GSOE9820 – Engineering Project Management

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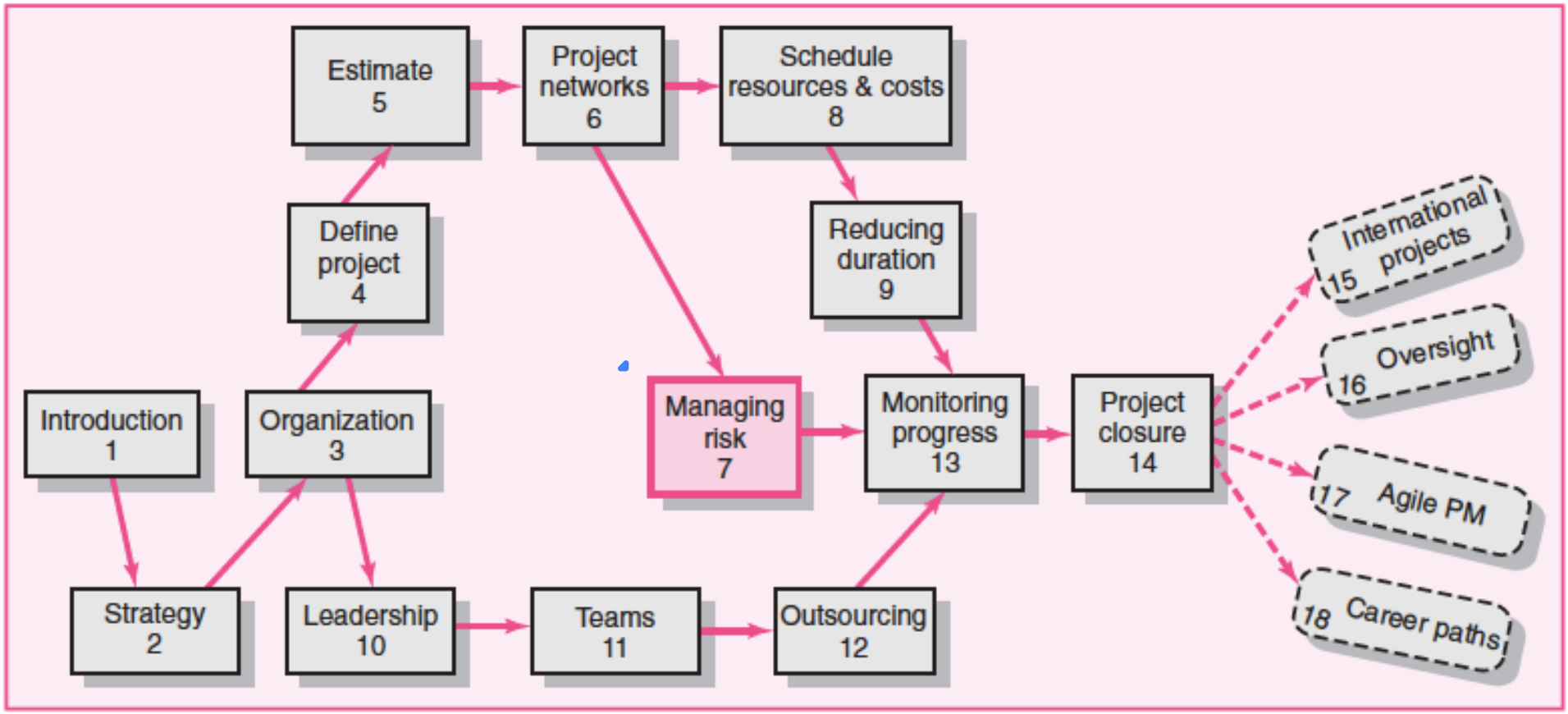
Never Stand Still | Faculty of Engineering | School of Mechanical and Manufacturing Engineering

Week 9
Managing Risk

Course Roadmap



What is Risk?

