Risk Management Part I

Lecture 7 by Professor Vladimir Geroimenko

Module “Software Project Management“

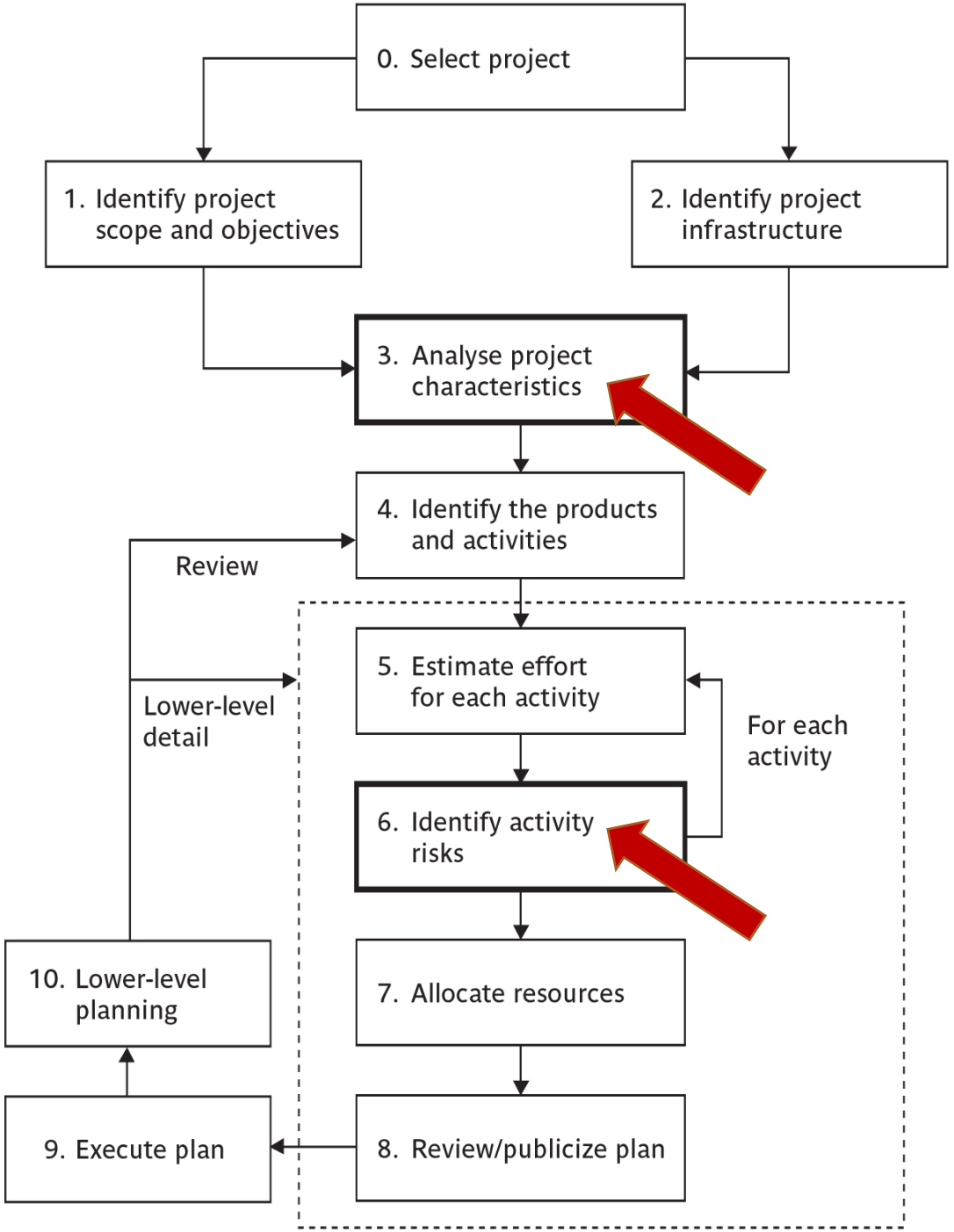
01 November 2023 - Teaching Week 6

Textbook reference: Chapter 7

Lecture Outline

- Project risks
  - What causes project risks
- Risk Management Framework
  - Risk identification
  - Risk assessment
  - Risk reduction
  - Risk monitoring
- Estimation techniques
  - Risk exposure
  - Qualitative measures

Managing risks in the Step Wise framework



Project Risks

- *Project risks are factors that cause a project to be **delayed** or **over-budget***
- Project plans must be based on ***assumptions***. ***Risk*** is the possibility that an assumption is wrong.

