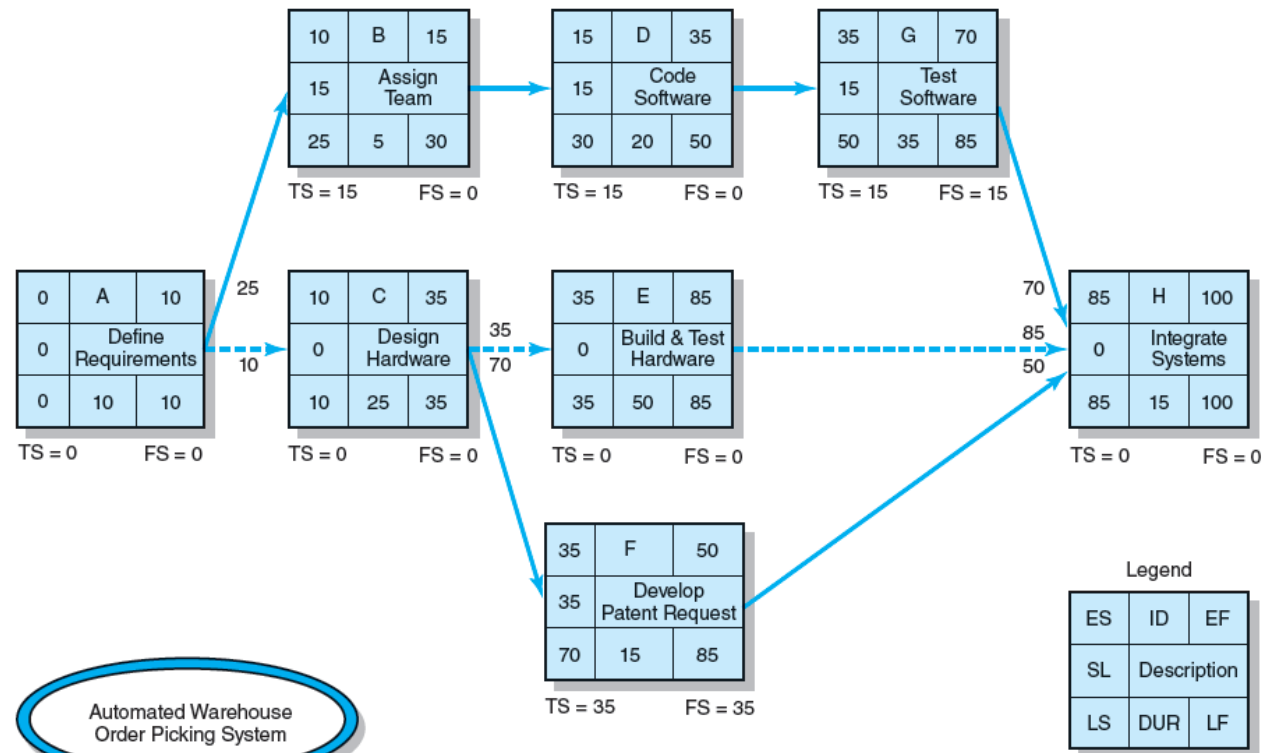


What we learned last week

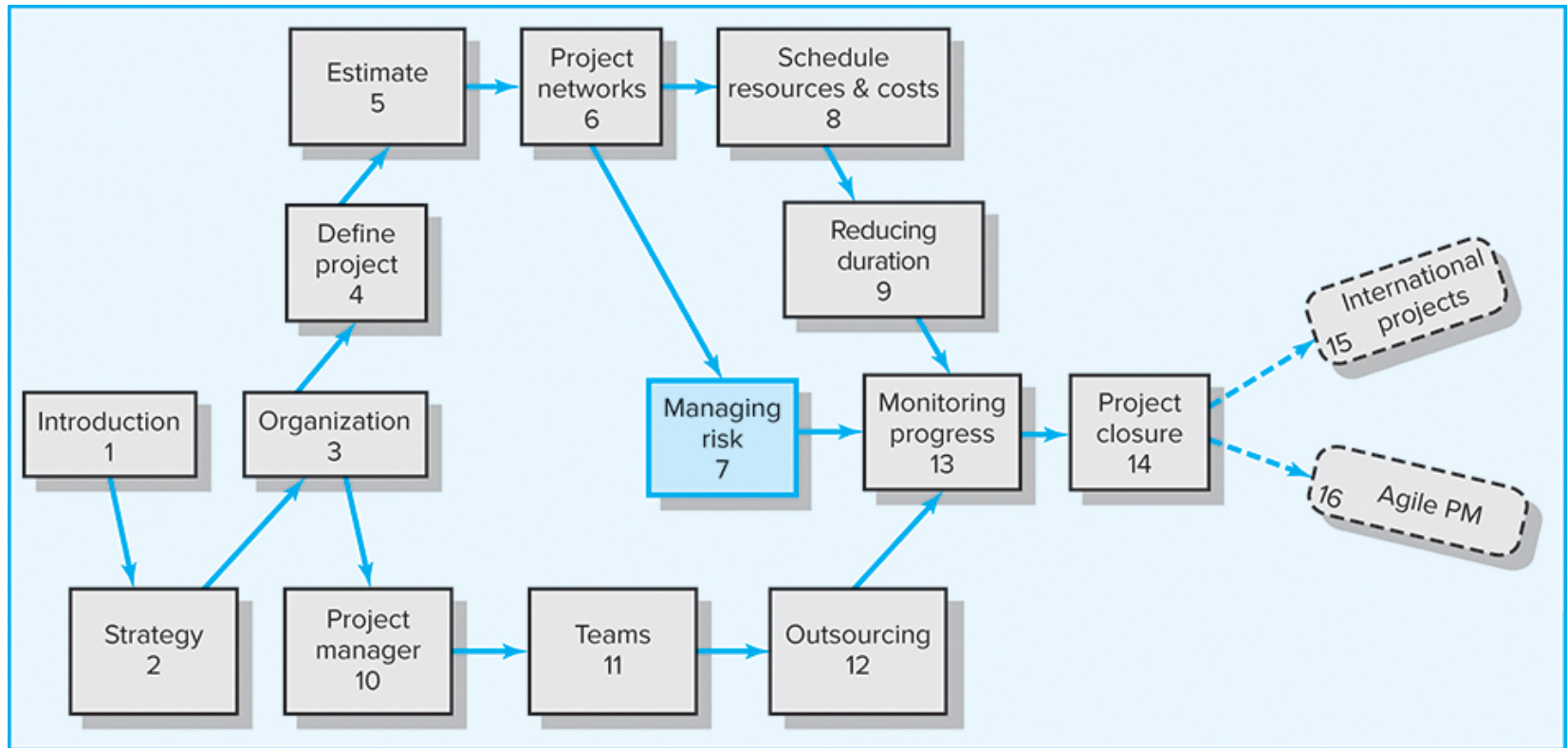
- Network diagram (AoN) including forward and backward pass
- CPM and Critical path analysis



