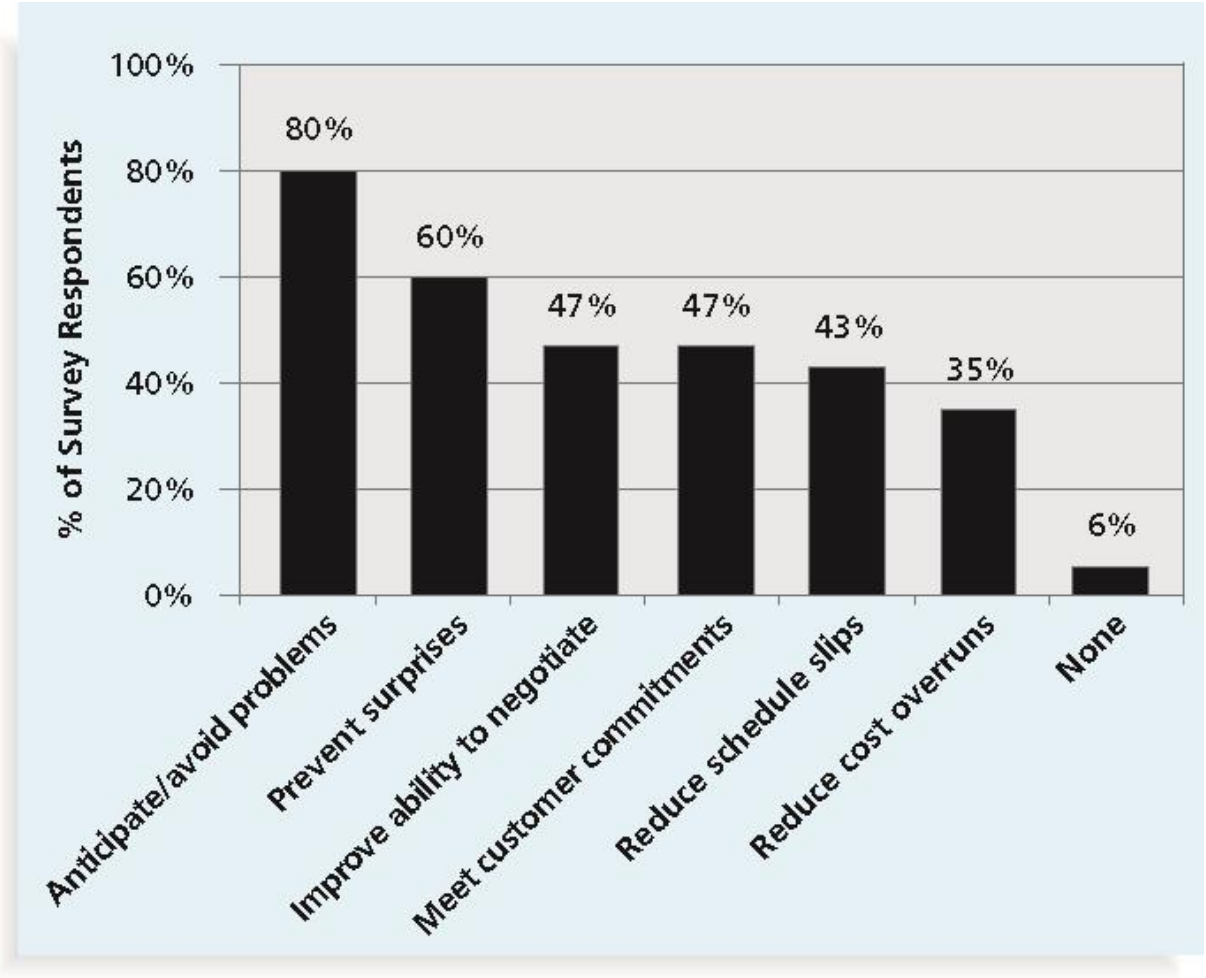
Learning Objectives

- 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**
- Discuss the **qualitative risk analysis** process and explain how to create probability/impact matrixes
- 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**

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**

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
  - maximize potential positive risks

Project Risk Management Processes

- **Plan risk management**: deciding how to approach and plan the risk management activities for the project
- **Identify risks**: determining which risks are likely to affect a project and documenting the characteristics of each
- **Perform qualitative risk analysis**: prioritizing risks based on their probability and impact of occurrence

