Capstone Computing Project

Project Risk Management

Outline

- Introduction to Risk
- Project Risk Management
- Boehm's top 10 development risks
- Project Risk Management Processes with examples

Risk

- Risk involves uncertainty and loss:
  - Uncertainty: The degree of certainty about whether the risk will happen
  - Loss: If the risk becomes a reality, unwanted consequences or losses will occur

Example: Project Risk

- A company introduced OO technology into its organization, using a well-defined project "X" as the pilot
- Many project “X” personnel were familiar with OO, but it had not been part of their development process (had very little experience and training in application of OO)
- It is taking project personnel longer than expected to climb the learning curve
- Some personnel are concerned that the modules implemented to date might be too inefficient to satisfy project "X" performance requirements

Project Risk Management

- The art and science of identifying, analyzing, and responding to risk throughout the project duration
- Often overlooked in projects, but it can help improve project success
  - Studies show risk has the lowest maturity rating of all knowledge areas

Negative Risk

- The possibility of loss or injury
- Need to understand 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

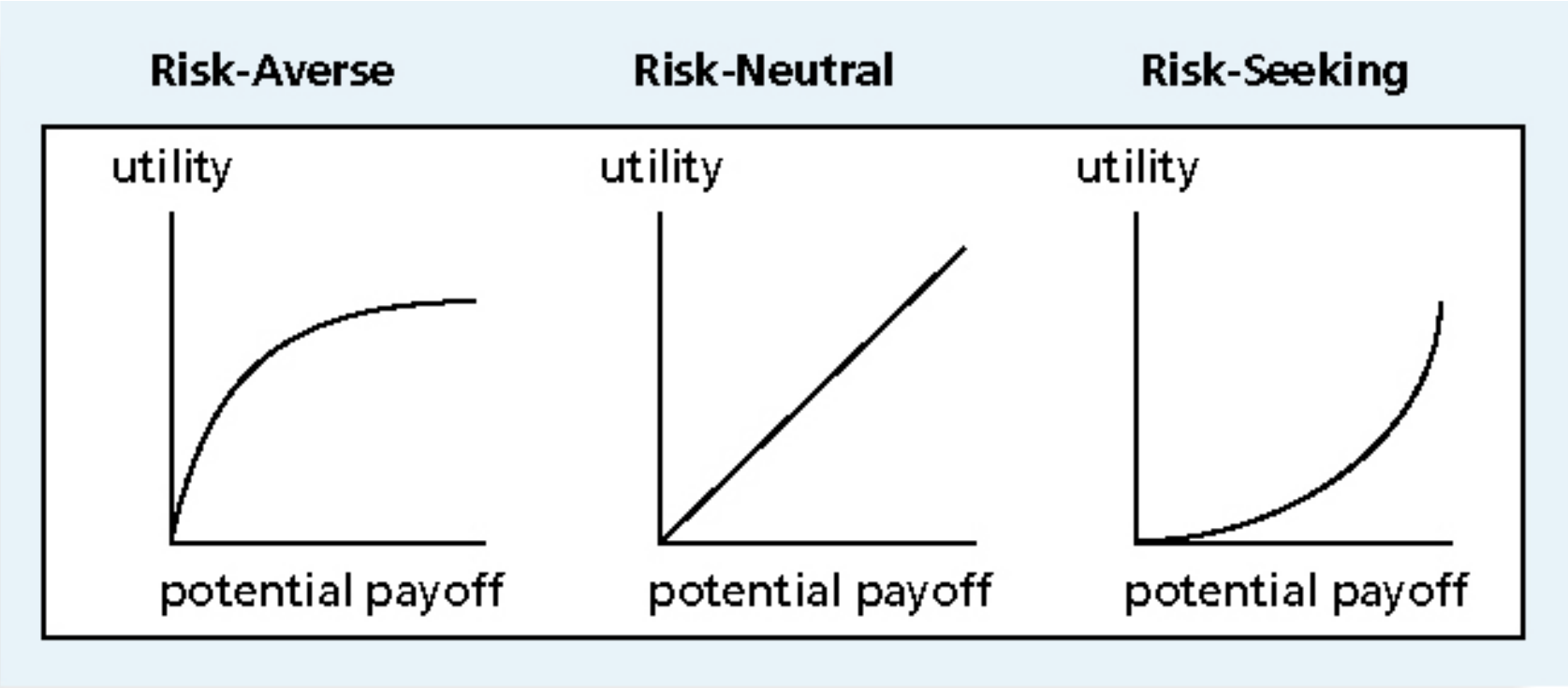
Risk Can Be Positive

- Positive risks result in good things happening
  - sometimes called opportunities
- A project **risk** is an uncertainty that can have a negative or positive effect on meeting project objectives
- 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