Chapter Seven

Managing Risk

Where We Are Now



Learning Objectives

Deliveries are delayed
Accidents happen
People get sick
etc

Risk

Chapter Outline

Risk Management Process

Step 1: Risk planning and context

Step 2: Risk identification

Step 3: Risk assessment

Step 4: Risk treatment

Step 5: Monitoring and control

Contingency Funding and Time Buffers

Risk

- Definition

- Uncertain or chance events that planning can not overcome or control
- The PMI states a risk is an ‘uncertain event or condition that, if it occurs, has a positive or negative effect on a project’s objective’

- Characteristics

- Focuses on the future
- Deals with probabilities
- Tends to emphasise negative consequences

Threats – external risk events

- A Threat is:
 - a risk event external to the organisation (inflation, market acceptance, government laws)
 - Not within the Project Manager's or team's responsibility area.
 - Normally considered before the decision to proceed with the project and, if the project is initiated, contingency funds for them are placed in a "Management Reserve" budget.

Risk vs uncertainty (from decision theory)

- Certainty (knowns): decision maker is aware of the entire alternative options and their outcomes for making a decision
- Uncertainty (unknown unknowns): where the nature and range of future risk events is unknown/ perhaps unknowable (a state of ignorance).
- Risk (known unknowns): where the future can be analysed. Risk is foreseeable and possible. Risk is quantifiable and may be described in statistical terms.

Anatomy of risk

- Causes → Event → Effects
- Causes: risk events have one or more causes (how and why can the event happen?)
- Event: What can go wrong? When we talk of risk we usually talk about events/ occurrence/ outcome.
- Effects: consequences emanating from events. In projects context: effects usually on cost, time and performance/ scope.