Is the potential of losing something of *value*, weighed against the potential to gain something of *value*.

The effect of *uncertainty* upon objectives
where an effect is a deviation from the expected - positive or negative.

Sources: http://en.wikipedia.org/wiki/Risk; http://www.merriam-webster.com/dictionary/risk; and ISO 31000

Anatomy of Risk

Risk in the context of project management

Uncertain or chance events that planning can not overcome or control.

Items of *value* are: scope, time, cost

The essence of project management is risk management.

What is Risk Management?

A **proactive** attempt to recognize and manage internal events and external threats that affect the likelihood of a project's success.

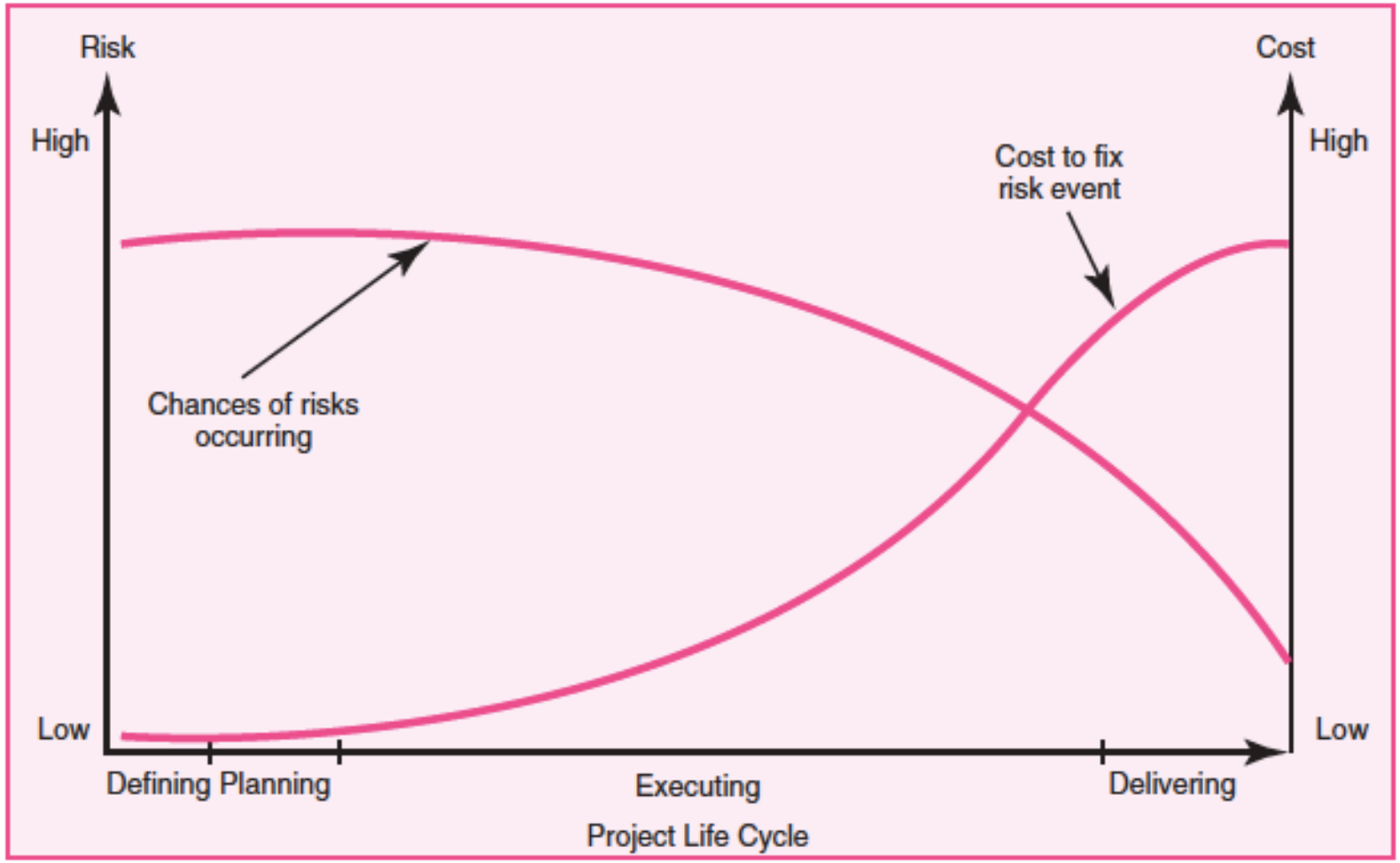
Incorporates an understanding of:

- What can go wrong (risk event)
- How to minimize the risk event's impact (consequences)
- What can be done before an event occurs (anticipation)
- What to do when an event occurs (contingency plans)

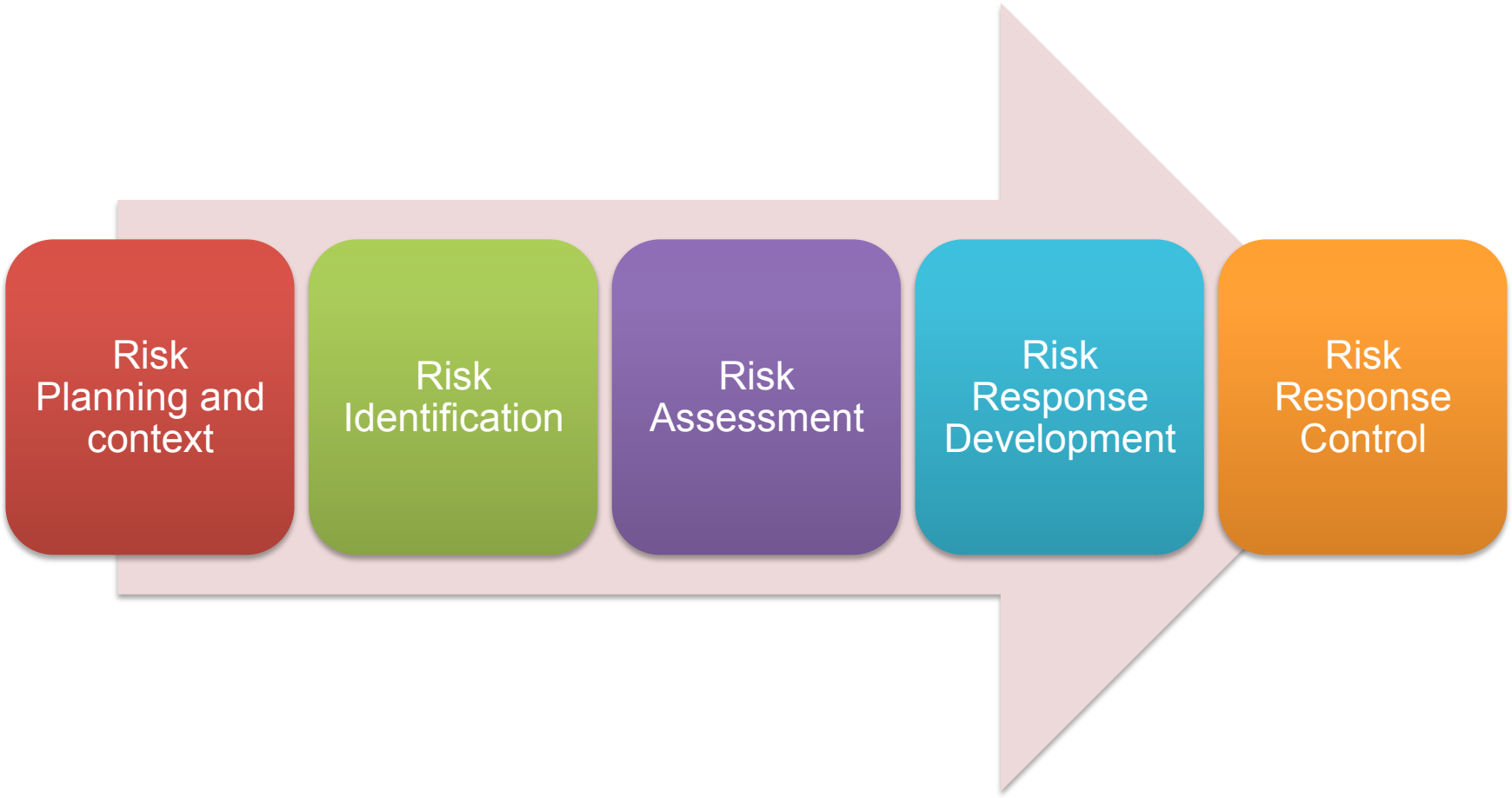
Benefits of Risk Management

- 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.

The risk management challenge



5-Step Risk Management Process



Risk Planning and context

The risk management plan includes:

- objectives
- methodology
- roles and responsibilities
- budgeting, timing
- risk categories
- scoring interpretation
- tolerance thresholds
- reporting formats
- tracking

Establishing the context

The external context	• the environment such as political, social, legal, financial and geographical
The organisational context	• culture, values, governance, capabilities, policies, processes, strategic objectives
The project context	• full set of objectives and project outcomes

Risk Identification

The process of generating a list of possible risks that could affect the project.

A common mistake is to identify **project objectives** rather than **events** as risks.

- E.g. Failure to meet schedule is a project objective, whereas adverse weather is an event which will effect the schedule.

