

Determining Project Risks

Prof.Dr. Fatih Alagöz

SWE523- Software Project Management

Risk Management

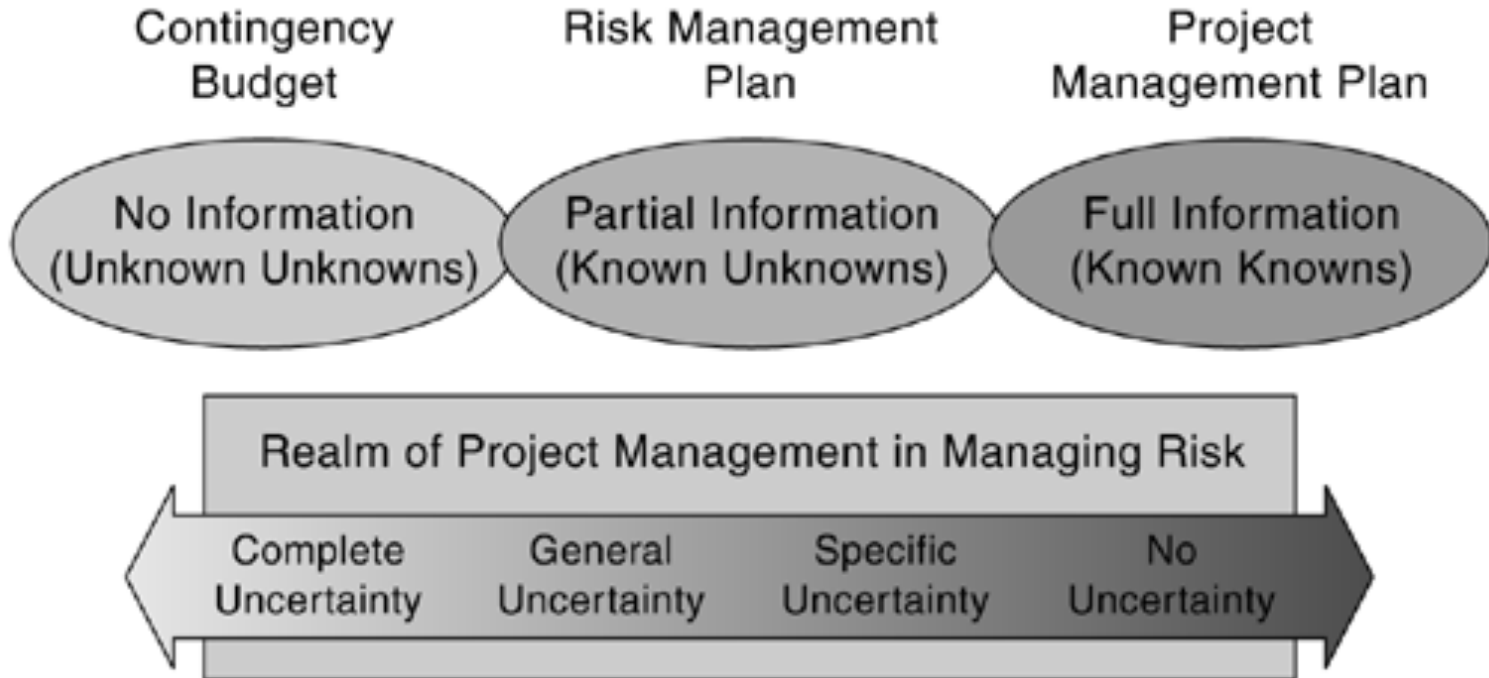
- understanding the internal and external project influences that can cause project failure
- should be reviewed regularly and adjusted accordingly
- to identify and handle the uncommon causes of project variation