The Risk Event Graph

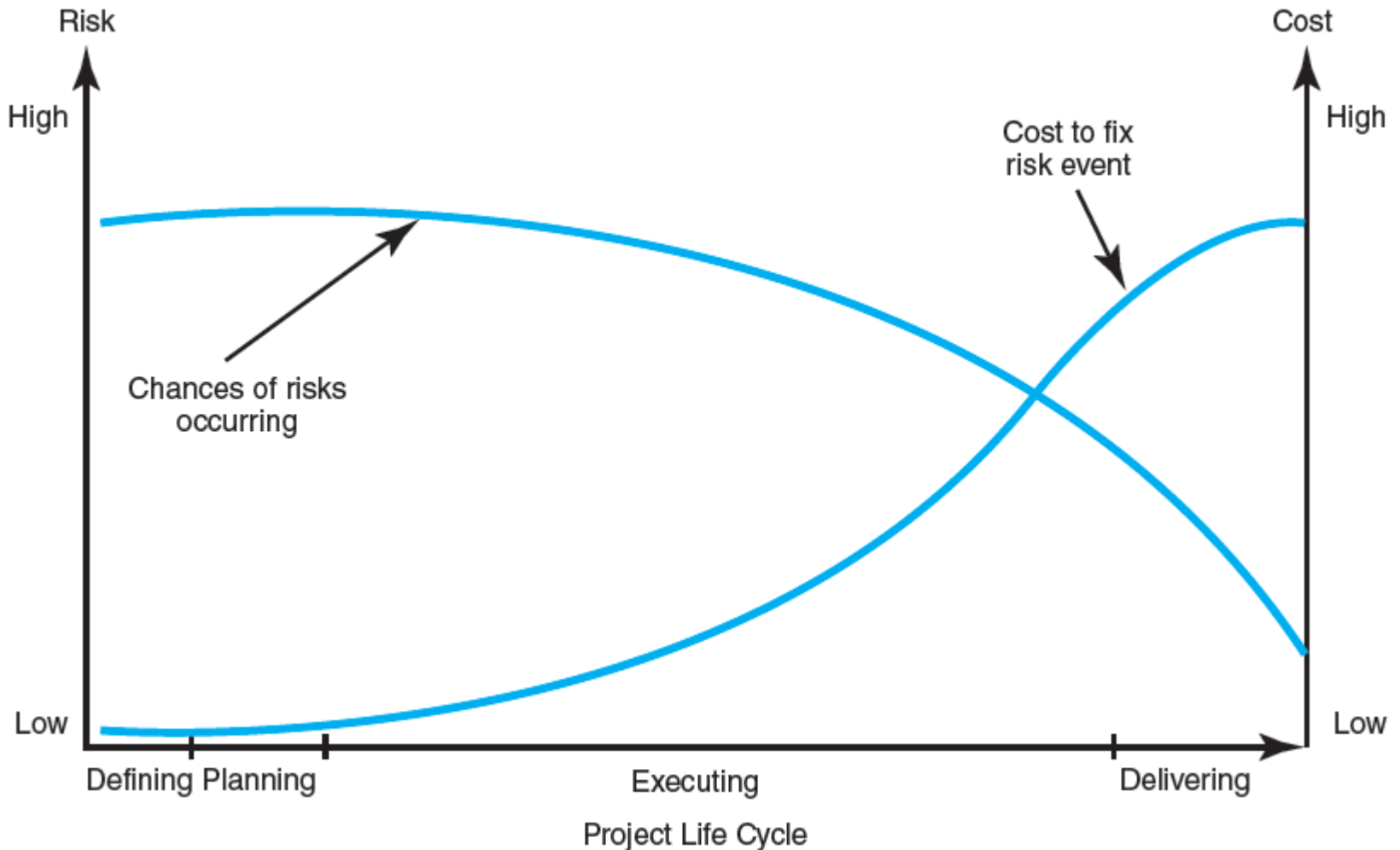


FIGURE 7.1

The Risk Event Graph

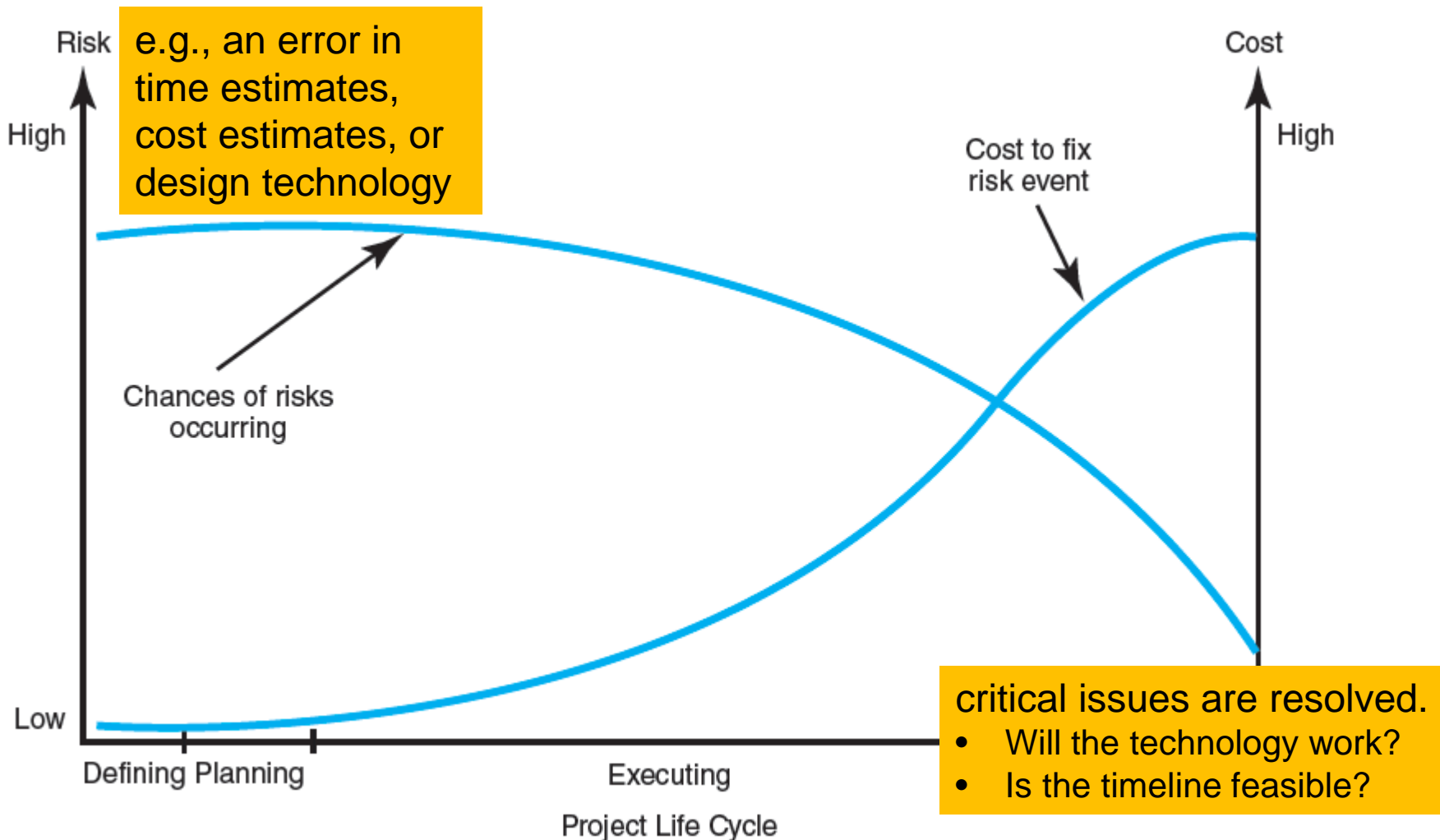


FIGURE 7.1

The Risk Event Graph

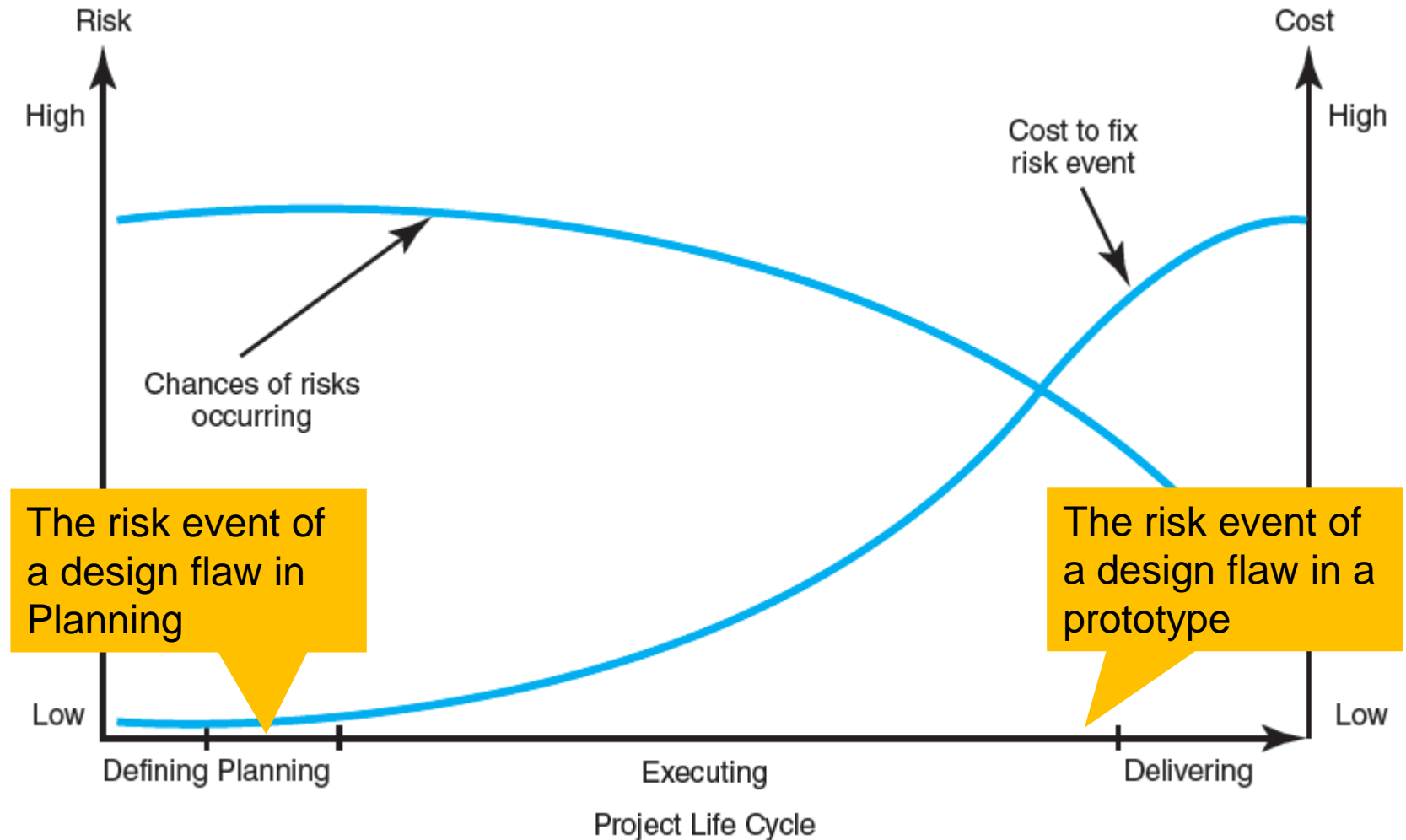