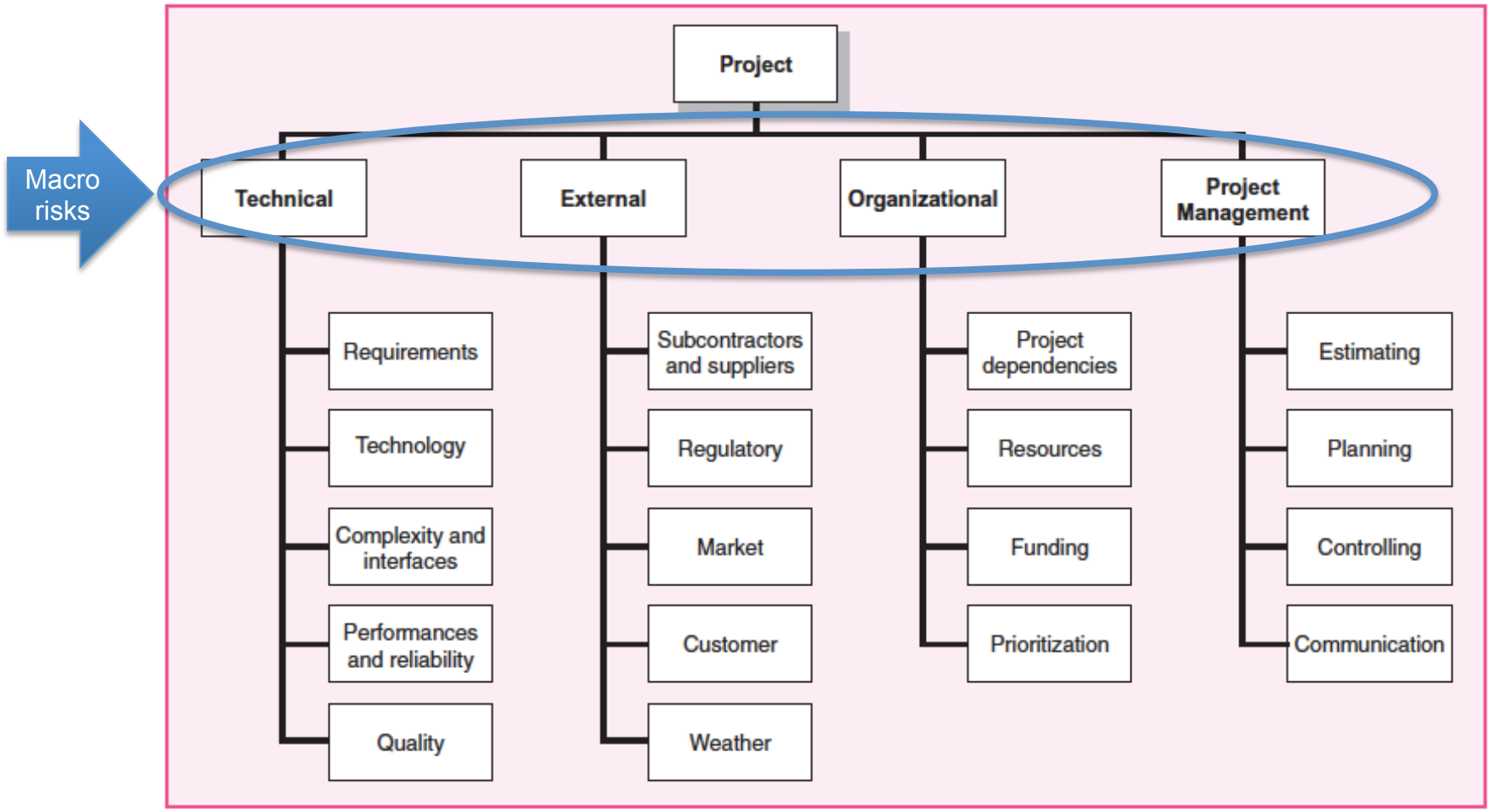
Common risk identification tools

- Personal experience
- Individual pondering
- Group processes
  - Brainstorming
  - Nominal group
  - Delphi
- Structured interviews
- Project information
- Checklists
- Risk breakdown structure (RBS)

Brainstorming

Is a group problem-solving technique that involves the spontaneous contribution of ideas from all members of the group.

Sample risk breakdown structure (RBS)



Risk Profiling

Is a list of questions that address traditional areas of uncertainty on a project.

Questions are often developed from previous similar projects.

For example:

- Are the design assumptions realistic?
- How reliable are the cost estimates?
- Are staff experienced?

Sample Risk Profiling questions

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?

Risk Assessment

Takes the list of risks identified in step 2 and attempts to prioritize them.

We typically evaluate each risk in terms of:

- Probability / Likelihood
- Impact / Severity
- Ease / Difficulty of Detection

Risk Assessment Tools

Scenario analysis – (Probability & Impact)

Impact Scales – (Simple (e.g. low/moderate/high))/Numerical e.g. 1-5)

Risk severity matrix – (Probability & Impact)

Failure Mode and Effects Analysis (FMEA) – (Probability, Impact & Ease of Detection)

Statistical Techniques

- Decision trees – used to assess alternative action using expected values
- NPV – for cash flow risks
- PERT (Program Evaluation and Review Technique) – activity and project risk

Risk Severity Matrix

0 – 5 = Low Risk 6 – 10 = Moderate Risk 11 – 15 = High Risk 16 – 25 = extremely high unacceptable risk		Severity of the potential injury/damage				
		Insignificant damage to Property, Equipment or Minor Injury **1**	Non-Reportable Injury, minor loss of Process or slight damage to Property **2**	Reportable Injury moderate loss of Process or limited damage to Property **3**	Major Injury, Single Fatality critical loss of Process/damage to Property **4**	Multiple Fatalities Catastrophic Loss of Business **5**
Likelihood of the hazard happening	Almost Certain **5**	5	10	15	20	25
	Will probably occur **4**	4	8	12	16	20
	Possible occur **3**	3	6	9	12	15
	Remote possibility **2**	2	4	6	8	10
	Extremely Unlikely **1**	1	2	3	4	5

Risk Response Development

Now that the risk event has been identified and assessed.

We need to make a decision on what type of response is appropriate.