Risk Categories

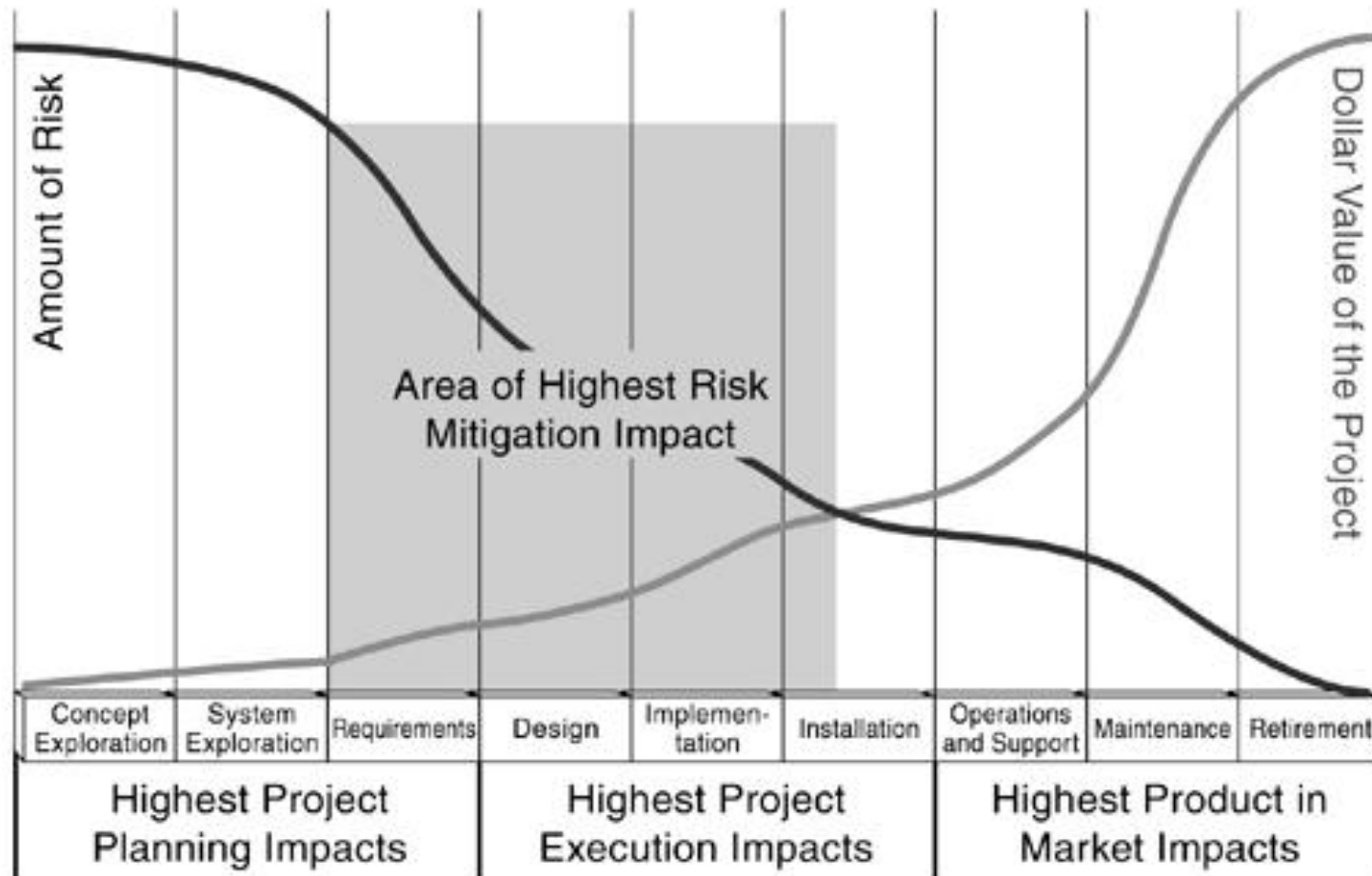
- Internal:
within the control of the project manager
- External:
outside the control of the project manager