FIGURE 7.1

The Risk Event Graph

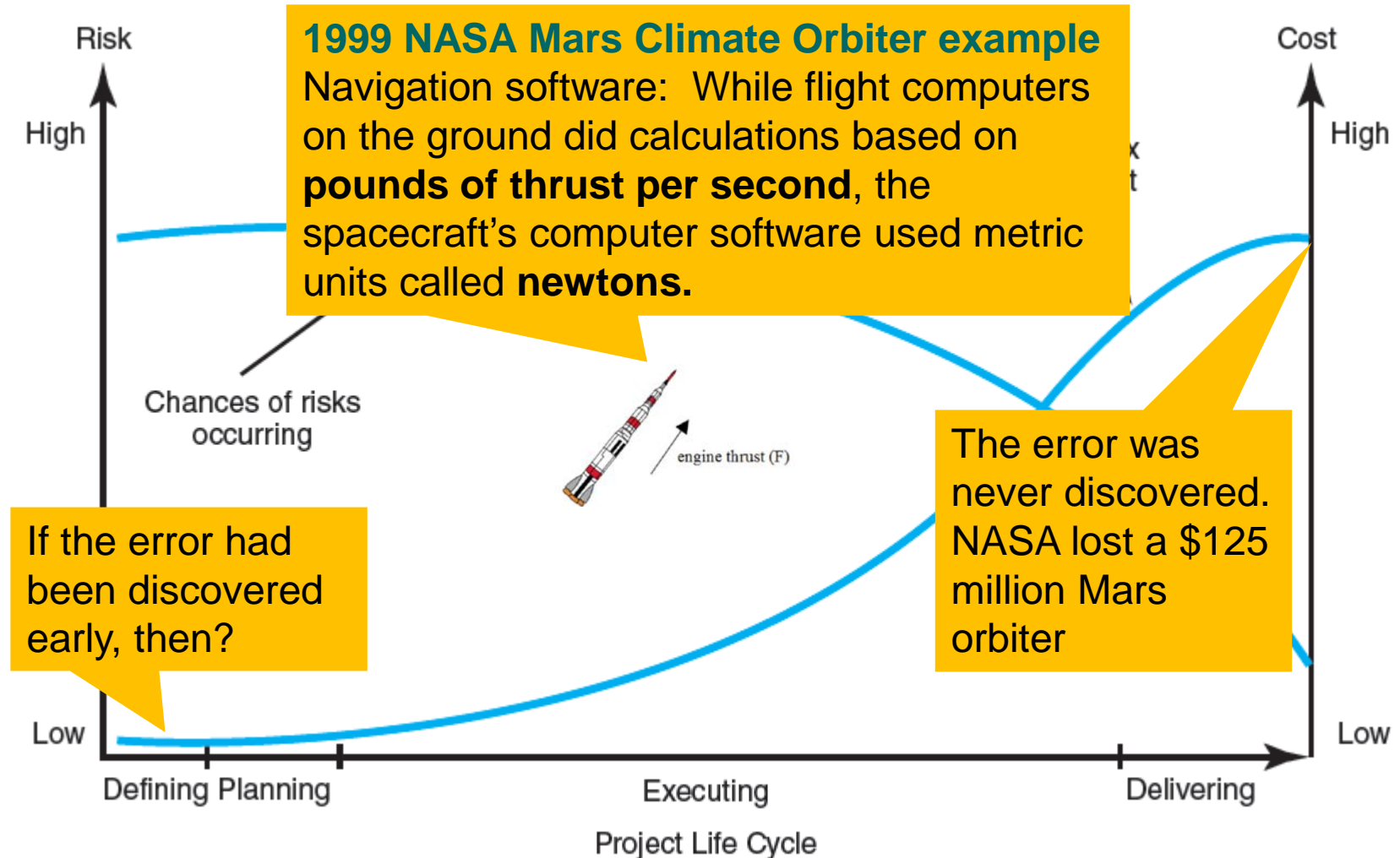


FIGURE 7.1

Risk Management Process

- Risk Management

- Entails the process of planning, identification, analysis, treatment and controlling of risks.