Key elements of risk:

- It relates to the ***future***
- It evolves ***causes*** and ***effects:*** for example, inexperienced staff → low productivity.

What Causes Project Risks?

- Planning assumptions.
    - We all make assumptions due to uncertainties in the early stage of the project. What happen if the assumptions turn out to be invalid?
- Estimation errors
- Eventualities

Estimation Errors

Estimation can be improved by analyzing historic data for similar tasks and similar projects.

- Keep historic data of your estimation and the actual performance
- Compare your estimation and the actual value
- Classify the tasks that are easy or difficult to give accurate estimation

Eventualities

- Unexpected and unimaginable events
- Examples of common unexpected events
  - Hardware cannot be delivered on time
  - Requirements specification needs to be rewritten
  - Staffing problem

Some definitions of risk

'An uncertain event or condition that, if it occurs, has a negative effect on a project's objectives' **PM-BOK**

'The chance of exposure to the adverse consequences of future events' **PRINCE2**

Please note:

- Risks relate to **possible future problems**, not current ones
- They involve a possible **cause** and its **effect,**

e.g. a developer leaves -> task delayed

Exercise: Match causes and possible effects

Causes

(a) Staff inexperience

(b) Lack of top management commitment

(c) New technology

(d) Users uncertain of their requirements

Possible affects

(i) Testing takes longer than planned

(ii) Planned effort and time for activities exceeded

(iii) Project scope increases

(iv) Time delay in getting changes to plan agreed

Cause a and effects i and ii

Causes

(a) Staff inexperience

(b) Lack of top management commitment

(c) New technology

(d) Users uncertain of their requirements

Possible affects

(i) Testing takes longer than planned

(ii) Planned effort and time for activities exceeded

(iii) Project scope increases

(iv) Time delay in getting changes to plan agreed

Cause b and effect iv

Causes

(a) Staff inexperience

(b) Lack of top management commitment

(c) New technology

(d) Users uncertain of their requirements

Possible affects

(i) Testing takes longer than planned

(ii) Planned effort and time for activities exceeded

(iii) Project scope increases

(iv) Time delay in getting changes to plan agreed

Cause c and effects i and ii

Causes

(a) Staff inexperience

(b) Lack of top management commitment

(c) New technology

(d) Users uncertain of their requirements

Possible affects

(i) Testing takes longer than planned

(ii) Planned effort and time for activities exceeded

(iii) Project scope increases

(iv) Time delay in getting changes to plan agreed

Cause d and effect iii

Causes

(a) Staff inexperience

