Risk Management

Risk Definition

- **Definition of Risk:** ‘an uncertain event or condition that, if it occurs has a positive or negative effect on a project’s objectives’.

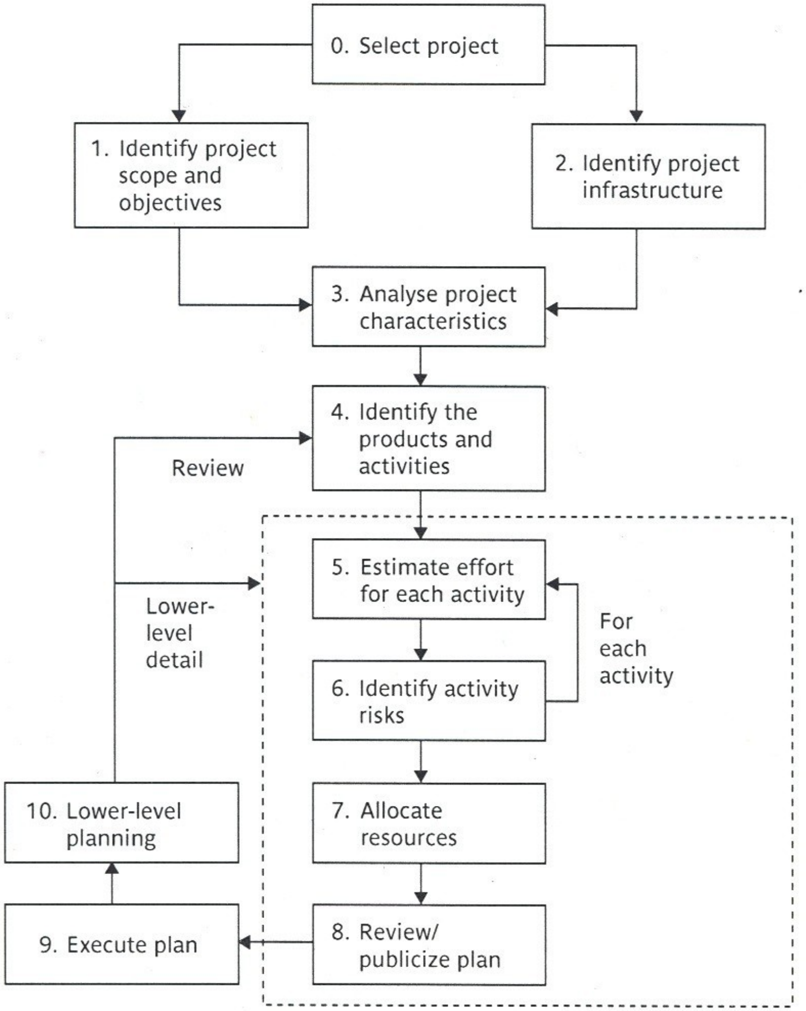
Risk Definition (cont’d)

- **Risk definition:** ‘the chance of exposure to the adverse consequences of future events’.

Risk Key Elements

- **It involves a cause and an effect.**
  - **Causes:**
    - The use of untrained staff.
    - Poor specifications.
    - An inaccurate estimate of effort.
  - **Effects:**
    - Cost over run.
    - Low productivity.

Boundaries of Risk Management


0. Select project
1. Identify project scope and objectives
2. Identify project infrastructure
3. Analyse project characteristics
4. Identify the products and activities
Review
5. Estimate effort for each activity
Lower-level detail
For each activity
6. Identify activity risks
7. Allocate resources
8. Review/ publicize plan
9. Execute plan
10. Lower-level planning

- Every plan is based on assumptions and **risk management** tries to plan for and control the situations where those assumptions become incorrect.
- **Risk planning** is carried out at steps: 3 & 6.