- Key attributes

- Is a Decision-making process (it informs decisions)
- Should have Structure and formality (it helps effective management)
- Has to have Continuity through the project (iterative, continuous monitoring)
- Has a Project focus (for project performance and outcomes, such as time, cost and performance)

Risk Management's Benefits

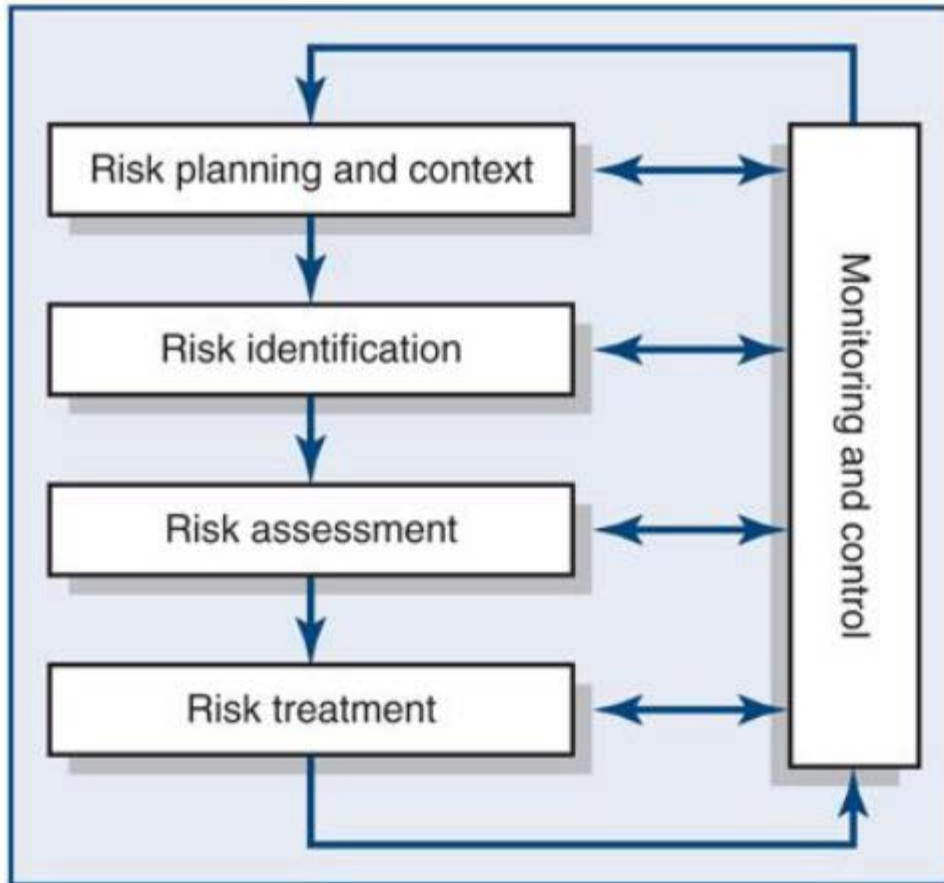
- A **proactive** rather than **reactive** approach
- Reduces surprises and negative consequences
- Prepares the project manager to take advantage of appropriate risks
- Provides better control over the future
- Improves chances of reaching project performance objectives within budget and on time

Risk Management Process

- Planning and context
 - Defines factors (internal/external) to take into account
 - Risk Management Plan
- Risk identification
 - Identify Potential risks and causes
 - list of risks
- Risk analysis and evaluation
 - Analyse risk likelihood and potential consequences
 - Risk Evaluation for Management
- Risk treatment
 - Strategies
- Implementation and control
 - Implement, monitor, control and review

Figure 7.3

THE RISK MANAGEMENT PROCESS



Adapted from Standards Australia, 2009

Step 1: Planning and context

- The risk management plan includes:
 - Objectives
 - methodology
 - roles and responsibilities
 - budgeting, timing
 - risk categories
 - scoring interpretation
 - tolerance thresholds
 - reporting formats
 - Tracking
 - Also establishing the **external, organizational and project** context

Step 2: Risk Identification

- The process of identifying potential risks: what, when and how
 - personal experience/ individual pondering
 - group processes
 - structured interviews
 - project information
 - Checklists
 - risk breakdown structure (RBS)