*A good project manager minimizes **variation** through process management.*

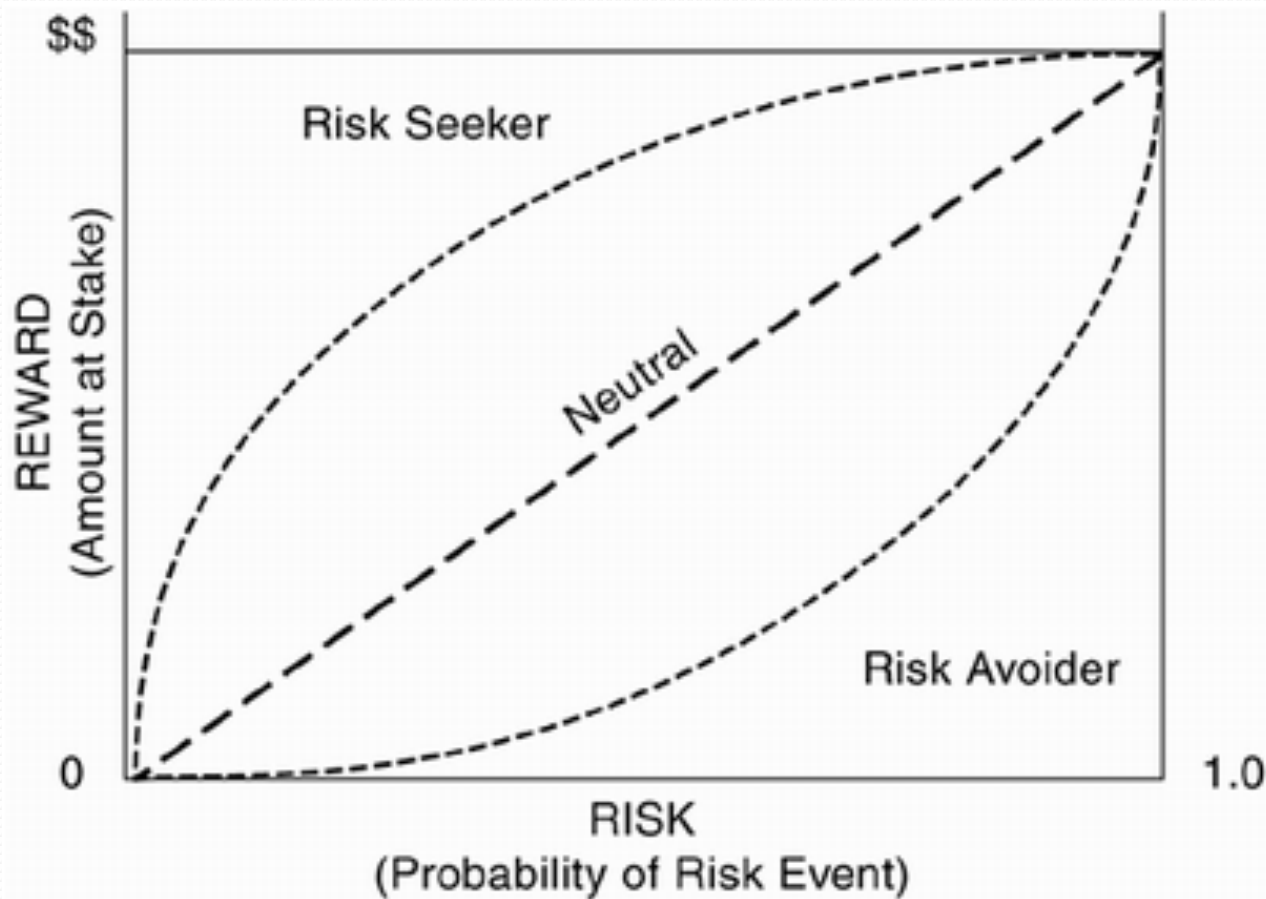
Risk Uncertainty Spectrum



Project Risks During the Life Cycle