(b) Lack of top management commitment

(c) New technology

(d) Users uncertain of their requirements

Possible affects

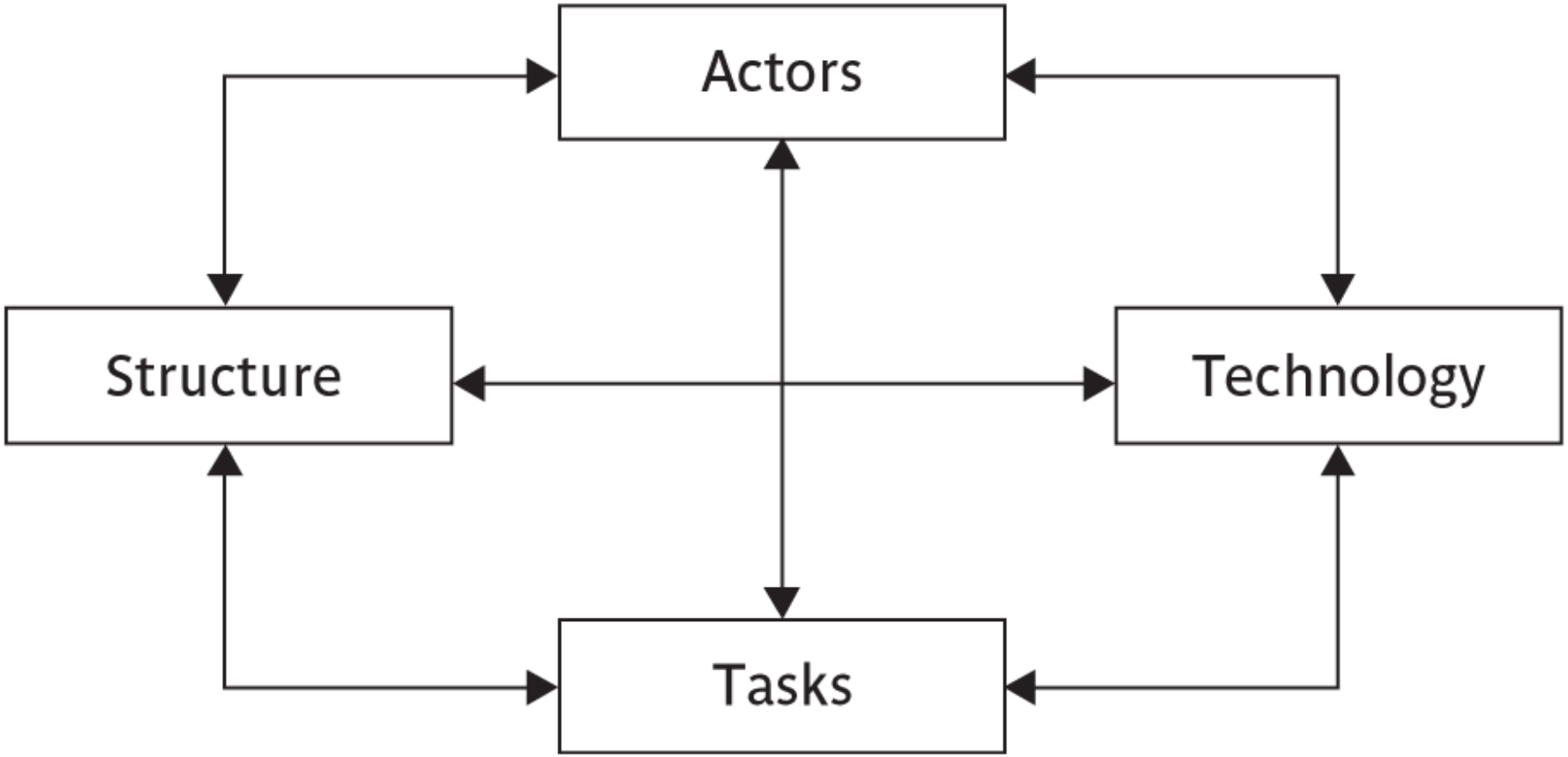
(i) Testing takes longer than planned

(ii) Planned effort and time for activities exceeded

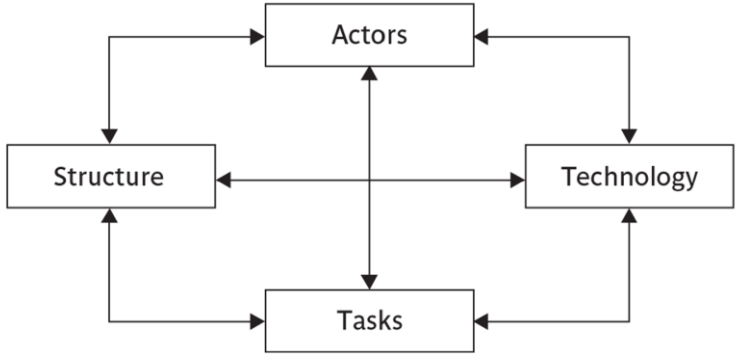
(iii) Project scope increases

(iv) Time delay in getting changes to plan agreed

Categories of risk



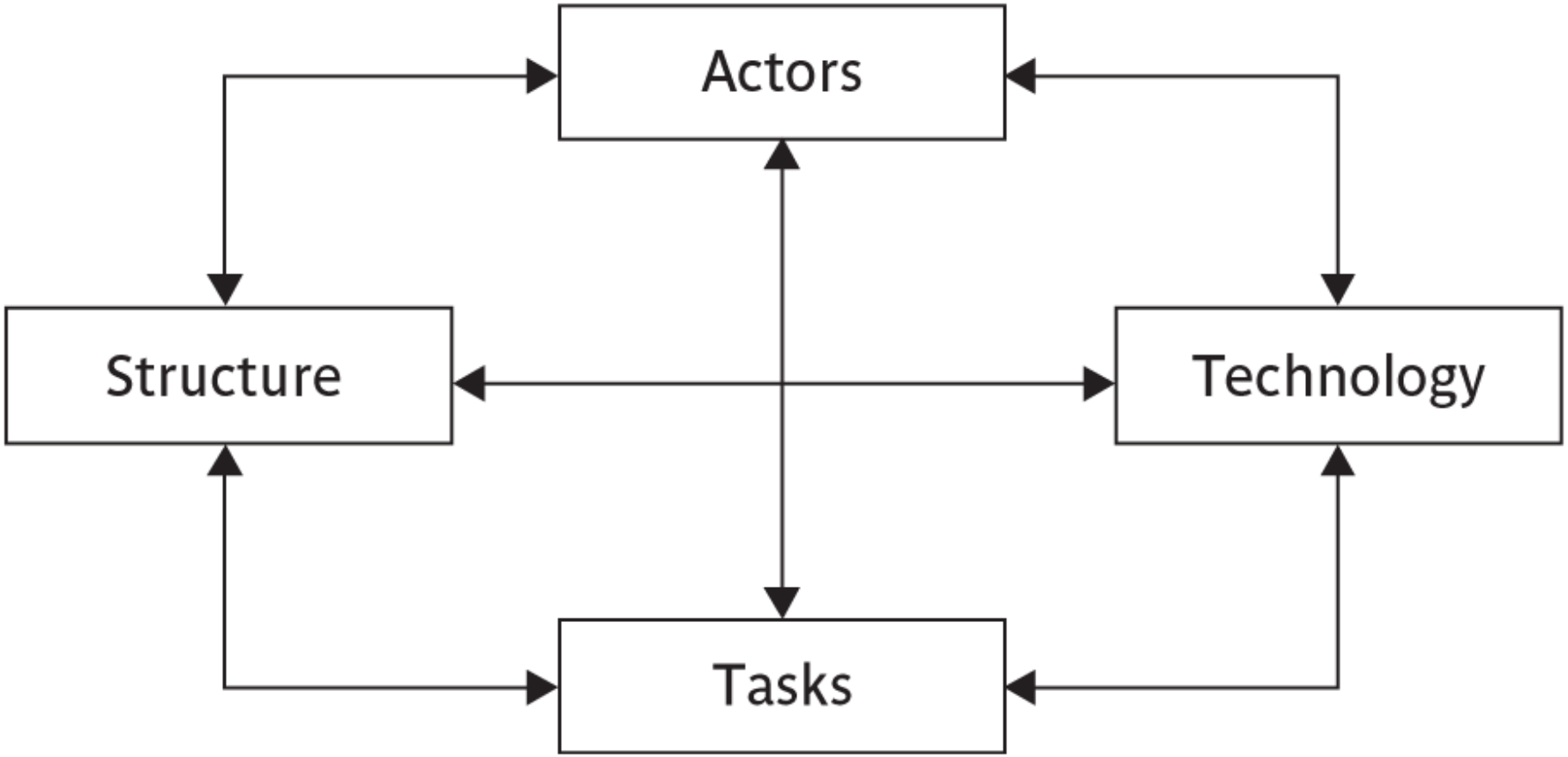
Categories of risk explained



- **Actors** relate to all those involved in the project including both developers, users and managers.
- **Technology** – both that used to implement the project and that embedded in the project deliverables.
- **Structure** – this includes management procedures, risk here is that a group who need to carry out a particular project task are not informed of this need.
- **Tasks** – the work to be carried out. A typical risk is that the amount of effort needed to carry out the task is underestimated.

(Based on Lyytinen's sociotechnical model of risk)

Categories of risk – all boxes are interlinked!



A Framework for Dealing with Risk

The planning for risk includes these steps:

- **Risk identification** – what risks might there be?
- **Risk analysis and prioritization** – which are the most serious risks?
- **Risk planning** – what are we going to do about them?
- **Risk monitoring** – what is the current state of the risk?

