Risk Overview

Excerpted from Pfleeger and Atlee, 4e
3.4 Risk Management

What is a Risk?

- Risk is an unwanted event that has negative consequences

- Distinguish risks from other project events
  - *Risk impact*: the loss associated with the event
  - *Risk probability*: the likelihood that the event will occur

- Quantify the effect of risks
  - *Risk exposure* = (risk probability) x (risk impact)

- Risk sources: generic and project-specific
3.4 Risk Management

Risk Exposure

- **Yes**
  - Do regression testing?
  - Find critical fault: \( P(UO) = 0.75 \), \( L(UO) = 0.5M \)
  - Don't find critical fault: \( P(UO) = 0.05 \), \( L(UO) = 30M \)

- **No**
  - Find critical fault: \( P(UO) = 0.25 \), \( L(UO) = 0.5M \)
  - Don't find critical fault: \( P(UO) = 0.55 \), \( L(UO) = 30M \)

<table>
<thead>
<tr>
<th>Risk Exposure</th>
<th>Combined Risk Exposure</th>
</tr>
</thead>
<tbody>
<tr>
<td>$.375M</td>
<td>$1.875M</td>
</tr>
<tr>
<td>$1.50M</td>
<td></td>
</tr>
<tr>
<td>$0M</td>
<td></td>
</tr>
<tr>
<td>$.125M</td>
<td>$16.625M</td>
</tr>
<tr>
<td>$16.50M</td>
<td></td>
</tr>
<tr>
<td>$0M</td>
<td></td>
</tr>
</tbody>
</table>
3.4 Risk Management
Quantifying Risk Impact

- The impact risk (severity) is an estimate of the impact to technical performance, cost, and schedule if the risk occurs.

- Impact can be quantitized to low, medium, and high.

<table>
<thead>
<tr>
<th>Impact</th>
<th>Performance</th>
<th>Schedule</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>Minimal or no impact, unimportant</td>
<td>Minimal or no impact</td>
<td>Minimal or no impact</td>
</tr>
<tr>
<td>Medium</td>
<td>Acceptable with reduction in margin</td>
<td>Additional resources required, Minor slip in key milestones (&lt;20% slip in total schedule)</td>
<td>Cost estimates exceed budget by &lt;7%</td>
</tr>
<tr>
<td>High</td>
<td>Acceptable with no remaining margin; Unacceptable</td>
<td>Major slip in key milestones or Critical Path impacted (&gt;20% slip in total schedule)</td>
<td>Cost estimates exceed budget by &gt;7%</td>
</tr>
</tbody>
</table>
3.4 Risk Management

Quantifying Risk Probability

- Risk Probability – likelihood an event will occur
- Risk Probability can be quantized to low, medium, and high.

<table>
<thead>
<tr>
<th>Likelihood of Occurrence</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>0 – 30% change this risk will occur</td>
</tr>
<tr>
<td>Medium</td>
<td>30% - 80% chance this risk will occur</td>
</tr>
<tr>
<td>High</td>
<td>80% - 100% change this risk will occur</td>
</tr>
</tbody>
</table>
3.4 Risk Management
Prioritizing Risk

- Focus on those items with the highest risk level

<table>
<thead>
<tr>
<th>Likelihood</th>
<th>Low</th>
<th>Medium</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>Green</td>
<td>Yellow</td>
<td>Yellow</td>
</tr>
<tr>
<td>Medium</td>
<td>Yellow</td>
<td>Red</td>
<td>Red</td>
</tr>
<tr>
<td>High</td>
<td>Red</td>
<td>Red</td>
<td>Red</td>
</tr>
</tbody>
</table>

Risk Level
- **HIGH** – unacceptable. Major disruptions to the project/program likely. Different approach dictated. Additional management attention required.
- **MEDIUM** – Some disruption to the project/program. Alternative approaches should be investigated to reduce risk. Additional management attention may be required.
- **LOW** – Minimum impact. Minimum oversight needed to ensure risk remains low.
3.4 Risk Management

Risk Management Activities

Risk management

- Risk assessment
  - Risk identification
  - Risk analysis
    - System dynamics
    - Performance models
    - Cost models
    - Network analysis
    - Decision analysis
    - Quality risk factor analysis
  - Risk prioritization
    - Risk exposure
    - Compound risk reduction
      - Buying information
      - Risk avoidance
      - Risk transfer
      - Risk reduction leverage
      - Development process
        - Risk element planning
        - Risk plan integration
  - Risk reduction
  - Risk control
    - Risk management planning
      - Risk element planning
      - Risk plan integration
    - Risk resolution
      - Risk mitigation
      - Risk monitoring and reporting
      - Risk reassessment
3.4 Risk Management
Risk Management Activities (continued)

- Three strategies for risk reduction (mitigation)
  - *Avoiding the risk*: change requirements for performance or functionality
  - *Transferring the risk*: transfer to other system, or buy insurance
  - *Assuming the risk*: accept and control it
3.4 Risk Management
Risk Management Activities (continued)

• What is the goal of risk mitigation?
  • Reduce both Likelihood AND Impact

• Cost of reducing risk
  \[ \text{Risk leverage} = \frac{(\text{risk exposure before reduction} - \text{risk exposure after reduction})}{(\text{cost of risk reduction})} \]
3.4 Risk Management
Sidebar 3.4 Boehm’s Top Ten Risk Items

- Personnel shortfalls
- Unrealistic schedules and budgets
- Developing the wrong functions
- Developing the wrong user interfaces
- Gold-plating
- Continuing stream of requirements changes
- Shortfalls in externally-performed tasks
- Shortfalls in externally-furnished components
- Real-time performance shortfalls
- Straining computer science capabilities
## 3.4 Risk Management

### Characterizing Risks

<table>
<thead>
<tr>
<th>Category</th>
<th>Subcategory</th>
</tr>
</thead>
</table>
| Personnel/Staffing | • Loss of institutional knowledge  
                  | • Staff retention  
                  | • Full staffing/Inadequate Staffing Levels  
                  | • Security clearances  
                  | • Lack of staff skills/qualifications |
| Technical        | • Security  
                  | • Incomplete, missing or outdate information  
                  | • Software  
                  | • Hardware  
                  | • Missing/Conflicting requirements |
| Management       | • Uncooperative customer  
                  | • Prime/subcontractor relations  
                  | • Task assignment processing |
Risks for your Project

- What risks do you have?
- What risks have already occurred?
  - Mitigation?
  - Impact on project?
  - Take home message?