Personal Risk Policies (I)

- Decision (1): Choose between
  - A. sure gain of $240
  - B. 25% chance to win $1000 and 75% chance to gain nothing
- Decision (2): Choose between
  - C. Sure loss of $750
  - D. 75% chance to lose $1000 and 25% chance to lose nothing

Personal Risk Policies (II)

- Choose between:
  - AD. 25% chance to win $240 and 75% chance to lose $760
  - BC. 25% chance to win $250 and 75% chance to lose $750

Boehm's top 10 development risks (I)

Risk	*Risk reduction techniques*
Personnel shortfalls	Staffing with top talent; job matching; teambuilding; training and career development; early scheduling of key personnel
Unrealistic time and cost estimates	Multiple estimation techniques; design to cost; incremental development; recording and analysis of past projects; standardization of methods
Developing the wrong software functions	Improved software evaluation; formal specification methods; user surveys; prototyping; early user manuals
Developing the wrong user interface	Prototyping; task analysis; user involvement

Boehm's top 10 development risks (II)

Gold plating	Requirements scrubbing, prototyping, design to cost
Late changes to requirements	Change control, incremental development
Shortfalls in externally supplied components	Benchmarking, inspections, formal specifications, contractual agreements, quality controls
Shortfalls in externally performed tasks	Quality assurance procedures, competitive design etc
Real time performance problems	Simulation, prototyping, tuning
Development technically too difficult	Technical analysis, cost-benefit analysis, prototyping , training

Project Risk Management Processes (I)

- **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

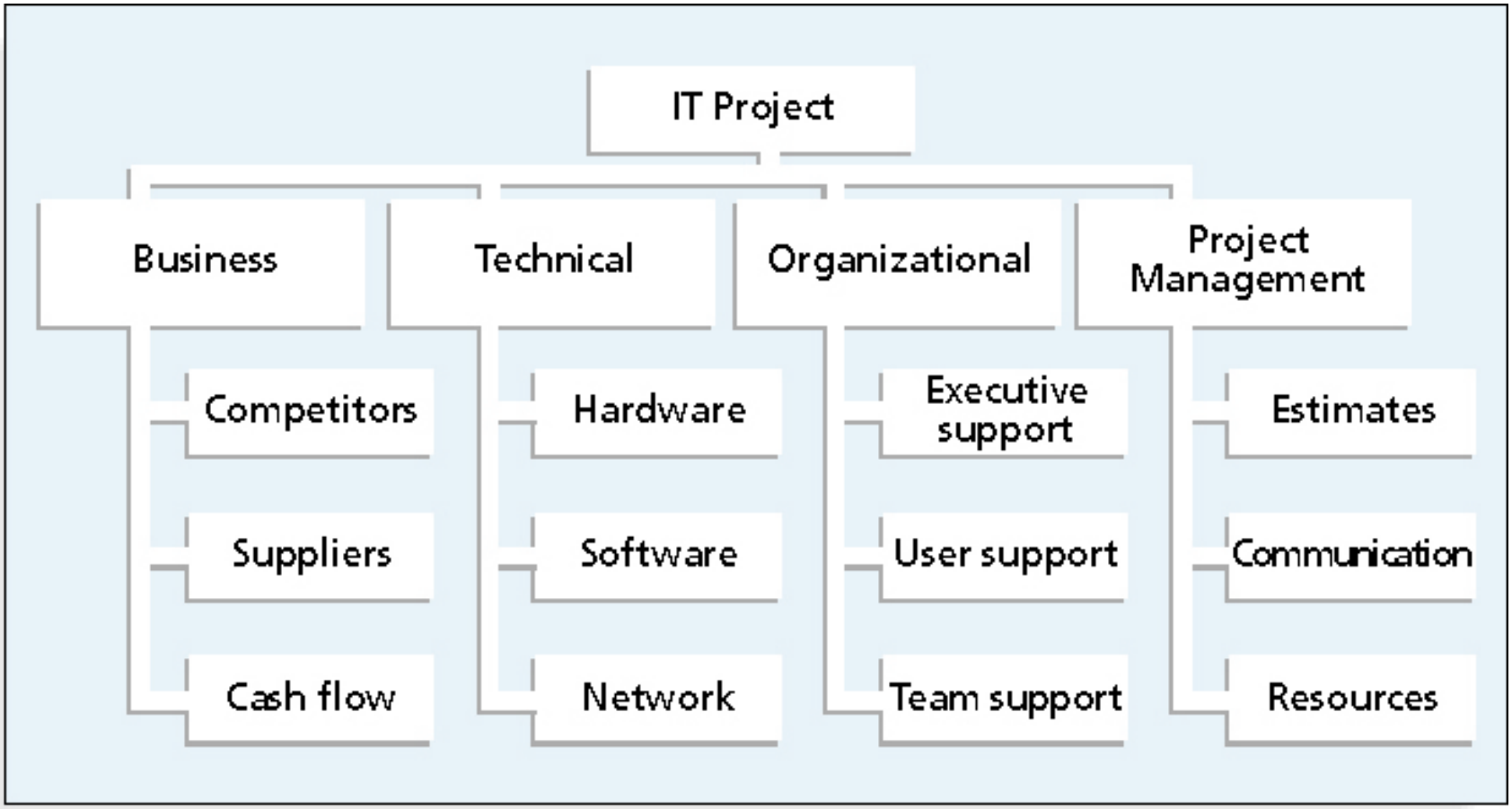
Project Risk Management Processes (II)