Risk Identification Approaches

- **Checklists** – usually based on the experience of past projects
- **Brainstorming** – getting knowledgeable stakeholders together to pool concerns

Type of risks

- *Generic risk* (common to all projects)
  - Standard checklist can be modified based on the risk analysis of previous projects
- *Specific risk* (only applies to individual projects)
  - Use brainstorming
  - More difficult to find
  - Need to involve project team members

Common Risk Factors

- **Application** factors
- **Staff** factors
- **Project** factors
- **Hardware & software** factors
- **Changeover** factors
- **Supplier** factors
- **Environment** factors
- **Health and safety** factors

Application Factors

- Nature of the application
  - A data processing application or a life-critical system (e.g., X-ray emission system)
- Expected size of the application
  - The larger is the size, the higher is the chance of errors, communication problems and management problems

Staff Factors

- Experience and skills
- Appropriateness of experience
- Staff satisfaction
- Staff turn-over rates

Project Factors

- Project objectives
  - Badly defined
  - Unclear to every team member and user
- Project methods
  - Badly specified methods
  - Unstructured methods

Hardware and Software Factors

- New hardware
  - Stability of the new hardware system
- Cross platform development
  - Development platform is not the operation platform
  - Does the language used support cross platform development?

Changeover Factors

- ‘All-in-one’ changeover
  - The new system is put into operation
- Incremental or gradual changeover
  - Adding new components to the system by phases
- Parallel changeover
  - Both the existing system and the new system are used in parallel

Supplier Factors

- Late delivery of hardware
- Instability of hardware
- Late completion of building sites

Environment Factors

- Changes in environment such as hardware platforms
- Changes in government policies
- Changes in business rules
- Restructuring of organizations

Health and Safety Factors

- Health and safety of staff and environment
- Staff sickness, death, pregnancy etc.
- Any tragic accident to staff

Boehm's top 10 development risks

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

Boehm’s top 10 development risks

5. Gold plating (= adding unnecessary extras)	Requirements scrubbing, prototyping, design to cost
6. Late changes to requirements	Change control, incremental development
7. Shortfalls in externally supplied components	Benchmarking, inspections, formal specifications, contractual agreements, quality controls
8. Shortfalls in externally performed tasks	Quality assurance procedures, competitive design
9. Real time performance problems	Simulation, prototyping, tuning
10. Development technically too difficult	Technical analysis, cost-benefit analysis, prototyping, training

Risk Analysis: Risk Exposure Measure

- Risk estimation is to assess the **impact** and **likelihood** of each hazard
- Risk exposure (= risk value / the importance of the risk)

Risk exposure = risk impact × risk likelihood

- Risk impact - The effect of the problem caused by the hazard
  - Delays to scheduled activities
  - Using additional expensive resources
  - Any compromise to the quality or functionality
- Risk likelihood - The probability that a hazard is going to occur

Risk Exposure Example:
The amount needed for an insurance premium

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

For example:

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

Please note: In practice, with project risks, these quantitative approaches are usually impractical and more qualitative approaches are used instead.