Project Risk Management Processes (continued)

- **Perform quantitative risk analysis**: numerically estimating the effects of risks on project objectives
- **Plan risk responses**: taking steps to enhance opportunities and reduce threats to meeting project objectives
- **Monitor and control risks**: 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

Plan Risk Management

- 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 level of detail will vary

Topics Addressed in a Risk Management Plan

- Methodology
- Roles and responsibilities
- Budget and schedule
- Risk categories
  - E.g. Market, Financial, Technology, People, Process
- Risk probability and impact
  - Scoring and interpretation methods
- Stakeholders' tolerances
  - Risk-averse Vs risk-seeking
- Tracking
- Risk documentation

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

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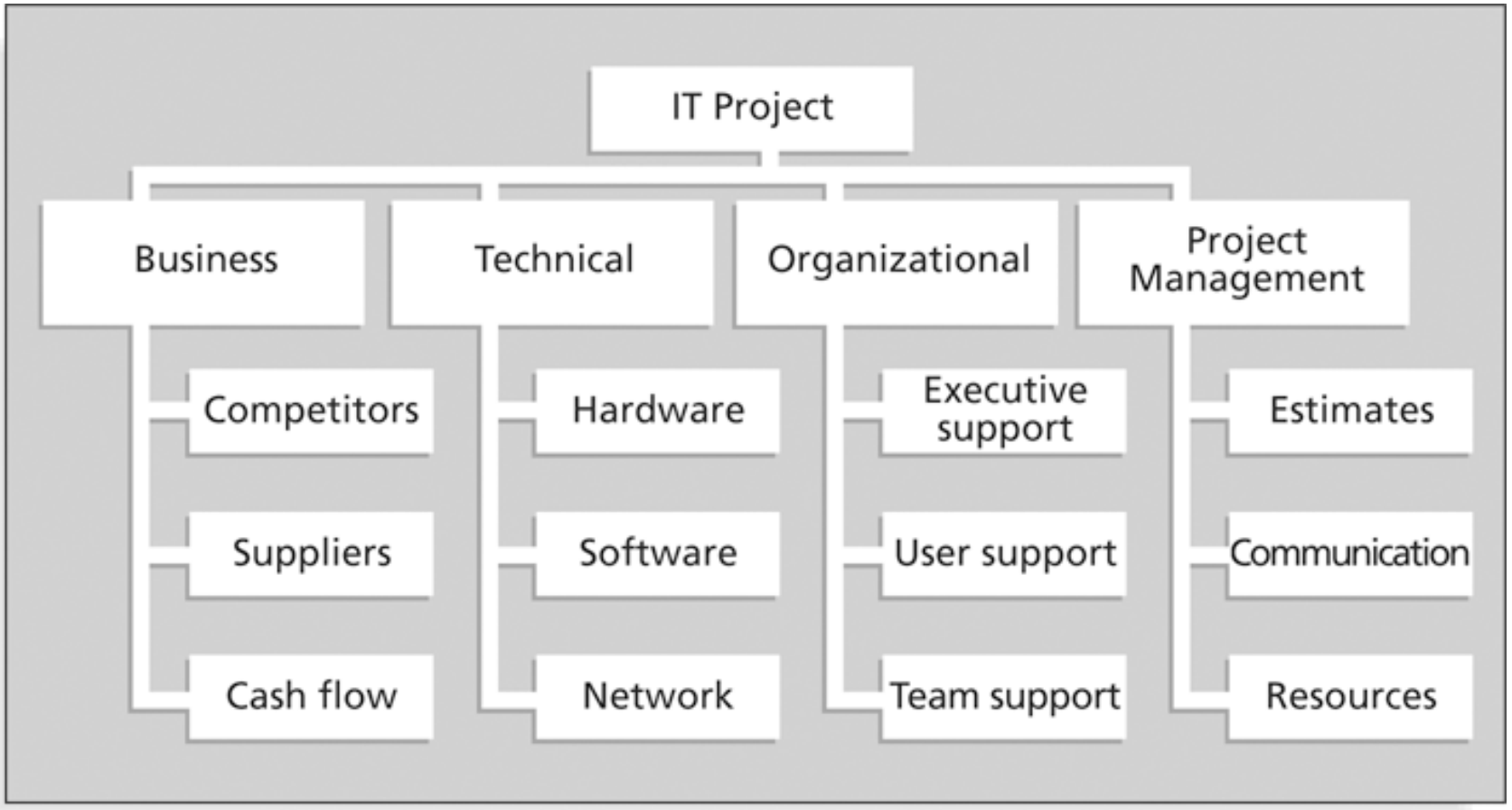
Sample Risk Breakdown Structure