- **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
- **Monitoring and controlling 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

Risk Breakdown Structure

- A **risk breakdown structure** is a hierarchy of potential risk categories for a project
- Mainly used to identify and categorize risks

Sample Risk Breakdown Structure



Identifying Risks

- Identifying risks is the process of understanding what potential events might hurt or enhance a particular project
- Risk identification tools and techniques include:
  - Brainstorming: collect ideas without judgment
  - The Delphi Technique: panel of experts provide anonymous input
  - Interviewing: people with similar project experience
  - SWOT analysis: strengths, weaknesses, opportunities, and threats

Performing 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

Risk probability: qualitative descriptors

Probability level	*Range*
High	Greater than 50% chance of happening
Significant	30-50% chance of happening
Moderate	10-29% chance of happening
Low	Less than 10% chance of happening

Qualitative descriptors of impact on cost and associated range values

Impact level	*Range*
High	Greater than 30% above budgeted expenditure
Significant	20 to 29% above budgeted expenditure
Moderate	10 to 19% above budgeted expenditure
Low	Within 10% of budgeted expenditure.

Probability impact matrix

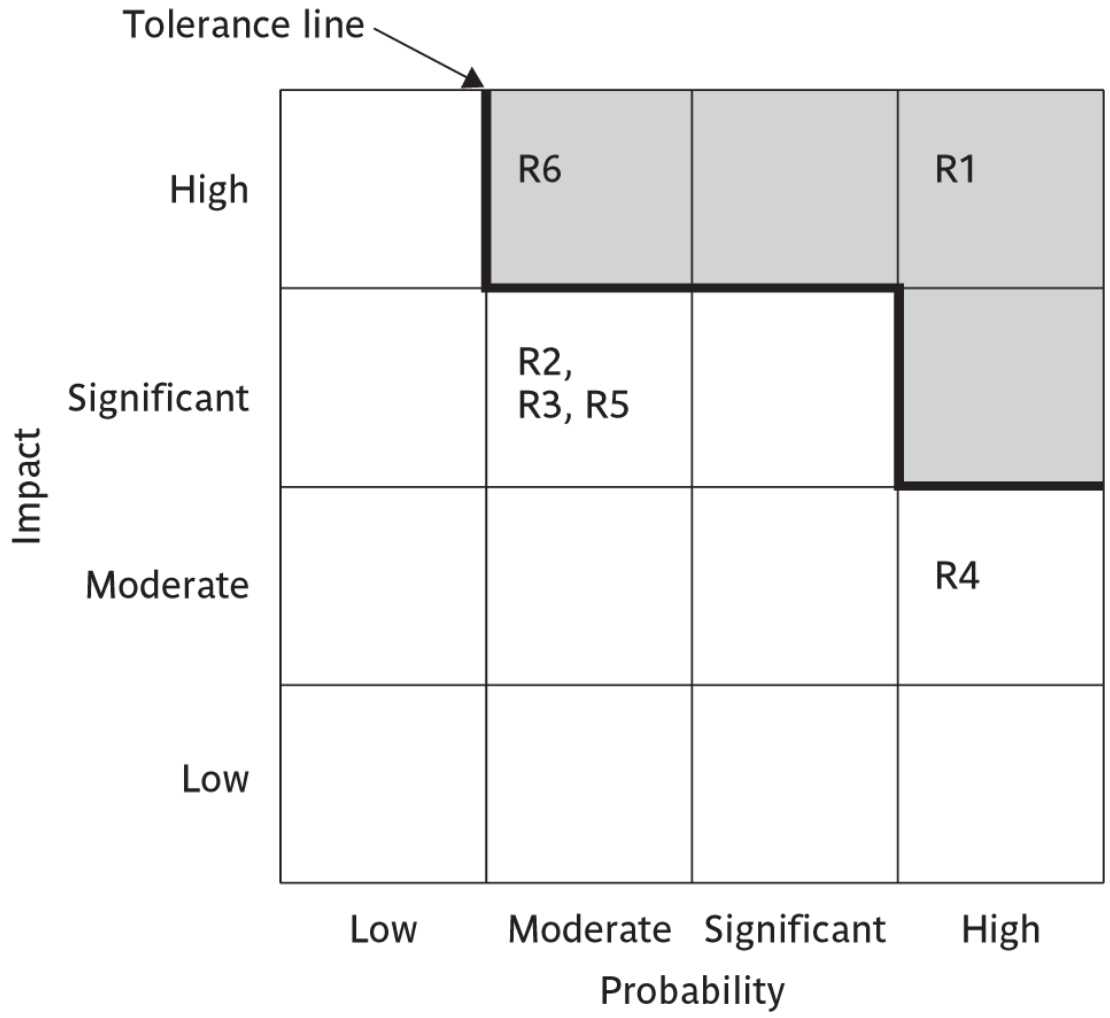
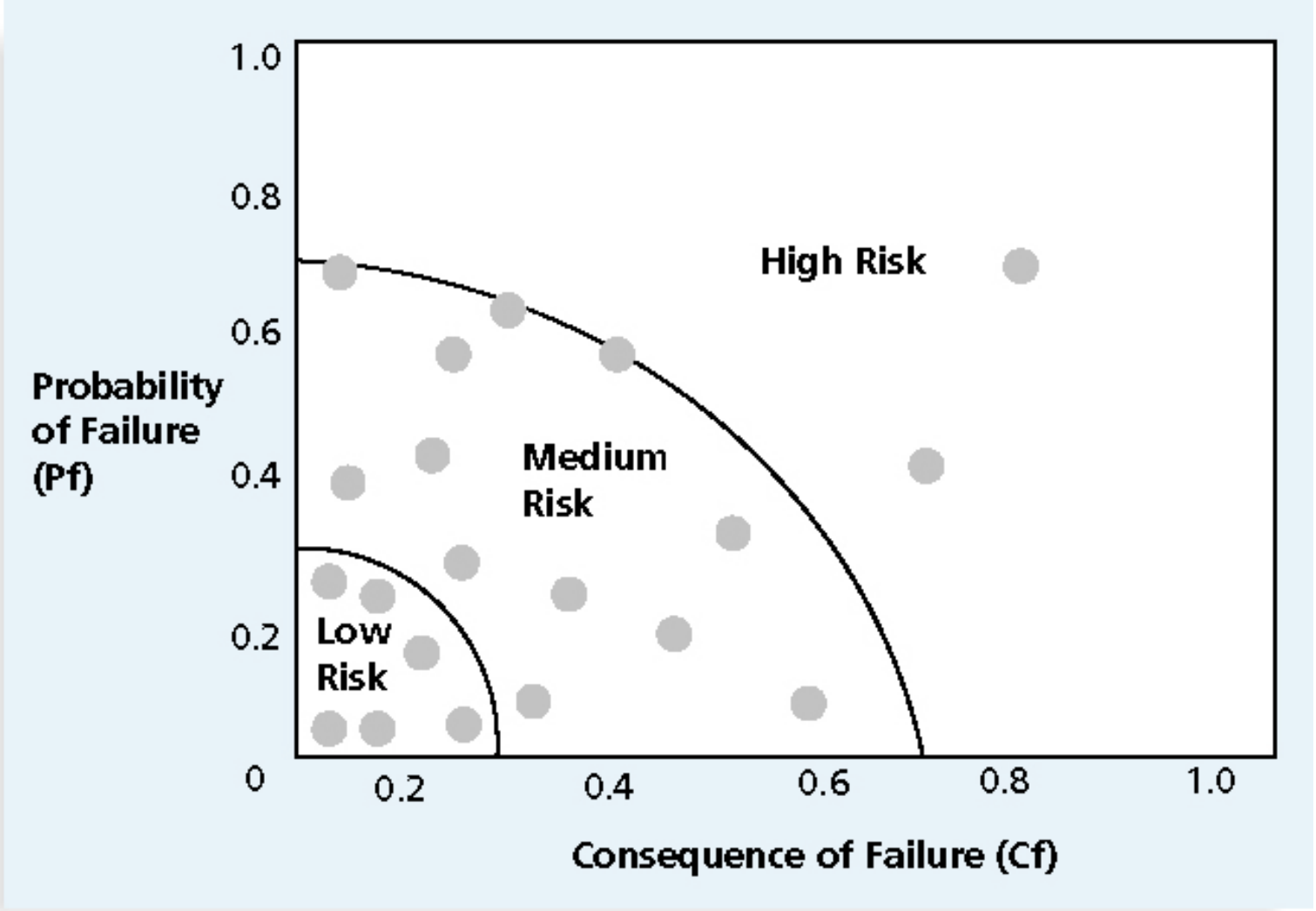