Variations in Risk Tolerance



Risk Exposure Formula

RE =

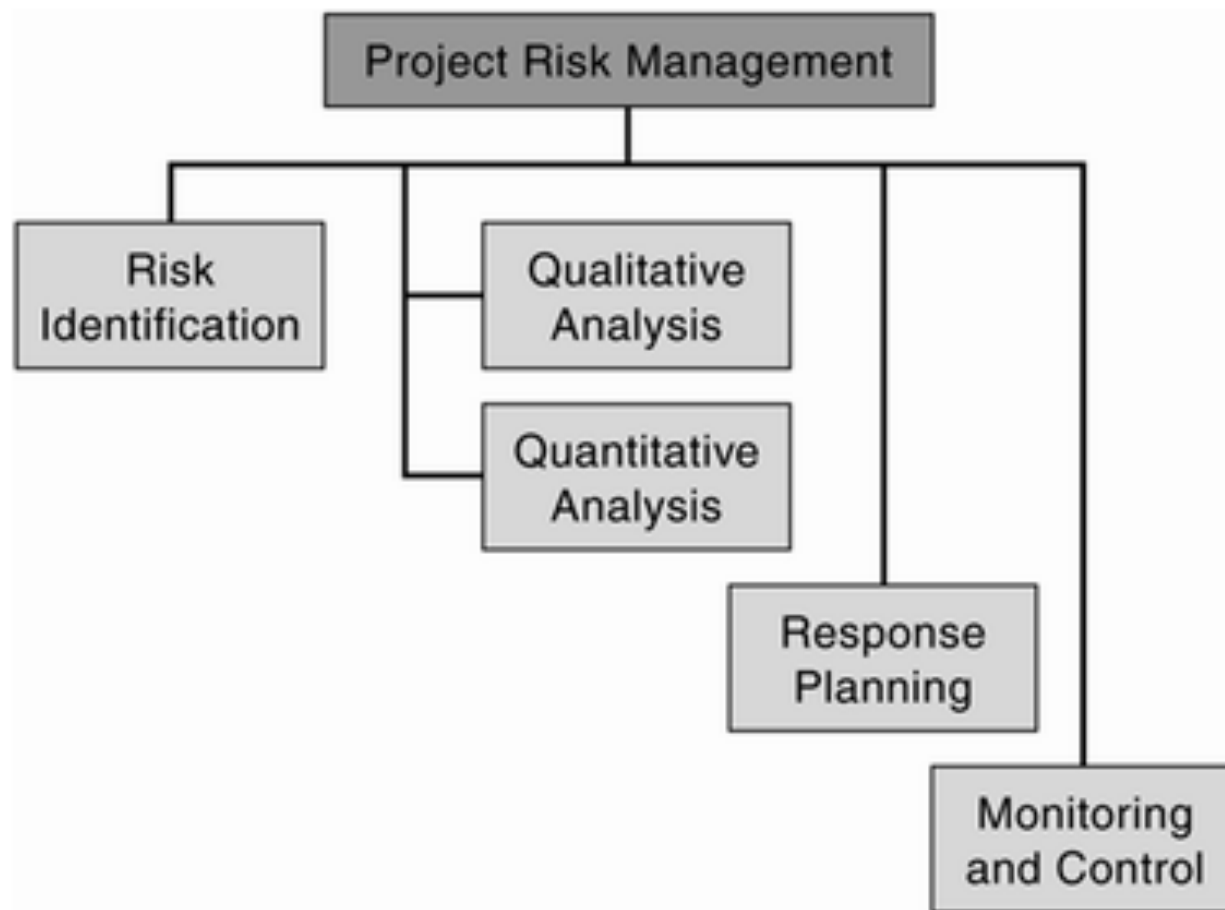
the *risk probability* (P) of an
unsatisfactory outcome for the
risk event

×

the *amount at stake* (L = loss)