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 actions that will be taken if the contingency plan is not effective

- ***Contingency reserves*** or ***allowances*** are provisions to reduce the risk of cost or schedule overruns to an acceptable level

Identify Risks

- 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

Delphi Technique

- The ***Delphi Technique*** is used to derive a consensus among a panel of experts
- A kind of expert judgment
- 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

Risk Register

- The main output of various risk management processes
- Can contain:
  - Risk events
    - refer to specific, uncertain events that may occur to the detriment or enhancement of the project. E.g. project delay, increase in costs, shortage in supply
  - Description
  - Rank
    - Usually a number, with 1 being the highest
  - Category
  - Root cause
  - Triggers
    - Indicators or symptoms, e.g. defective products, schedule overrun
  - Responses
  - Probability and impact
  - Owner

Sample Risk Register

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

Perform Qualitative Risk Analysis

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

- Use **probability/impact matrixes** or expert judgment

Sample Probability/Impact Matrix

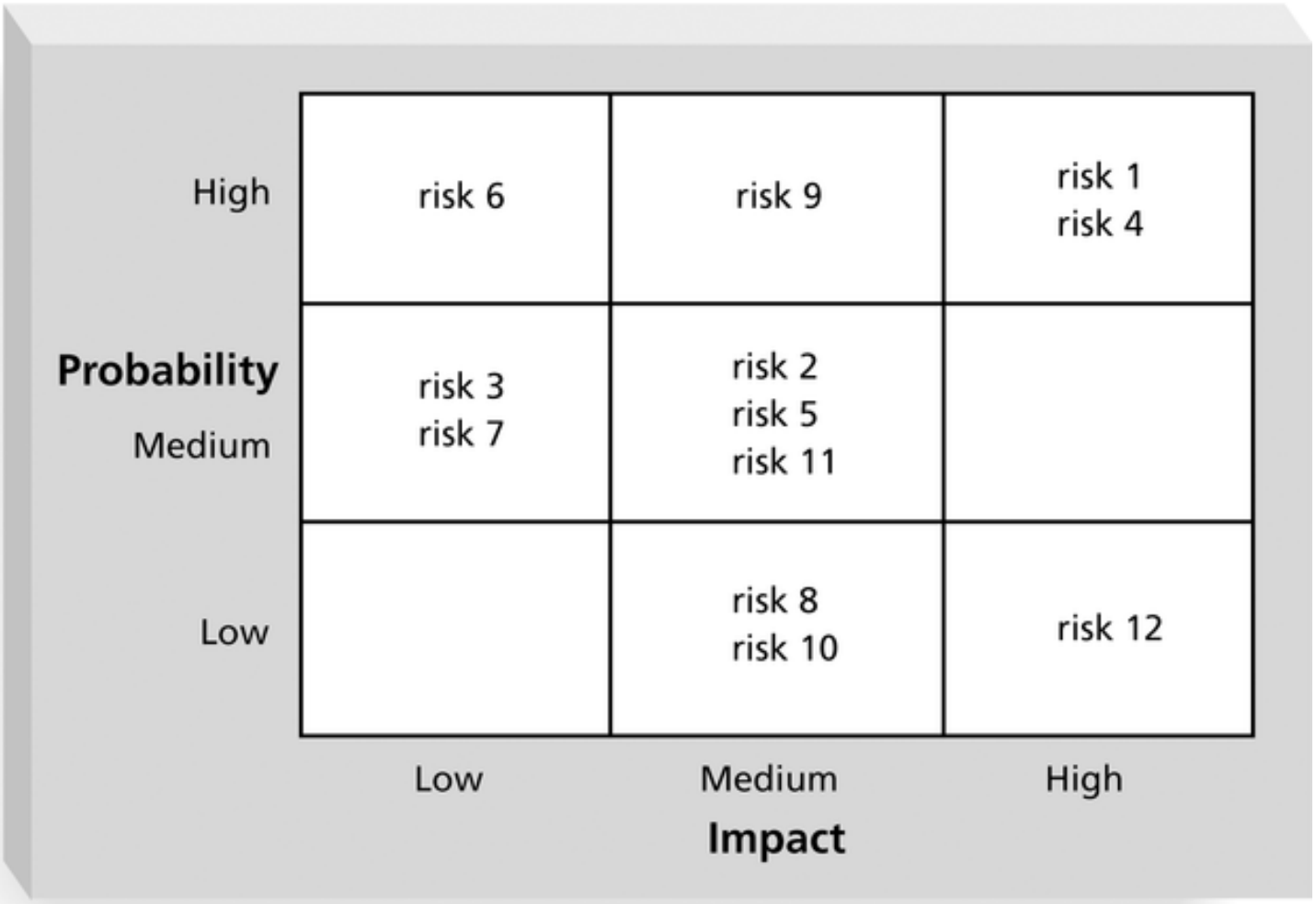
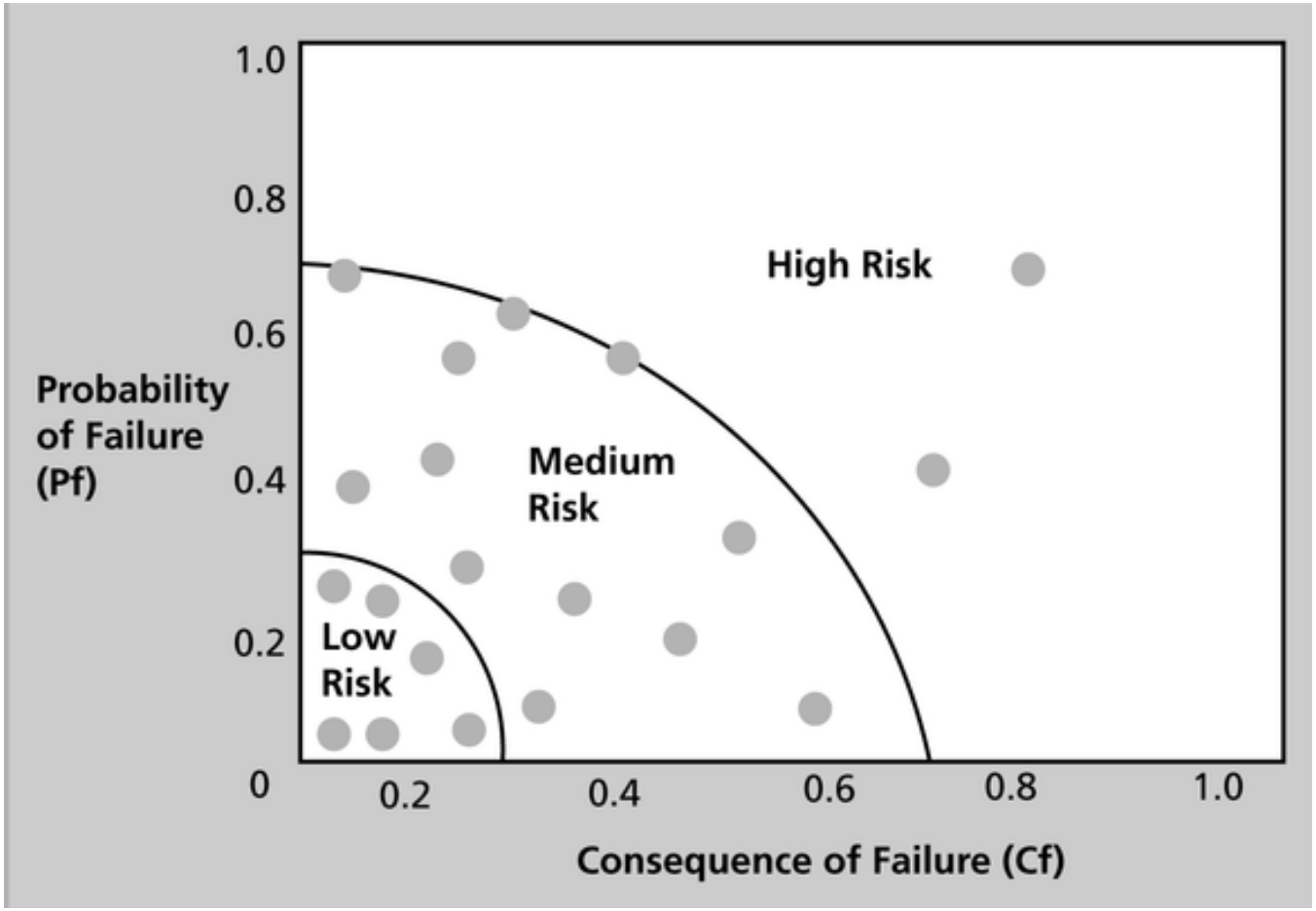