Step 2: Risk Identification

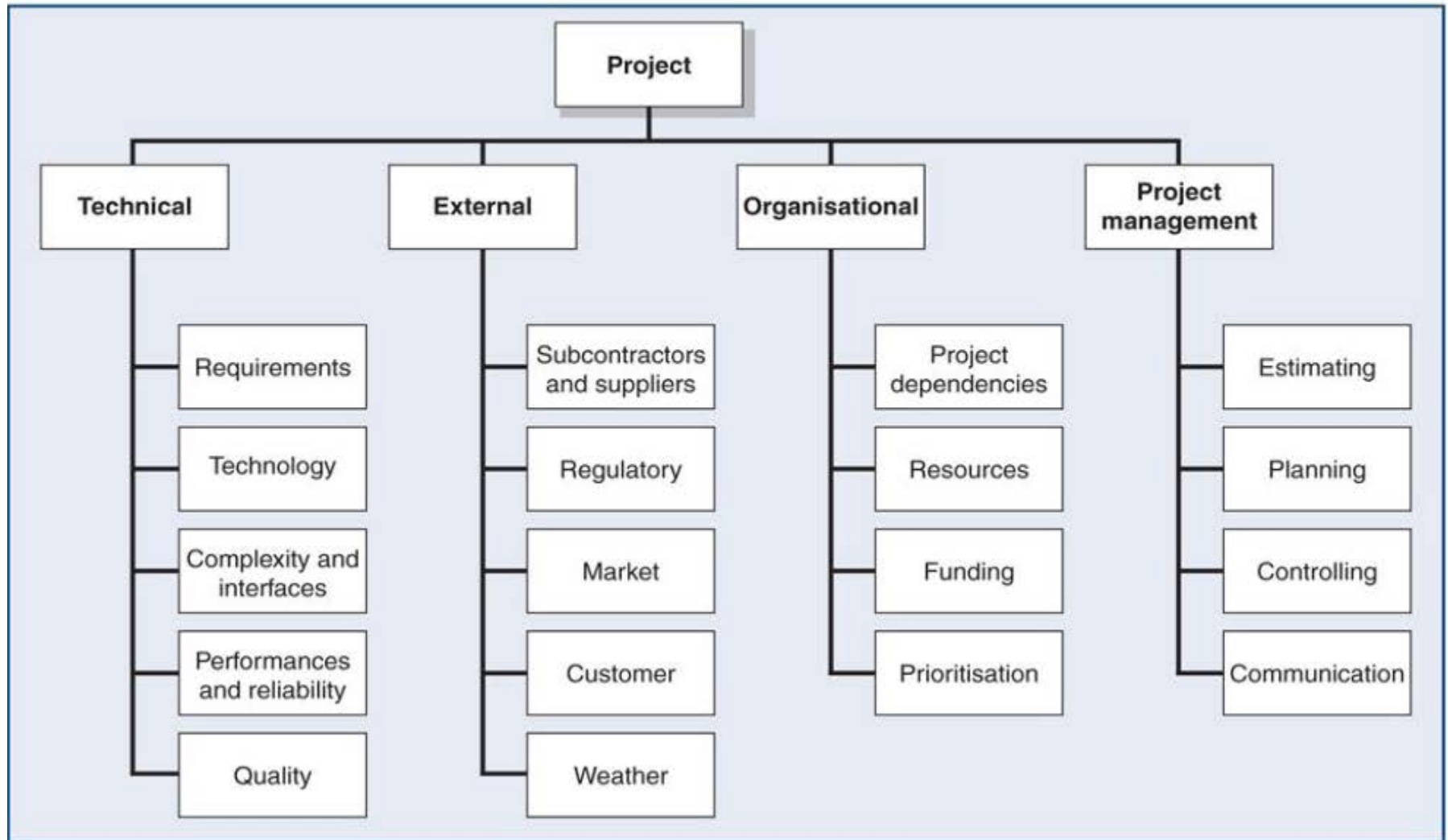
- Generate a list of possible risks through brainstorming, problem identification and risk profiling
 - Macro risks first (those that can affect the whole project), then **specific events**
 - Use core risk team and/or stakeholders
 - Typically occurs in the project planning phase
 - Try to focus on actual events that could produce consequences (rather than objectives)
 - Example: instead of identifying “failing to meet a deadline”, focus on the events that could cause this to happen (e.g., poor estimate, adverse weather, shipping delays, etc)

Step 2: Risk Identification

- Use risk breakdown structure (RBS) in conjunction with work breakdown structure (WBS) to identify and analyze risks
 - Macro risks first, then specific events
- Risk profile is a list of questions addressing additional areas of uncertainty on a project.

Figure 7.4

RISK BREAKDOWN STRUCTURE



Partial Risk Profile for Product Development Project

Technical Requirements

Are the requirements stable?

Design

Does the design depend on unrealistic or optimistic assumptions?

Testing

Will testing equipment be available when needed?

Development

Is the development process supported by a compatible set of procedures, methods, and tools?

Schedule

Is the schedule dependent upon the completion of other projects?

Budget

How reliable are the cost estimates?

Quality

Are quality considerations built into the design?

Management

Do people know who has authority for what?

Work Environment

Do people work cooperatively across functional boundaries?

Staffing

Is staff inexperienced or understaffed?

Customer

Does the customer understand what it will take to complete the project?

Contractors

Are there any ambiguities in contractor task definitions?

FIGURE 7.4

Step 3: Risk Analysis or evaluation

- Assess for the event's *likelihood* and *impact*
 - Likelihood of the event
 - either in words : rare Almost-certain
 - Or in numbers [0 .. 10] from “very unlikely (0)” to “almost certainly (10)”
 - Figure 7.6
 - Impact/ consequence of the event
 - Rank-order descriptions e.g.,:
 - » Very-low, low, moderate, high and very high
 - » 1-10
 - » Figure 7.5

Defined Conditions for Impact Scales of a Risk on Major Project Objectives (Examples for negative impacts only)

Relative or Numerical Scale					
Project Objective	1 Very Low	2 Low	3 Moderate	4 High	5 Very High
Cost	Insignificant cost increase	< 10% cost increase	10–20% cost increase	20–40% cost increase	> 40% cost increase
Time	Insignificant time increase	< 5% time increase	5–10% time increase	10–20% time increase	> 20% time increase
Scope	Scope decrease barely noticeable	Minor areas of scope affected	Major areas of scope affected	Scope reduction unacceptable to sponsor	Project end item is effectively useless
Quality	Quality degradation barely noticeable	Only very demanding applications are affected	Quality reduction requires sponsor approval	Quality reduction unacceptable to sponsor	Project end item is effectively useless

FIGURE 7.5

Figure 7.6**LIKELIHOOD RATINGS—PROJECTS**

Descriptor	Definition	Probability
Almost certain	Event is expected to occur in most circumstances	91–100%
Likely	Event will probably occur in most circumstances	61–90%
Possible	Event should occur at some time	41–60%
Unlikely	Event could occur at some time	10–40%
Rare	Event will only occur in exceptional circumstances	0–10%

Example: Risk Assessment Form

IS project: the upgrade from Windows 10 to windows 11

Risk Event	Likelihood	Impact	When
Interface problems	4	4	Conversion
System freezing	2	5	Start-up
User backlash	4	3	Postinstallation
Hardware malfunctioning	1	5	Installation

Now, the question is: which event should be considered as of higher risk? (eg, event 2 or event 3?)