Chart Showing High-, Medium-, and Low-Risk Technologies



Example of Top Ten Risk Item Tracking

	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	After previous project manager quit, assigned a new one to lead the project
Poor cost estimates	4	4	3	Revising cost estimates
Poor time estimates	5	5	3	Revising schedule estimates

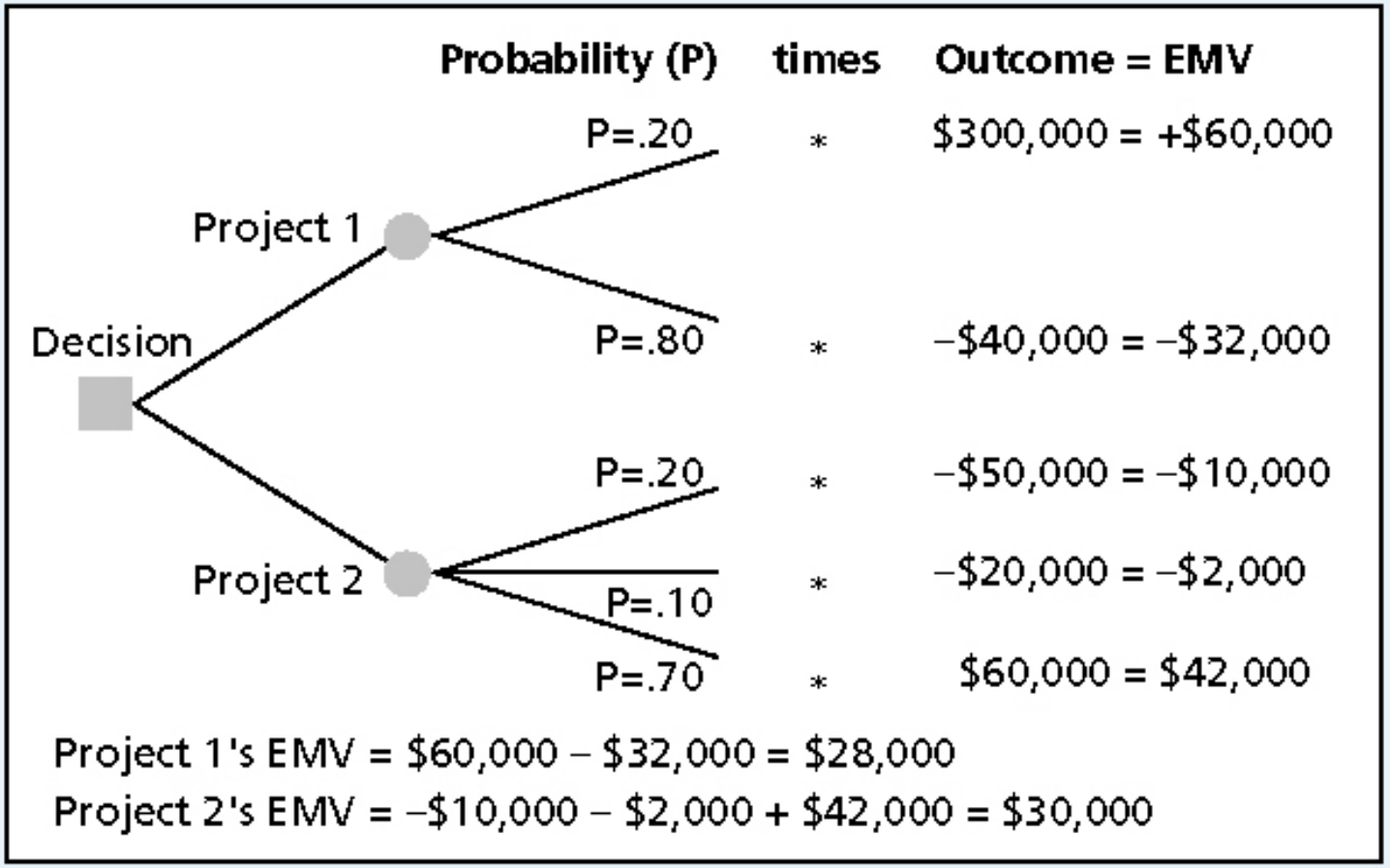
Performing Quantitative Risk Analysis

- 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 include:
  - Decision tree analysis
  - Simulation
  - Sensitivity analysis

Decision Trees and Expected Monetary Value (EMV)

- A **decision tree** is used to help select the best course of action when 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

Expected Monetary Value (EMV) Example



Risk Exposure

- Some way is needed of distinguishing the more damaging and likely risks

Risk exposure (RE) = (potential damage) x (probability of occurrence)

Potential damage: a money value e.g. a flood would cause $0.5 millions of damage

Probability 0.00 (absolutely no chance) to 1.00 (absolutely certain) e.g. 0.01 (one in hundred chance)

RE = $0.5m x 0.01 = $5,000

Crudely analogous to the amount needed for an insurance premium

Planning Risk Responses

- After identifying and quantifying risks, you must decide how to respond to them

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		

Risk Reduction Leverage (RRL) (I)