Risk Management Strategies

Mitigating/Reducing/Controlling Risk

- Reducing the likelihood an adverse event will occur.
- Reducing impact of adverse event.

Avoiding Risk

- Changing the project plan to eliminate the risk or condition.

Transferring Risk

- Paying a premium to pass the risk to another party.
- Requiring Build-Own-Operate-Transfer (BOOT) provisions.

Accepting/Retaining Risk

- Making a conscious decision to accept the 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

- Potential disadvantages of not having a Contingency Plan
  - Having no plan may slow managerial response
  - Decisions made under pressure can be potentially dangerous and costly

Types of Risks

- Technical
- Schedule
- Cost
- Funding

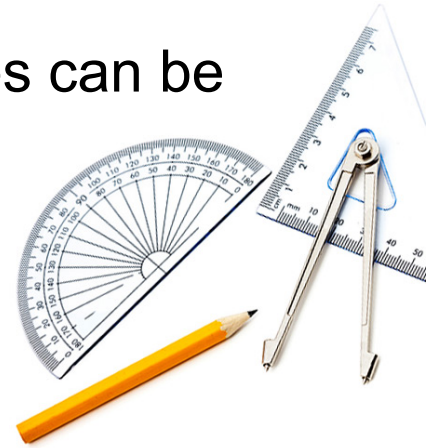
Technical Risks

Technical risks are often difficult to manage

Mitigation Strategies

- Backups/Alternatives
  - Different solutions can be implemented if a chosen technology fails

- Testing and modeling
  - Assessing whether technical uncertainties can be resolved through the use of:
    - CAD systems
    - Build models/prototypes
    - Experiments



Schedule Risks

Is the threat of a project not finishing on time

Mitigation Strategies

- Time Buffers/Project Slack
- Compression/Crashing of project schedules by running activities in parallel or changing relationships (e.g. start-to-start lag relationships)

Cost Risks

Projects of long duration often need some contingency for price changes.

Mitigation Strategies

- Contingency funding
- Cost sensitive projects should be evaluated item by item

Funding Risks

Changes in the supply of funds for the project can dramatically affect the likelihood of implementation or successful completion of a project

Mitigation Strategies

- Contingency funding
- Modularisation of project

Contingency Funding

Are funds established to cover project risks, both identified and unknown

Size of funds often reflects overall risk of a project

Typical rules of thumb for funding levels

- 1-10% for similar projects
- 20-60% for unique and high tech projects

Project owners are often reluctant to set up project contingency funds that seem to imply the project plan might be a poor one.

Types of Contingency funding

Budget reserves

Are linked to the identified risks of specific work packages or cost accounts in WBS.

Management reserves

Are funds to be used to cover major unforeseen risks (e.g. change in project scope) of the total project

Are created after budget reserves are identified

Time Buffers

Are amounts of time used to compensate for unplanned delays in the project schedule

Time buffers are added to:

- Activities with severe risk
- Merge activities that are prone to delays due to one or more preceding activities being late
- Noncritical activities to reduce the likelihood that they will create another critical path
- Activities that require scarce resources to ensure resources are available when needed

Opportunity Management tactics

Exploit	• Seeking to eliminate the uncertainty associated with an opportunity to ensure that it definitely happens.
Share	• Allocating some or all of the ownership of an opportunity to another party who is best able to capture the opportunity for the benefit of the project.
Enhance	• Taking action to increase the probability and/or the positive impact of an opportunity.
Accept	• Being willing to take advantage of an opportunity if it occurs, but not taking action to pursue it.

Risk Response Control

Risk control

- Execution of the risk response strategy
- Monitoring of triggering events
- Initiating contingency plans
- Watching for new risks

Establishing a Change Management System

- Monitoring, tracking, and reporting risk
- Fostering an open organization environment
- Repeating risk identification/assessment exercises
- Assigning and documenting responsibility for managing risk

Risk Register

Contains the following information

- All identified risks and descriptions
- Probability of occurrence
- Impact
- Responses (mitigations / contingencies)
- Owners
- Current Status

Change Control Management

Change is inevitable!