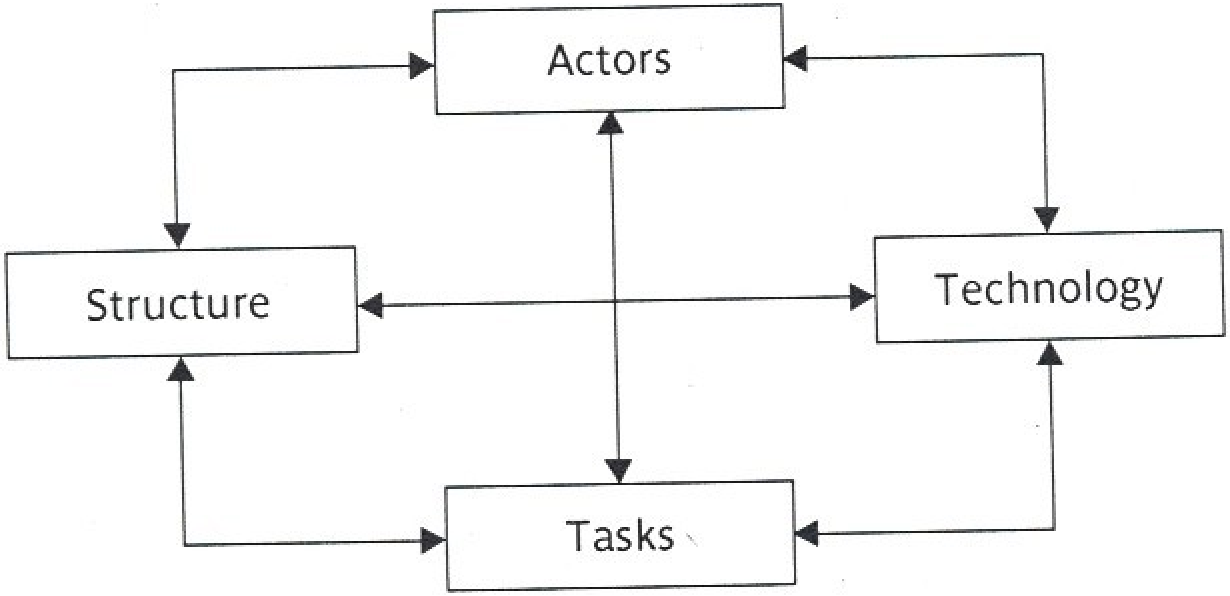
Risk Categories

- **Project Risks:** are risks that could prevent the achievement of the objectives given to the project manager and the project team.
- These objectives are formulated toward achieving project success.
- **Project success factors:**
  - On time.
  - Within budget.
  - Required functionality.
  - Quality.
- **Project risks can be classified under these four categories.**

Risk Categories (cont’d)

A different way to categorize risks:

- A sociotechnical model proposed by Kalle Lyytinen and his colleagues


Actors
Structure
Technology
Tasks

Risk Categories (cont'd)

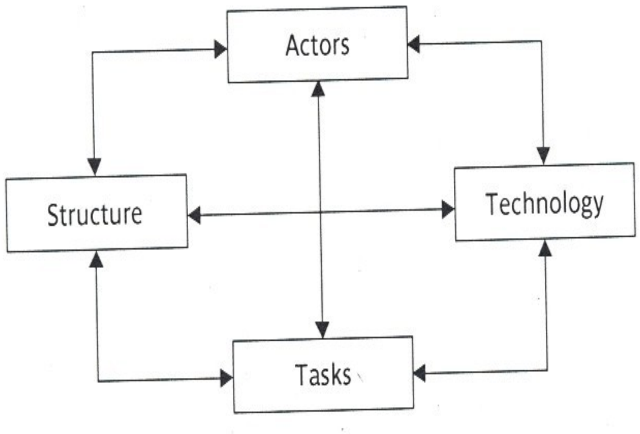
- **Actors :** refers to all people involved in the development of the application.
- **Risk:**
  - A high staff turnover, leads to expertise of value to the project being lost.
- **Technology:** encompasses both the technology:
  - Used to implement the application and
  - That embedded in the delivered products.
- **Risk:**
  - Relating to the appropriateness of the technology and
  - The possible faults in it.

Risk Categories (cont’d)

- **Structure:** describes the management structures and systems, including those affecting planning and control.

- **Risk:**
  - Responsibility for managing the users involvement at the implementation stage might not be clearly allocated.

- **Tasks:** relates to the work planned.
- **Risk:**
  - The complexity of work might lead to delays because of the additional time required integrate the large number of components.