$$RE = P \times L$$

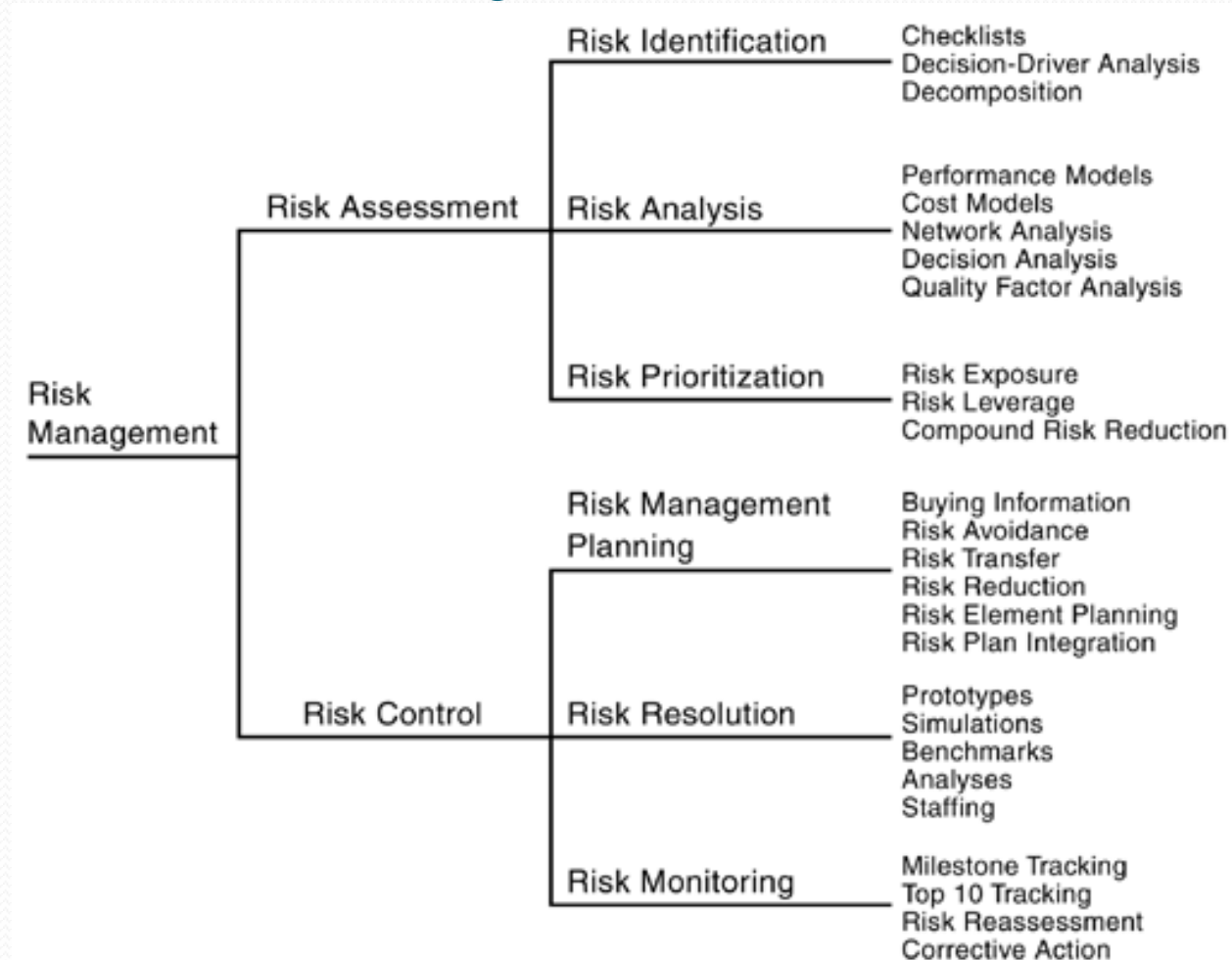
Risk Management Model



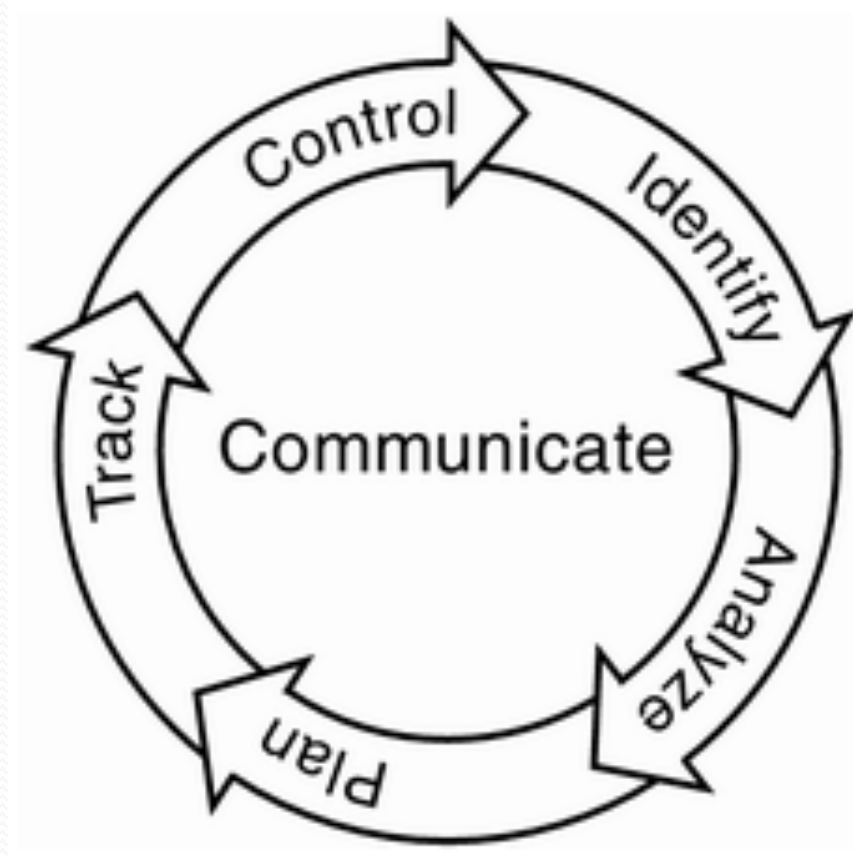
Risk Management Model

- **Risk identification**—developing the sources of risk, identifying potential risk events, and symptoms of risk
- **Risk quantification**—using qualitative and quantitative analysis, determining the value of the opportunities to pursue versus the threats to avoid, and the opportunities to ignore versus the threats to accept
- **Response planning**—developing the risk management and contingency plans, identifying reserves required in both dollars and person-hours, and determining how mitigation can occur through contractual means
- **Monitoring and control**—developing corrective action plans and monitoring their implementation as part of the overall implementation of the risk management plan