- A problem when you have a number of possible countermeasures for risks is that it can be difficult to decide which should be implemented
- RRL is a simple calculation that gives a numeric value to a countermeasure, enabling different countermeasures to be compared

Risk Reduction Leverage (RRL) (II)

Risk reduction leverage =

$$(RE_{before} - RE_{after}) / (\text{cost of risk reduction})$$

RE_{before} is risk exposure before risk reduction e.g. 1% chance of a fire causing $200k damage

RE_{after} is risk exposure after risk reduction e.g. fire alarm costing $500 reduces probability of fire damage to 0.5%

RRL = (1% of $200k)-(0.5% of $200k)/$500 = 2

RRL > 1.00 therefore worth doing

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

Summary

- Project risk management involves identifying, analyzing, and responding to risk throughout the life of a project
- Main processes include:
  - Plan risk management
  - Identify risks
  - Perform qualitative risk analysis
  - Perform quantitative risk analysis
  - Plan risk responses
  - Monitor and control risks

References

- Schwalbe, K., Information Technology Project Management, Rev 6th Ed, CENGAGE Learning, 2011, Chapter 11
- Bob Hughes and Mike Cotterell, Software Project Management, 5th Ed, McGraw Hill, 2009, Chapter 7
- Roger Pressman, *Software Engineering: A Practitioner's Approach. New* York, USA: McGraw Hill, 2015, Chapter 25