- All boxes are interlinked. Why?
- Risks often arise from the relationships between factors.
- Example: between technology and people: If the development technology is novel, and the developers are not experience in its use this could lead to delay of the results.

Risk Framework

Planning for risk includes these steps:

1. Risk identification.
2. Risk analysis and prioritization.
3. Risk planning.
4. Risk monitoring.

- When risks are identified, plans can be made to reduce or remove their effects.
- The plans are reassessed to ensure:
  - That the original risks are reduced sufficiently and
  - No new risks are inadvertently introduced.

Risk Identification

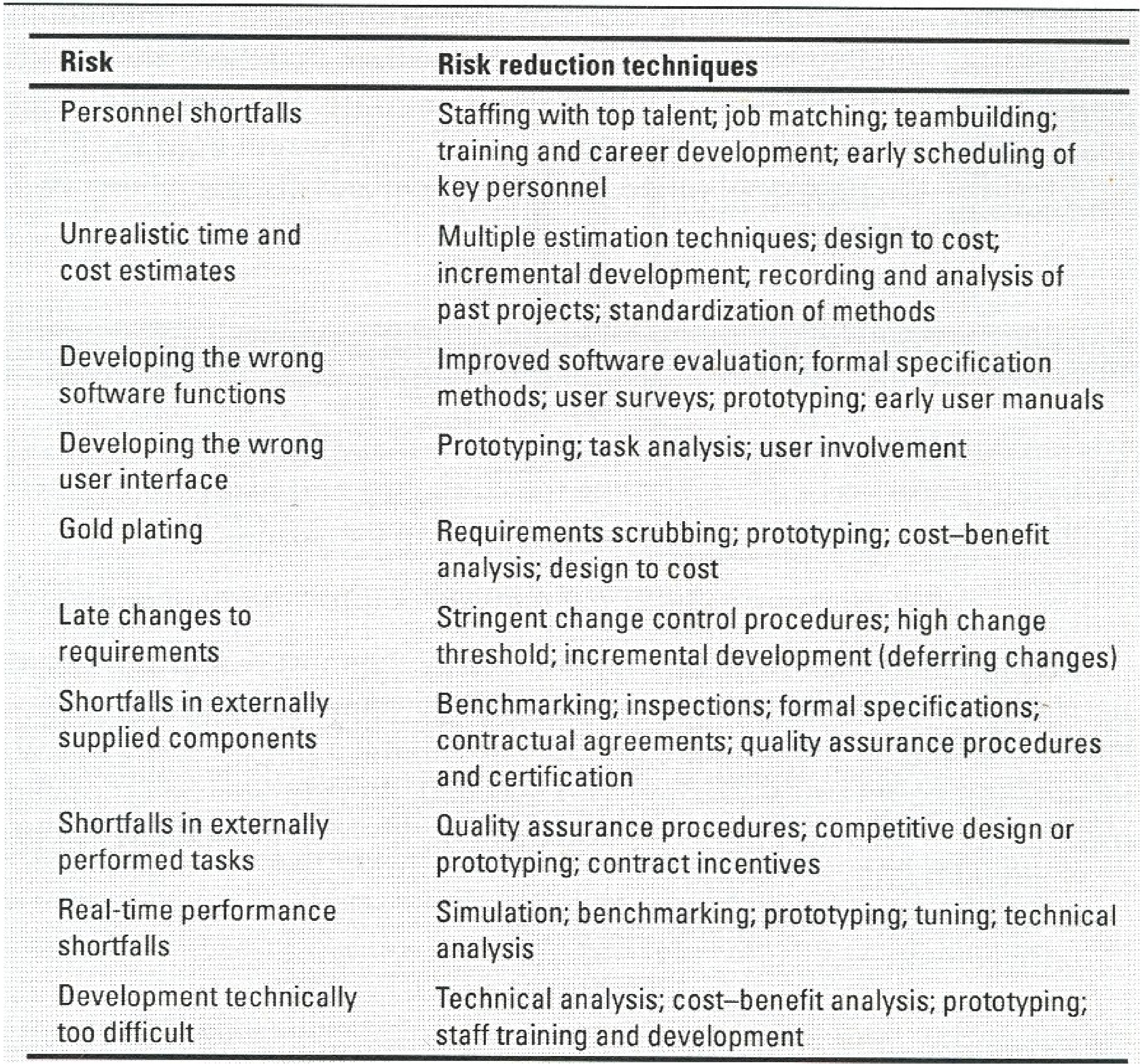
The two main approaches to identify risk are:

- – The use of checklists.
- – Brainstorming.