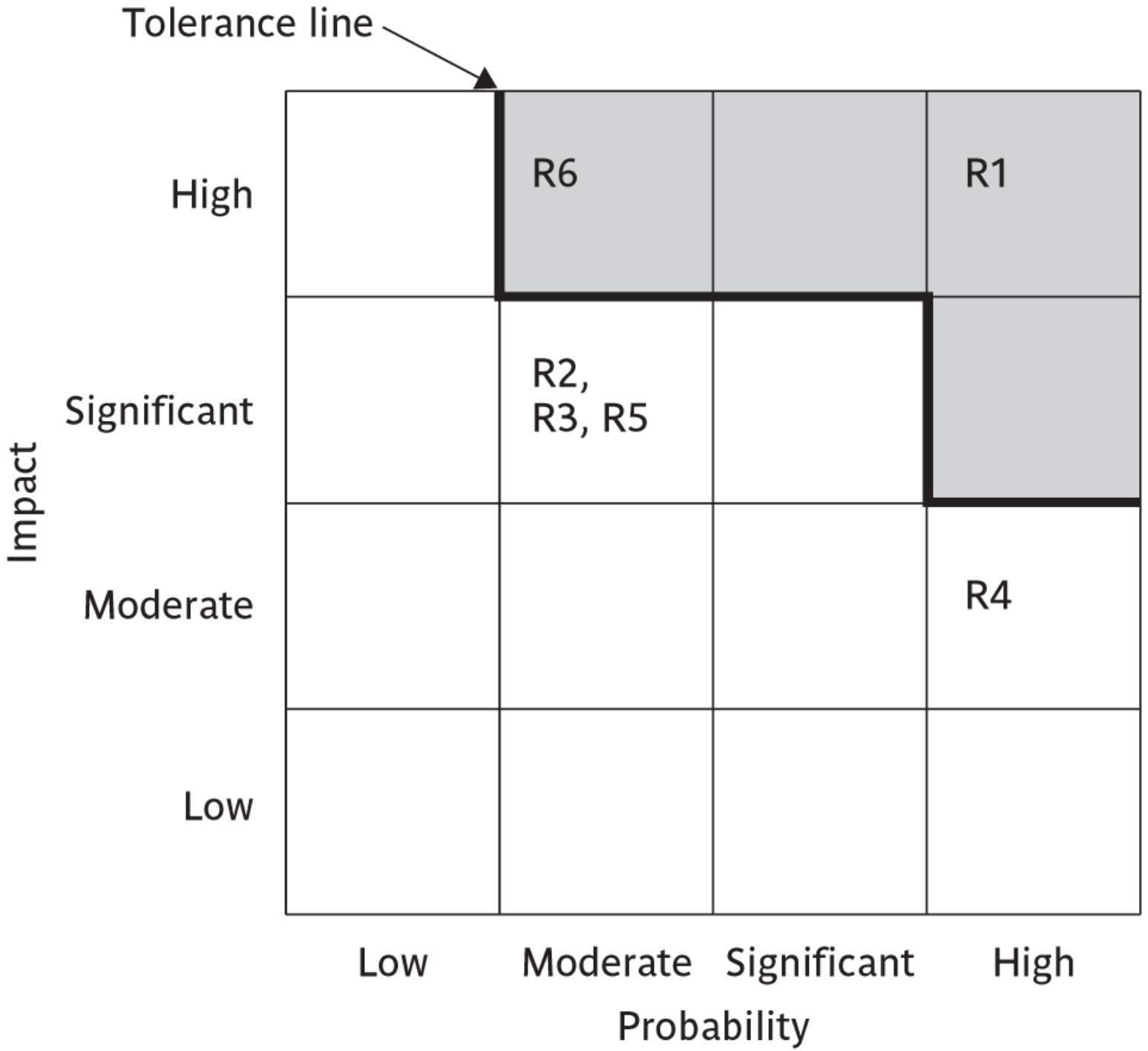
Risk probability: qualitative descriptors