Chart Showing High-, Medium-, and Low-Risk Technologies



Watch List

- 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 on a quantitative basis

Perform 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

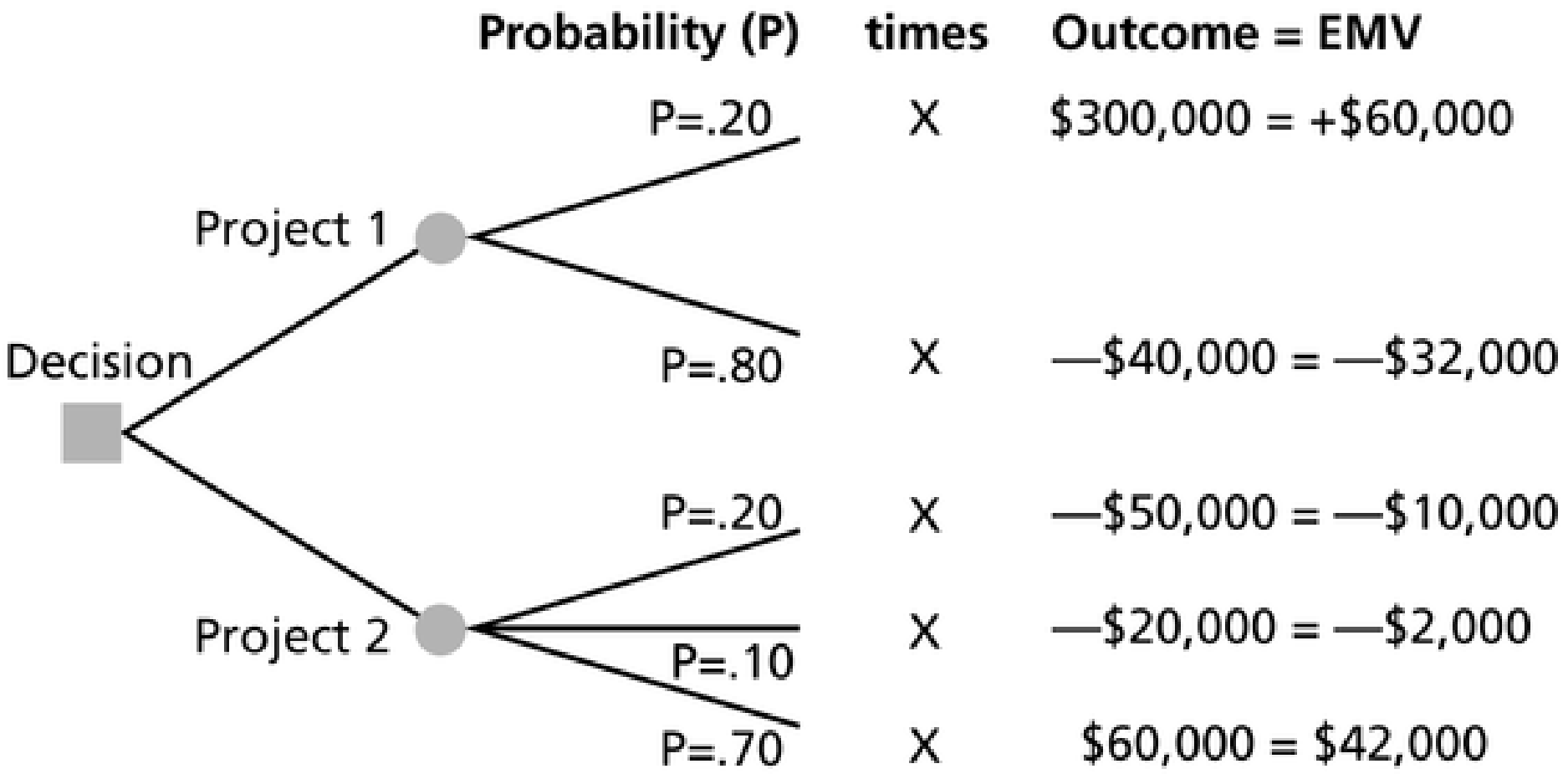
Decision Trees and Expected Monetary Value (EMV)