Checklists: are lists of the risks that have been found to occur regularly in software development projects.

- Those checklists often suggest some potential countermeasures for each risk.
- A group of representatives for a project examines a checklist identifying risks applicable to their project.
- PRINCE2, recommends that after completing a project, all the problems that were identified as risks during the project to be added to an organizational risk checklist to be used with new projects.

Software Project Risk Checklist Example



Risk	Risk reduction techniques
Personnel shortfalls	Staffing with top talent; job matching; teambuilding; training and career development; early scheduling of key personnel
Unrealistic time and cost estimates	Multiple estimation techniques; design to cost; incremental development; recording and analysis of past projects; standardization of methods
Developing the wrong software functions	Improved software evaluation; formal specification methods; user surveys; prototyping; early user manuals
Developing the wrong user interface	Prototyping; task analysis; user involvement
Gold plating	Requirements scrubbing; prototyping; cost–benefit analysis; design to cost
Late changes to requirements	Stringent change control procedures; high change threshold; incremental development (deferring changes)
Shortfalls in externally supplied components	Benchmarking; inspections; formal specifications; contractual agreements; quality assurance procedures and certification
Shortfalls in externally performed tasks	Quality assurance procedures; competitive design or prototyping; contract incentives
Real-time performance shortfalls	Simulation; benchmarking; prototyping; tuning; technical analysis
Development technically too difficult	Technical analysis; cost–benefit analysis; prototyping; staff training and development

Risk Identification (cont’d)

Brainstorming (thinking ahead):

Representatives of the main stakeholders of the project, are brought together , in order to use their individual knowledge of different parts of the project

➔ to identify the problems that can occur (identify risks).

Risk Assessment
(Risk analysis and prioritization)

In order to prioritize the risks that were identified, we need a way to distinguish:

- The likely and damaging risks from those identified in the previous step “risk identification”.

One way of doing so is to calculate the **risk exposure** for each risk identified, using the following formula:

- ***Risk Exposure (RE)= (potential damage) ×(probability of occurrence)***

Risk Assessment (cont'd)

Ways of assessing the potential damage and probability of occurrence:

1. In money values and probabilities.

Say a project depended on a data center vulnerable to fire. It might be estimated that if fire occurred a new computer configuration could be established for $**500,000.** it might also be estimated that there is a **1 in 1000** chance that a fire will occur.

The **risk exposure (RE) in this case would be:**

500,000 *0.001=$500

The higher the** ***RE, the more attention or priority is given to

the risk

Example (True or False):

A risk that has a potential damage of **$40,000** and a probability of occurrence of **12%** will be given a **higher priority** than a risk having a potential damage of **$35,000** and a likelihood of **14%**.

False

Risk Exposure= potential damage * probability of occurrence (likelihood)