Boehm's Project Risk Model

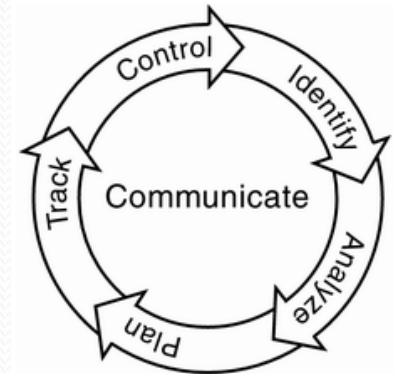


Software Engineering Institute's Risk Management Model

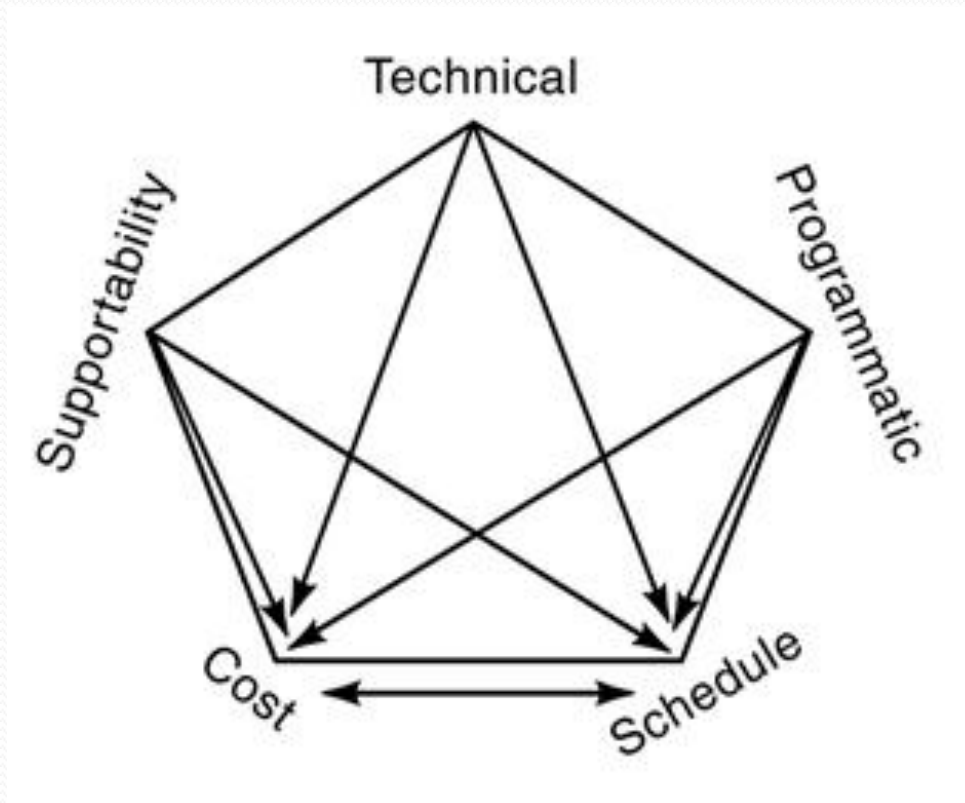


Software Engineering Institute's Risk Management Model

- **Identify**—search for and locate risks before they become problems;
- **Analyze**—transform risk data into decision-making information, evaluate impact, probability, and timeframe; classify risks and prioritize risks;
- **Plan**—translate risk information into decisions and mitigating actions (both present and future) and implement those actions;
- **Track**—monitor risk indicators and mitigation actions;
- **Control**—correct for deviations from the risk mitigation plans.



Risk Sources



Examples - Technical Sources

- Physical properties
- Material properties
- Radiation properties
- Testing and modeling
- Integration and interface
- Software design
- Safety
- Requirements changes
- Fault detection
- Operating environment
- Proven or unproven technology
- System complexity
- Unique or special resources

Examples - Programmatic Sources

- Material availability
- Personnel availability
- Personnel skills
- Safety
- Security
- Environmental impact
- Communication problems
- Labor strikes
- Requirements changes
- Political advocacy
- Contractor stability
- Funding profile
- Regulatory changes

Examples - Supportability Sources

- **Reliability and maintainability**