- 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

- ***Expected 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

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

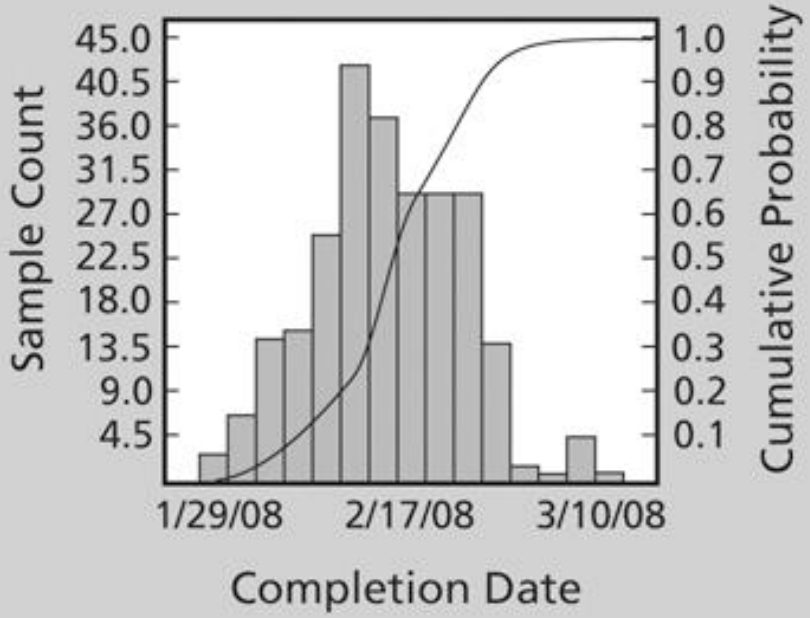
Simulation

- Typically performed using ***Monte Carlo Analysis***
- It uses the network diagram and estimates to "**perform**" the project many times → to simulate the cost or schedule results
- Provide the probability of completing the project on any specific day, or for any specific amount of cost
- Results in a probability distribution

Sample Monte Carlo Simulation Results for Project Schedule

Date: 1/14/08 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	2/4/08	0.55	2/17/08
0.10	2/8/08	0.60	2/18/08
0.15	2/9/08	0.65	2/19/08
0.20	2/10/08	0.70	2/22/08
0.25	2/11/08	0.75	2/22/08
0.30	2/12/08	0.80	2/23/08
0.35	2/15/08	0.85	2/24/08
0.40	2/15/08	0.90	2/25/08
0.45	2/16/08	0.95	2/26/08
0.50	2/17/08	1.00	3/10/08