Risk Exposure for risk1= 40,000 *0.12=$4800

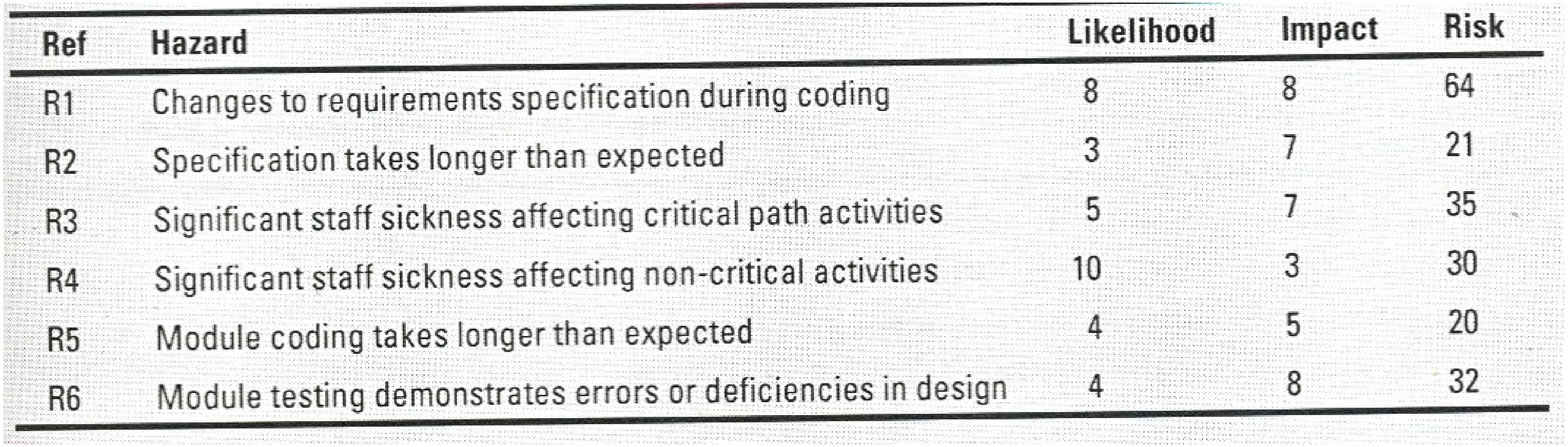
Risk Exposure for risk1= 35,000 *0.14= $4900 this risk exposure is higher so it will be given more priority.

Risk Assessment (cont’d)

2. Relative scales from 0 to 10.

- Both risk loss (damage) and the likelihood (probability of occurrence) will be assessed using relative scales from 0 to 10.
- Then they will be multiplied together to get a notional risk exposure (RE).

Risk Exposure (RE)



Ref	Hazard	Likelihood	Impact	Risk
R1	Changes to requirements specification during coding	8	8	64
R2	Specification takes longer than expected	3	7	21
R3	Significant staff sickness affecting critical path activities	5	7	35
R4	Significant staff sickness affecting non-critical activities	10	3	30
R5	Module coding takes longer than expected	4	5	20
R6	Module testing demonstrates errors or deficiencies in design	4	8	32

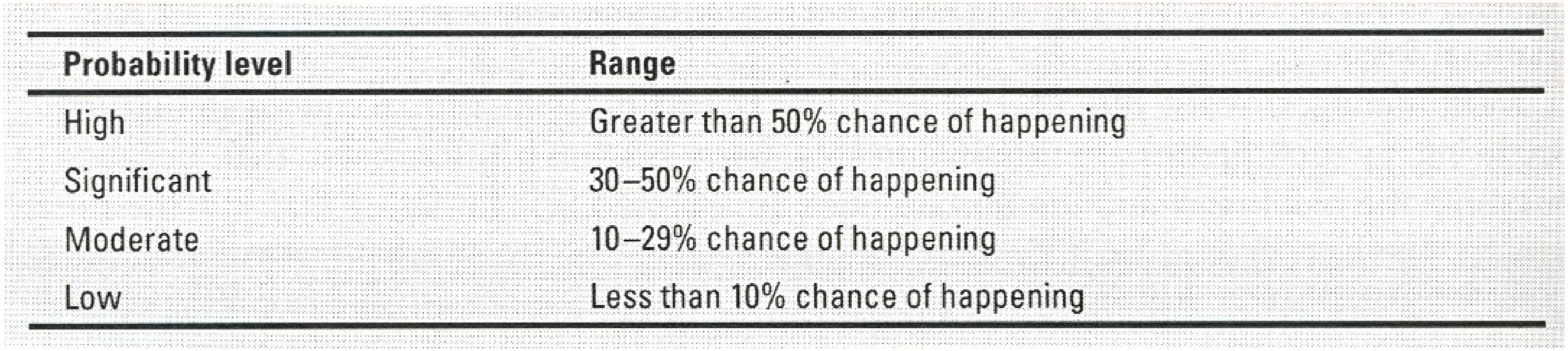
Risk in the table refers to the Risk Exposure (RE)

Risk Assessment (cont’d)

3. Qualitative descriptors.

Another approach is to use qualitative descriptions of the possible impact and the likelihood of each risk.