FIGURE 7.6

Figure 7.7**EVALUATION LIKELIHOOD—CONSEQUENCE MATRIX**

Risk rating	Insignificant	Minor	Moderate	Major	Catastrophic
Almost certain	Moderate	High	High	Extreme	Extreme
Likely	Moderate	Moderate	High	Extreme	Extreme
Possible	Low	Moderate	High	High	Extreme
Unlikely	Low	Moderate	Moderate	High	High
Rare	Low	Low	Moderate	High	High

Risk Severity Matrix

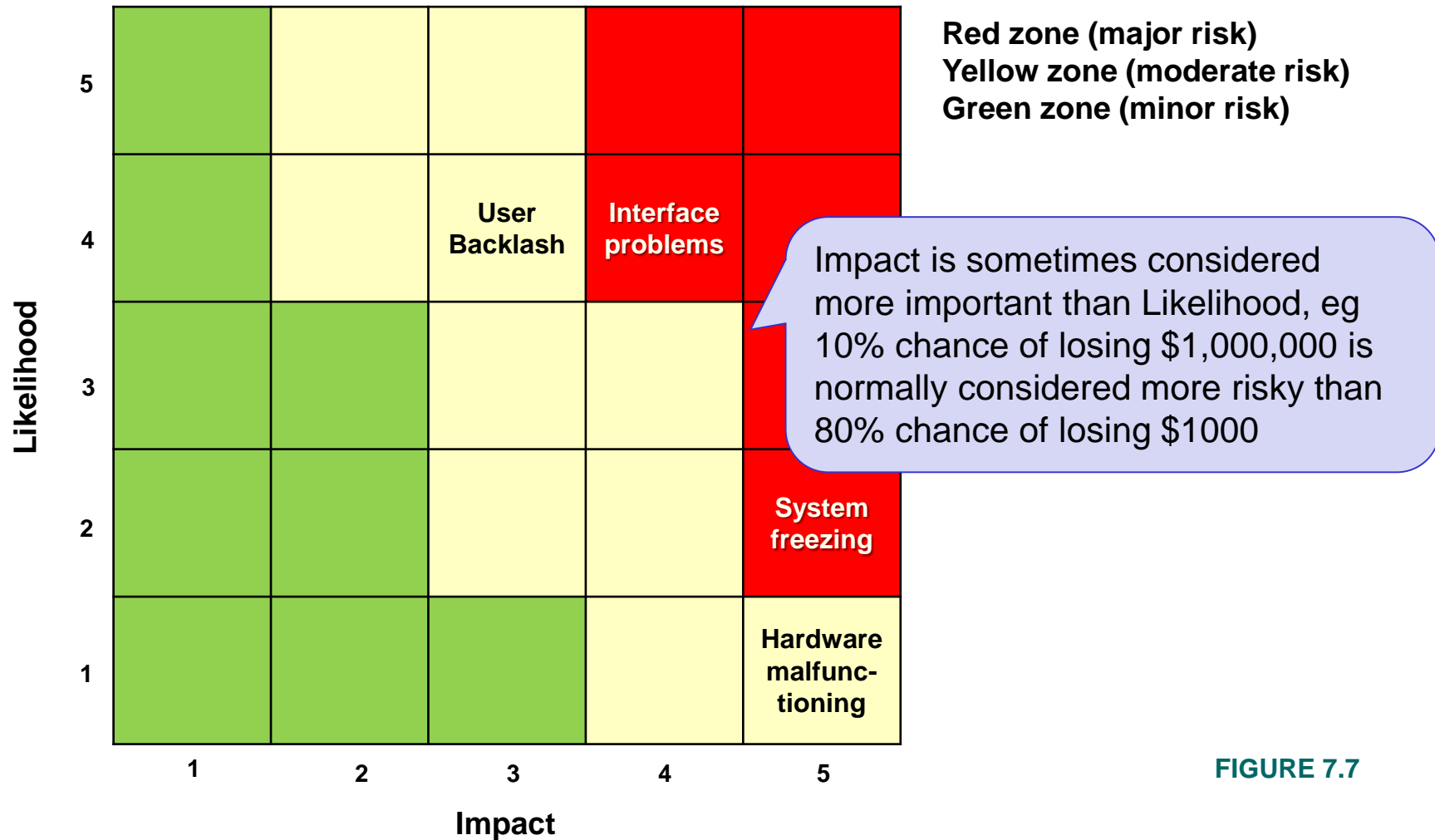


FIGURE 7.7

Risk tolerance and risk appetite

- Tolerance/ acceptance
 - Once the risks are ranked by means of likelihood-consequence matrix, we need to decide if the risks are tolerable. Risk tolerance is the amount of the risk that is acceptable to the sponsor.
- Risk appetite
 - Refers to the amount and types of risk that a decision-maker is prepared to pursue, retain or take.

Step 3: Risk analysis and evaluation

- Risk Assessment matrix (form) and Risk Severity matrix (Likelihood-consequence matrix)
 - Allows prioritisation of risks
- Failure Mode and Effects Analysis (FMEA)
 - Adds Detection to the Severity Matrix
 - $\text{Impact} \times \text{Probability} \times \text{Detection} = \text{Risk Value}$
 - However, it treats $1 \times 5 \times 5$ the same as $5 \times 5 \times 1$, so we need qualitative input for prioritizing.
- Probability analysis
 - Decision trees, NPV, and PERT

Step 4: Risk Treatment

- **Avoiding Risk**
 - Changing the project plan to eliminate the risk or condition
- **Reduction/ Mitigation: reduce the likelihood or consequences of the risk, pre-or post-risk.**
 - Reducing the likelihood an adverse event will occur
 - Reducing the impact of an adverse event
 - Contingency plans
- **Transferring Risk: shifts responsibility and consequences to another party (contract/ insurance) though the risk still exists.**
 - Paying a premium to pass the risk to another party
 - Requiring Build-Own-Operate-Transfer (BOOT) provisions
- **Accepting/ retaining Risk**
 - accepting the risk and exposure with no further action to manage.
Often for low risk

Step 4: Risk Treatment

– Avoiding Risk

- Changing the project plan to eliminate the risk or condition
- It is impossible to eliminate all risk events
 - Some specific risks may be avoided
- e.g., adopting proven technology instead of experimental technology
- e.g., choosing an Australian supplier as opposed to an Indonesian supplier
- e.g., choosing to move a concert indoors