- Training and training support
- Equipment
- Human resource considerations
- System safety
- Technical data
- Facility considerations
- Interoperability considerations
- Transportability
- Computer resources support
- Packaging, handling, storage

Analyzing and Quantifying Risks

- Brainstorming
 1. Offer risk analysis ideas without judgment or evaluation
 2. Build on ideas offered
 3. Repeat until all ideas on risk analysis are exhausted
- Delphi method
 1. Select a panel of experts (isolated from each other and unknown to one another)
 2. Prepare and circulate a questionnaire about a risk
 3. Solicit risk handling approaches and opinions
 4. Share all responses and statistical feedback with entire group
 5. Repeat until there is convergence on a consensus approach

Analyzing and Quantifying Risks

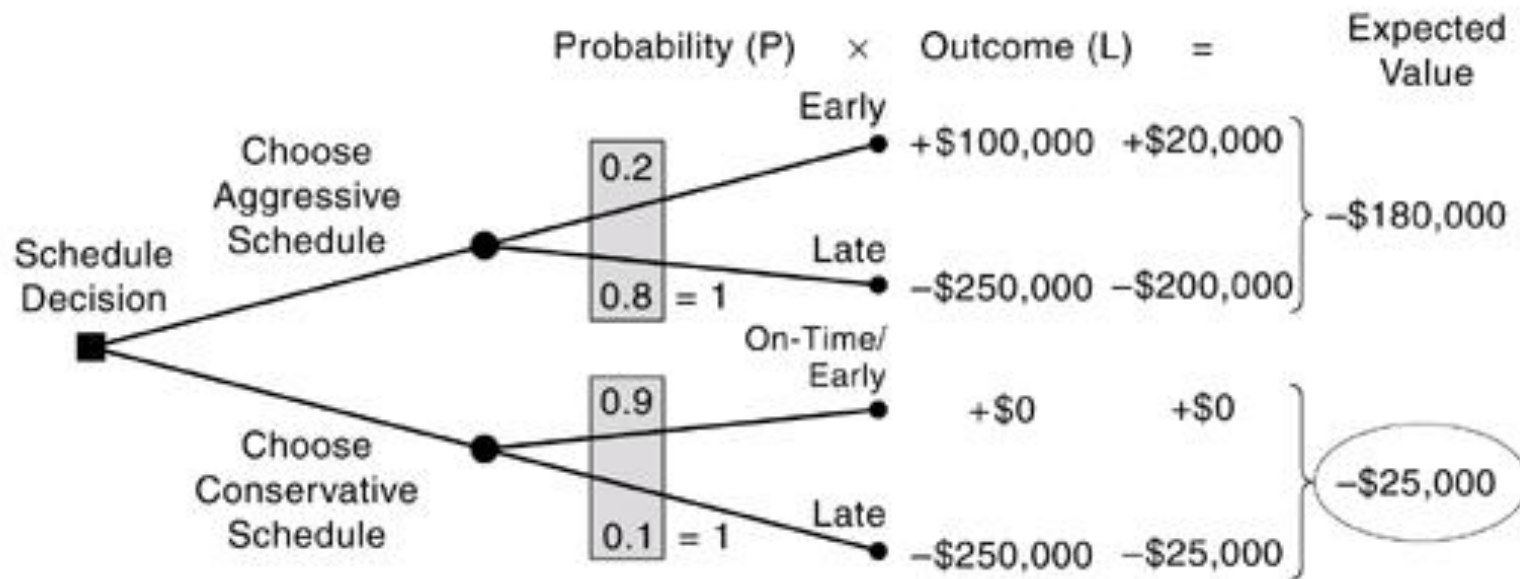
- Sensitivity analysis
 1. Choose a few variables with big impact to the plan
 2. Define a likely range of variation
 3. Assess effect of changing them on project outcome
- Probability analysis
 1. Similar to sensitivity analysis
 2. Adds a probability distribution for each variable, usually skewed to eliminate optimism
- Monte Carlo simulation
 1. Similar to probability analysis
 2. Assign randomly chosen values for each variable
 3. Run simulation a number of times to get a probability distribution for the outcome
 4. Produces a range of probabilities for the outcome