Most changes are will be:

- Scope changes
- Implementation of contingency plans
- Improvement changes

Change Management System

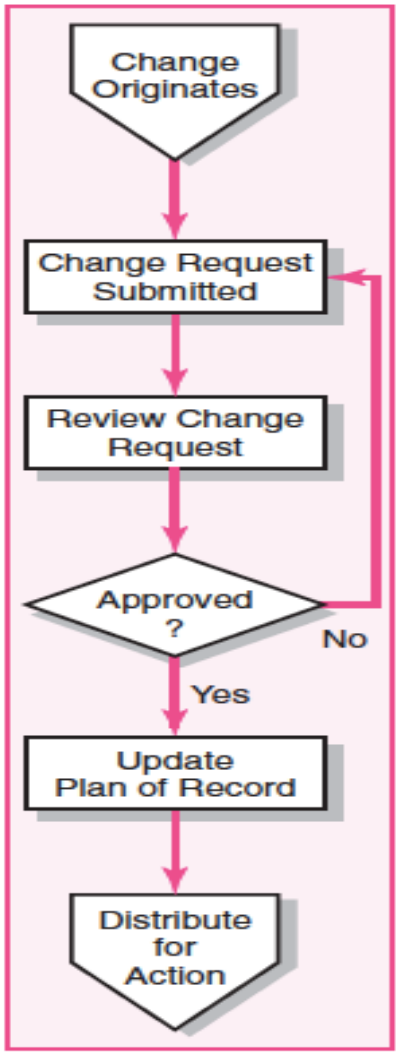
Involves reporting, controlling and recording changes to the project baseline

Goal is to establish a process for introducing necessary changes in the project in a timely and efficient manner

Key activities of a Change Management System

- Identify proposed changes
- List expected effects of proposed changes on schedule and budget
- Review, evaluate, and approve or disapprove of changes formally
- Negotiate and resolve conflicts of change, condition, and cost
- Communicate changes to parties affected
- Assign responsibility for implementing change
- Adjust master schedule and budget
- Track all changes that are to be implemented

Sample Change Control Process and Request



Project name *Irish/Chinese culture exchange* Project sponsor *Irish embassy*

Request number *12* Date *June 6, 2xxx*

Originator *Jennifer McDonald* Change requested by *Chinese culture office*

Description of requested change

1. *Request river dancers to replace small Irish dance group.*
2. *Request one combination dance with river dancers and China ballet group.*

Reason for change

River dancers will enhance stature of event. The group is well known and loved by Chinese people.

Areas of impact of proposed change–describe each on separate sheet

[X] Scope [X] Cost [ ] Other _____

[ ] Schedule [ ] Risk

Disposition	Priority	Funding Source
[ ] Approve	[ ] Emergency	[ ] Mgmt. reserve
[X] Approve as amended	[X] Urgent	[ ] Budget reserve
[ ] Disapprove	[ ] Low	[X] Customer
[ ] Deferred		[ ] Other

Sign-off Approvals

Project manager *William O'Mally* Date *June 12, 2xxx*

Project sponsor *Kenneth Thompson* Date *June 13, 2xxx*

Project customer *Hong Lee* Date *June 18, 2xxx*

Other _____ Date _____

Benefits of a Change Control System

- Inconsequential changes are discouraged by the formal process
- Costs of changes are maintained in a log/register
- Integrity of the WBS and performance measures are maintained
- Allocation and use of budget and management reserve funds are tracked
- Responsibility for implementation is clarified
- Effect of changes is visible to all parties involved
- Implementation of change is monitored
- Scope changes will be quickly reflected in baseline and performance measures

Successful Risk Management

Risk management is an iterative process that occurs throughout the lifecycle of a project.

Successful risk management requires a culture in which threats are embraced, not denied and where problems are identified and not hidden.