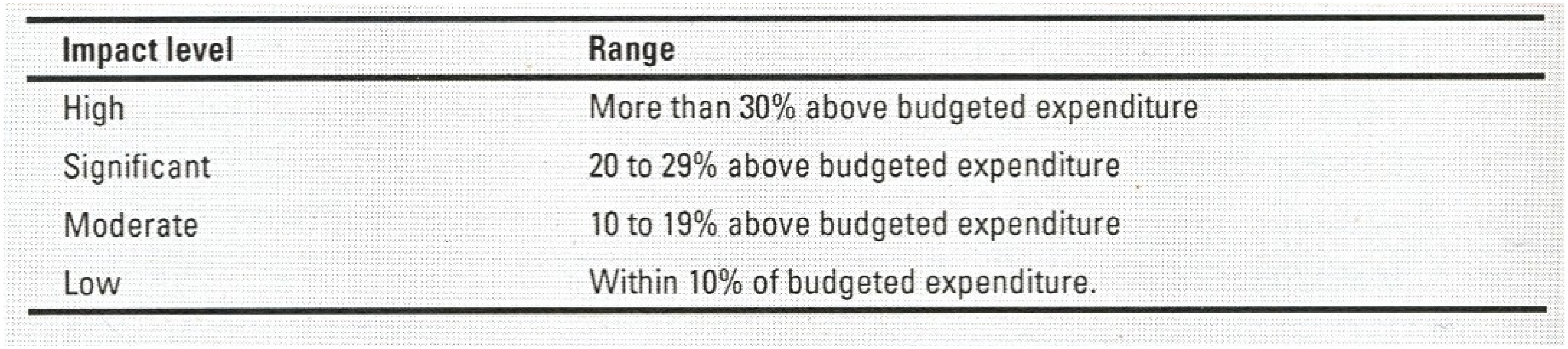
Qualitative Descriptors



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 for the “risk probability ” and associated range values.

Risk Assessment (cont’d)



Impact level	Range
High	More 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.

Qualitative descriptors of “impact on cost” and associated range values.

Risk Assessment (cont’d)

- **Consider R5, which refers to that coding the module would take longer than planned. This risk has an impact on what?**
  - **Time (the planned completion date) and cost.**

- **What could be a response to such risk?**
  - **Option: Add software developers and split the remaining work between them.**
    - **This may increase the cost but will save the planned completion date.**

  - **Option: reduce time spent on software testing.**
- **This will save both duration and staff costs but the price could be decreased quality in the project deliverable.**

Risk Assessment (cont’d)

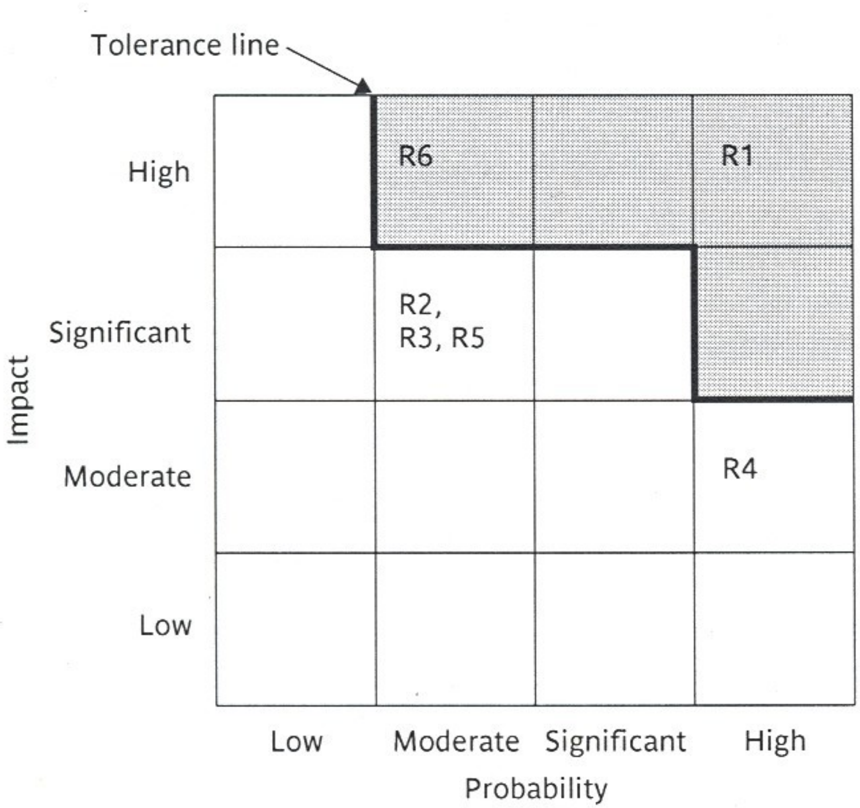
- **The risk exposure** cannot be calculated by multiplying the two factors when you are using qualitative descriptors.