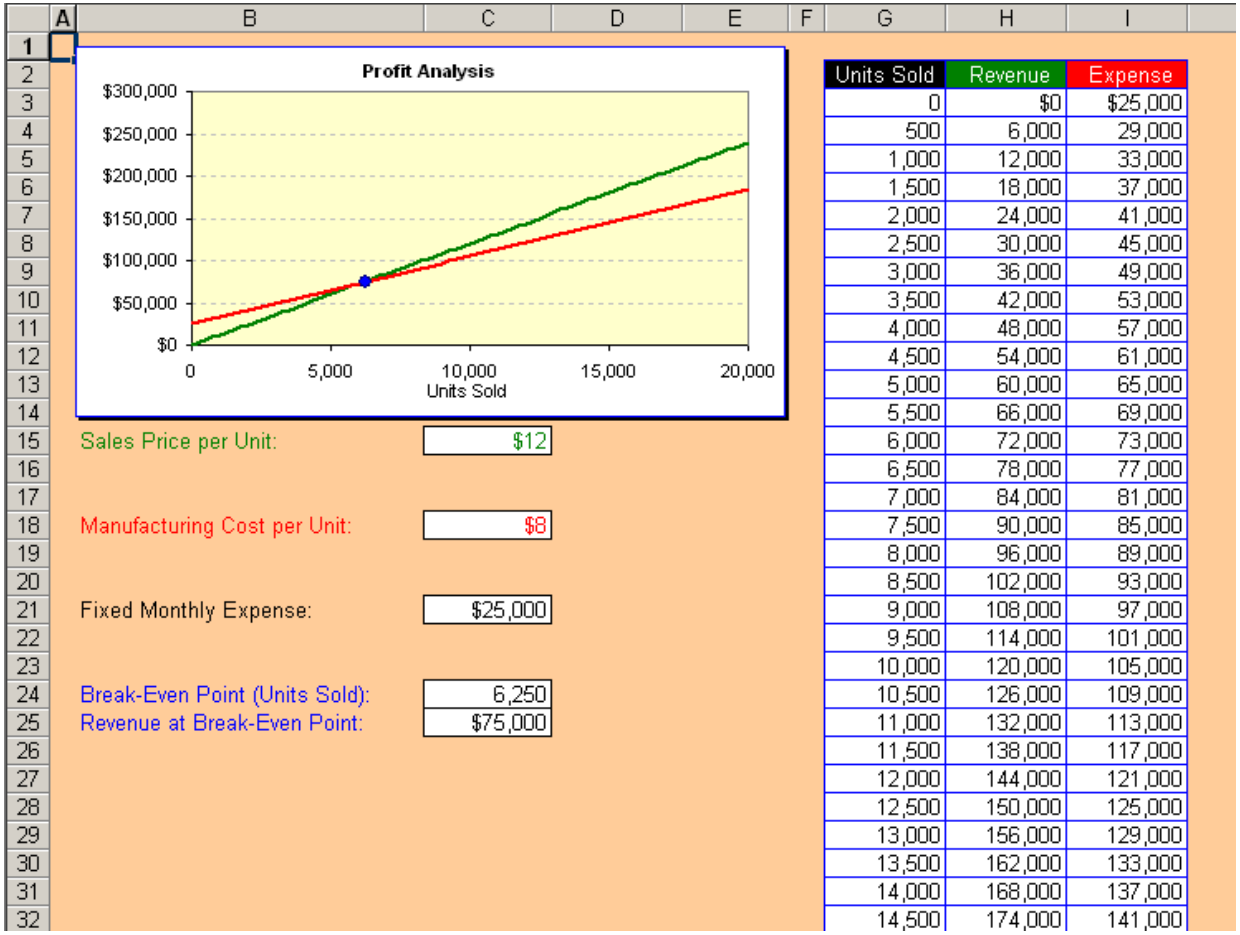
Sensitivity Analysis

- ***Sensitivity analysis*** is a technique used to show the effects of changing one or more variables on an outcome

- For example, determining what the **monthly payments** for a loan will be given different **interest rates** or **periods** of the loan

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

Sample Sensitivity Analysis for Determining Break-Even Point



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

Plan Risk Responses

- After identifying and quantifying risks, you must decide how to respond to them
- Objective is to:
  - Reduce threat
  - Enhance opportunities

Strategies for Negative Risks

- ***Avoid***
  - Involves **eliminating** a specific threat by changing the project plan to adopt an alternative strategy/approach to eliminate the risk entirely
  - E.g. eliminating a problem staff, acquiring expertise
- ***Transfer***
  - **Passes** the risk and the responsibility of developing a risk response to a third party
  - Always involves payment of a risk premium
  - E.g. insurance, performance bonds, warranties, guarantees
- ***Mitigate***
  - Specific actions are taken to **reduce the probability** of occurrence or **consequence** of an adverse risk event to an acceptable level
  - E.g. conducting more tests, choosing a more stable supplier, developing a prototype

Strategies for Positive Risks

- ***Exploit***
  - Make the opportunity definitely happen
  - E.g. assigning more talented resources to ensure time reduction will be achieved
- ***Share***
  - Allocate ownership to a third party who is best able to capture the opportunity for the benefit of the project
  - E.g. forming joint ventures, risk-sharing partnerships
- ***Enhance***
  - Increase probability and/or positive impacts by maximizing key drivers of these positive-impact risks, or reinforcing its trigger conditions

Strategies for Both and Threats and Opportunities

- ***Accept***
  - A conscious decision to take no action or unable to identify any other suitable response strategy
    - **Active**: Contingency plan, fallback plan, contingency reserve
    - **Passive**: Requires no action; anticipating lower profits or project delay

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

Monitor and Control Risks

- Involves managing the project according to the risk response plan, e.g.
  - Monitor risk triggers
  - Review and communicate risk status
  - Revisit the watch list
  - etc.

- ***Workarounds*** are **unplanned responses** to risk events that must be done when there are no contingency plans