Step 4: Risk Treatment

– Mitigating Risk

- Reducing the likelihood an adverse event will occur
 - Testing and prototyping
 - » e.g., Information System project: the team tested the new system on a smaller isolated network.
 - Identifying the root causes
 - » e.g., a vendor will be unable to supply: invite the vendor to attend design meetings, and restructure the contract to include incentives for on-time delivery.
 - Scheduling outdoor work during the summer months, investing in up-front safety training, and choosing high-quality materials and equipment, provide training for team members, wear a helmet
- Reducing the impact of an adverse event

Step 4: Risk Treatment

– Mitigating Risk

- Reducing the likelihood an adverse event will occur
- Reducing the impact of an adverse event
 - e.g., a new innovative bridge project using continuous cement-pouring process – no interruption required – solution: having two additional portable cement plants built nearby
 - e.g., System and software development projects: parallel innovation processes are used in case on fails.

Step 4: Risk Treatment

– Transferring Risk

- Paying a premium to pass the risk to another party
 - Insurance
- Requiring Build-Own-Operate-Transfer (BOOT) provisions
 - On large and international construction projects such as power station, transport, water supply, and telecom industries, within receiving the right to achieve income from the facility under a period of time
 - » e.g., toll roads, parking structures, tunnels, bridges
 - A public authority makes an agreement with a private company
 - And later transferring it back into public ownership

Step 4: Risk Treatment

– Accepting Risk

- Making a conscious decision to accept the risk
- So large (e.g., an earthquake or flood)
- Increasing material prices

Step 4: Risk Treatment

- After risk treatment, update
 - Residual risk
 - Tolerability
- And also think about Secondary risk

Contingency Planning

- Contingency Plan

- An alternative plan that will be used if a possible foreseen risk event actually occurs
- A plan of actions that will reduce or mitigate the negative impact (consequences) of a risk event

- Risks of Not Having a Contingency Plan

- Having no plan may slow managerial response
- Decisions made under pressure can be potentially dangerous and costly

Risk Response Matrix

Risk Event	Response	Contingency Plan	Trigger	Who Is Responsible
Interface problems	Mitigate: Test prototype	Work around until help comes	Not solved within 24 hours	Nils
System freezing	Mitigate: Test prototype	Reinstall OS	Still frozen after one hour	Emmylou
User backlash	Mitigate: Prototype demonstration	Increase staff support	Call from top management	Eddie
Equipment malfunctions	Mitigate: Select reliable vendor Transfer: Warranty	Order replacement	Equipment fails	Jim

FIGURE 7.8

Contingency Funding and Time Buffers

- Contingency Funds: Funds to cover project risks (both those identified and those unknown).
 - The size of funds reflects overall risk of a project
 - Their use needs to be closely monitored
 - It is Independent of the original time and cost estimates
 - Risks may NOT occur, so they are NOT included in the cost baseline
 - If the risk occurs then contingency funds are drawn from the reserve and added to the cost baseline
 - If the risk does not occur, then the funding for that risk to a work package/activity is deducted from the budget reserve.
 - Because the use of contingency funds for different events requires different levels of authority, Contingency funds are usually divided into two categories:
 - Budget Reserves and Management Reserves

Contingency Funding and Time Buffers

- Budget reserves

- Are linked to the identified risks of specific **work packages**.
- Allocated to the specific work packages/activities
- Communicated to the project team but Allocated by PM if required

- Management reserves

- Are large funds to be used to cover major unforeseen risks (e.g., change in project scope) of **the total project**.
- Allocated to the entire project
- Established After budget reserves are identified and funded
- Controlled by PM and Project Owner (internal or external)
- May contain technical reserves for a project involving a highly innovative process or product, as a fallback plan in case the process/product is unsuccessful

Contingency Funding and Time Buffers

- Time Buffers

- Are Amounts of time used to compensate for unplanned delays in the project schedule.
- Allocate at critical project times, for example to:
 - Activities with Severe risk;
 - Merge activities that may become late due to predecessors being late;
 - Noncritical activities, so that they will not become critical activities if the project is very volatile;
 - Activities that require scarce resource (to ensure that there is adequate time to get the resources when they are required)
- If the overall schedule is uncertain, we could add a buffer at the end of a project –however, this requires top management and/or project owner authorisation

Principles for selection for treatment

Practicality	Realistic, achievable, easy to implement
Effectiveness	Rating the comparative effectiveness of options
Acceptability	Agreement and commitment of stakeholders
Cost	Balancing cost of treatment option against benefit
Capability	Effective allocation for responsibility
Timeliness	Implemented at the time to be successful
Precautions	Need to take action as risk event has serious consequences

Step 5: Implementation and Control

- Monitoring and review of the risk management process
- Use progress meetings and risk audits to evaluate:
 - that the identified risks remain valid
 - If there are any changes in the level of risk
 - the implementation process
 - If any new risks have been identified
 - If any new treatments for existing risks have been identified

Step 5: Implementation and Control

- Maintain a Risk register as formal documentation of the risk management process and decisions

Figure 7.8 SIMPLE RISK REGISTER

No.	Risk	Probability	Con	Rating	Treatment	Residual probability	Residual consequences	Residual rating	Who	When	\$	Status
1	Rain	Medium	High	High	Umbrellas	Medium	Low	Low	PM	By 2/2/13	500	Pending

Risk Register

- The Risk Register contains all identified Risks and their:
 - Descriptions
 - Category
 - Probability of Occurrence (Likelihood)
 - Impact
 - Responses
 - Contingency Plan
 - Owners
 - Current Status
- Update the register at status meetings—monitoring of the existing risks, review of risk profiles and identification of new risks allows the priority of risks to be re-assessed

Lastly

- Opportunity management
 - Process of identifying, analyzing, evaluation and treating potential positive events

Next Week

- We will look at:
 - Scheduling Resources, Costs (Chapter 8)
 - Reducing Project Duration (Chapter 9)