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

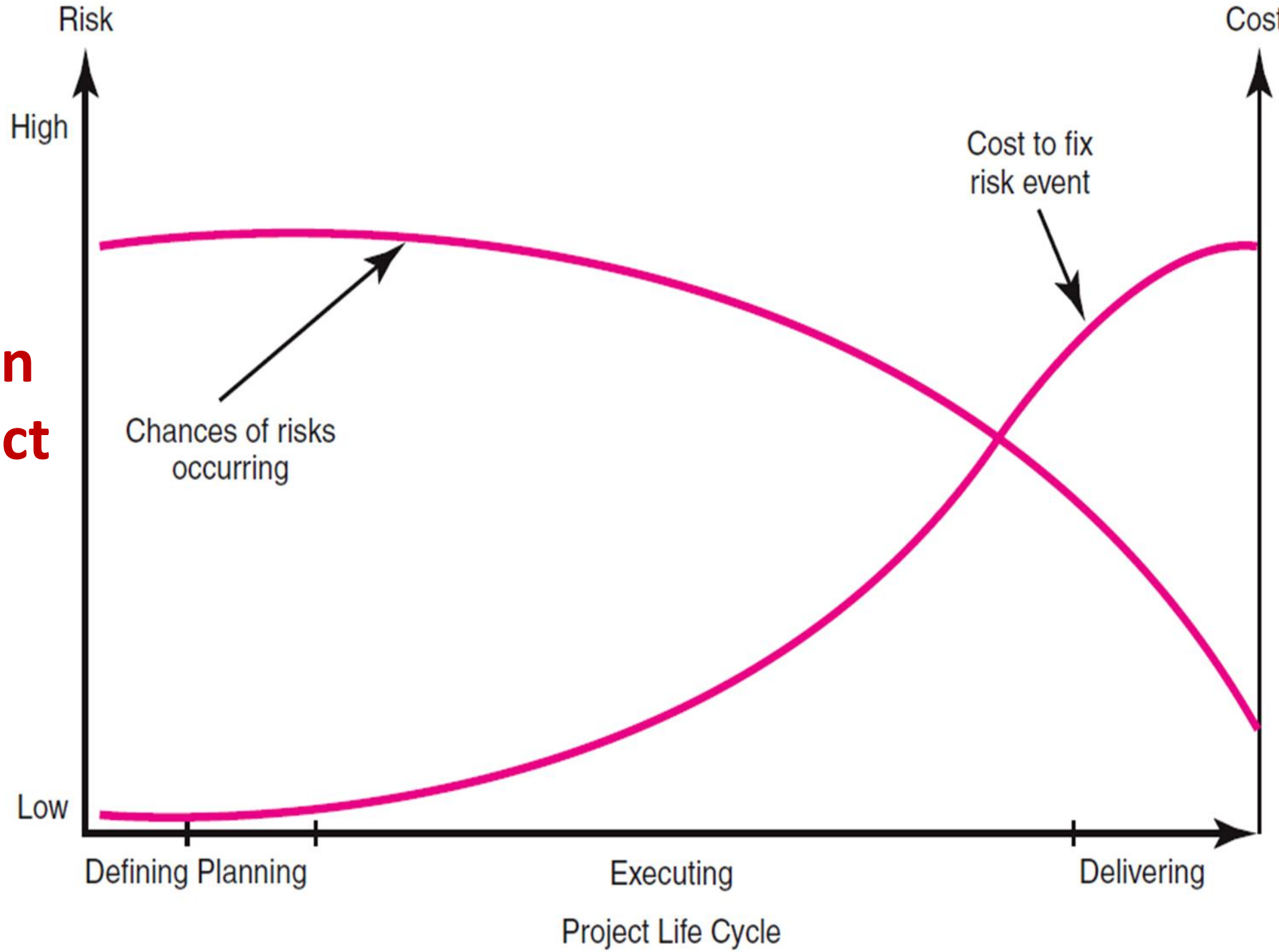
Qualitative descriptors of impact on cost

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



Risk in Project Life Cycle



Risk planning

Five different ways of handling risk:

1. Risk acceptance
2. Risk avoidance
3. Risk reduction
4. Risk transfer
5. Risk mitigation/contingency measures

1. Risk acceptance

- The cost of avoiding the risk may be greater than the actual cost of the damage that might be inflicted.

2. Risk avoidance

- Avoid the environment in which the risk occurs.
- For example, buying an off-the-shelf application would avoid a lot of the risks associated with software development.

3. Risk reduction

- The risk is accepted but actions are taken to reduce its likelihood.
- For example, prototypes ought to reduce the risk of incorrect requirements

4. Risk transfer

- The risk is transferred to another person or organization.
- For example, the risk of incorrect development estimates can be transferred by negotiating a fixed price contract with an outside software supplier.
- The impact of the risk can be transferred away from the project by contracting out or taking out insurance

5. Risk mitigation

- Tries to reduce the impact if the risk does occur
- For example, taking backups to allow rapid recovery in the case of data corruption

Contingency planning

- Contingency Plan (Plan B)
  - 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 Reduction Leverage (RRL)

- RRL is used to determine whether it is worthwhile to carry out the risk reduction plan.
- The **higher is the RRL** value, the **more worthwhile** is to carry out the risk reduction plan.

$$\text{RRL} = \frac{\text{RE}_{\text{before}} - \text{RE}_{\text{after}}}{\text{risk reduction cost}}$$

If RRL > 1, it is worth doing

Risk Reduction Leverage: An Example

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

Please note: You could think in terms of the analogy to insurance. An insurance company might reduce the fire insurance premium from £2k to £1k on condition that a fire alarm is installed. The insured would save £1k a year by investing £500, so it would be worth doing.

RISK RECORD					
Risk id		Risk title			
Owner		Date raised		Status	
Risk description					
Impact description					
Recommended risk mitigation					
Probability/impact values					

	Probability	Impact		
		Cost	Duration	Quality
Pre-mitigation				
Post-mitigation				

Incident/action history			
Date	Incident/action	Actor	Outcome/comment

Thank you for your attention

Any questions, please?