Analyzing and Quantifying Risks

- Utility theory
 1. Comprehends decision maker's attitude toward risk
 2. Viewed as theoretical
- Decision tree analysis
 1. Graphical method
 2. Forces probability considerations for each outcome
 3. Usually applied to cost and time

Decision Tree Example

- \$100,000 bonus for being early with an aggressive schedule (probability of success = 20%)
- \$250,000 penalty for being late with any schedule (probability of being on time = 90%)



Developing and Controlling Risks

- Accept—do nothing. Accept consequences in an active or passive fashion.
- Transfer—Move the loss to a third party through a contract, get a warranty, or buy insurance.
- Mitigate—Reduce the impact or probability by using contingency planning or a reserve, or eliminate the cause by using alternative software development strategies.

Risk Response Table

ID	Risk Item	Prob	Loss	Risk Exp.	Resolution Approach	Who	Date
1	Too few engineering experts	70	9	630	Contract now for more	PM	1/15
2	Design schedule tight	50	9	450	Enforce Delphi estimates	PM	ongoing
3	Report function weak	20	9	180	Review with customer	Project Leader	2/15
4	Interface too different	25	6	150	Review with customer	Project Leader	2/15
5	New requirements	30	5	150	Review cost each time	PM	ongoing
6	"Goldplating" threat	30	4	120	Hold to requirements document	Project Leader	ongoing
7	Unknown quality	10	6	60	Get second supplier	PM	2/1
8	Wall unstable	10	6	60	Investigate braces	Engineer	2/15
9	Timing problems	5	6	30	Simulate and test	Engineer	ongoing
10	New technology risky	5	2	10	Review with chief scientist	Project Leader	by stage

Weekly Risk Change Report

Risk Item	Rank This Week	Last Rank	Number of Weeks on List	Resolution Approach
Too few engineering experts	1	1	2	Contract under discussion
Design schedule tight	2	2	2	Enforcing Delphi estimates
Report function weak	3	5	3	On agenda with customer
Interface too different	4	4	3	On agenda with customer
New requirements	5	3	4	Review each new one for cost
"Goldplating" threat	6	6	4	Reviewing each phase
Unknown quality	7	8	3	No second supplier found yet
Wall unstable	8	new		Contract for braces in process
Timing problems	9	new		Plan to simulate in March
New technology risky	10	10	4	Reviewed requirements

Summary

- Software risk management is the formal process in which risk factors are systematically identified, assessed, and mitigated.
- The determination of the risk in a project either due to external or internal causes is a major part of project management.
- Risk management consists of risk identification, risk quantification, risk response development, and risk response control.