- **The risk exposure** instead is indicated by the position of the risk in a matrix.

- The matrices used are called **probability impact grids or summary risk profiles.**
- Part of the matrix (some of the cells) is zoned off by a tolerance line.
- Risks appearing in that zone are given more attention than other risks (higher degree of seriousness).

Risk Assessment (cont'd)

- **Probability Impact Grid**



	Low	Moderate	Significant	High
High		R6		R1
Significant		R2, R3, R5		
Moderate				R4
Low				

Risk Planning

- **After:**

– The major risks are identified and

– Prioritized.

- The task becomes "**how to deal with them".**
- **The choices for dealing with them are:**

– Risk acceptance.

– Risk avoidance.

– Risk reduction and mitigation.

– Risk transfer.

Risk Planning (cont’d)

- **Risk Acceptance:**
  - This is deciding to do nothing about the risk. This means you will accept its consequences. Why?
  - In order to concentrate on the more likely or damaging risks.
  - The damage that those risks could cause would be less than the costs needed to act towards reducing their probability of occurrence.

Risk Planning (cont’d)

- **Risk Avoidance:**

– Some activities are so prone to accident that it is best to avoid them altogether.

– Example to avoid all the problems associated with developing software solutions from scratch, a solution could be to:

- Buy an off-the-shelf product.

Risk Planning (cont’d)

- **Risk Reduction and Mitigation:**

– **Risk Reduction:** attempts to reduce the <u>likelihood</u> of the risk occurring.

e.g. **consider the following risk:** developers leaving a
company in the middle of a project for a better paid job.

In order to reduce the probability of such a risk occurring:

the developers could be promised to be paid generous
bonuses on successful completion of the project.

Risk Planning (cont’d)

- **Risk Mitigation:** is the action taken to ensure that the impact of the risk is reduced when it occurs.

  Taking regular backups of data storage, is it a risk mitigation measure or a risk reduction measure?

  Since it would reduce the impact of data corruption not its likelihood of happening, in this sense it is a data mitigation measure.

Risk Planning (cont’d)

- **Risk Transfer:**
  - In this case the risk is transferred to another person or organization.
  - **Example:** a software development task is outsourced for a fixed fee.
  - Another example is when you buy insurance(e.g. for a car).

Risk Management

Contingency Plans:

- Although risk reduction measures try to reduce the probability or the likelihood of risks, they still could happen.
- **Contingency plan** is a planned action to be carried out if a risk materializes (occurs).

Risk Management (cont’d)

Example:

Consider the following risk:

- Staff absence through illness.

One risk reduction measure taken:

- Employers will encourage their employees to live a healthy lifestyle.
- **Still,** any of the staff members can get sick by a flu.
- **Such risks** that will happen eventually no matter what

  precautions can be taken to reduce their likelihood need a **<u>contingency plan.</u>**

Risk Management (cont’d)

A contingency plan in this case can be:

- To get other team members to cover on urgent tasks.
- What are the factors that will allow the above action to be worthwhile?
  - Intermediate steps were well documented.
  - There is a standard methodology for the way that work was carried out for the activity.
- Which one of the recommended approaches in the extreme programming would provide an alternative way to deal with

the problem of a team member being ill?

  - Pair programming.

Risk Management (cont’d)

Deciding on the risk actions:

- For each risk you will have a set of countermeasures or risk reduction actions.
- These risk reduction measures should be cost-effective.
- The cost effectiveness of a risk reduction action can be assessed by the risk reduction leverage (**RRL).**
- The risk reduction action with a **RRL** above 1 is worthwhile.

RRL= (RE before – RE after)/cost of risk reduction.

Risk Management (cont’d)

Say a project depended on a data center vulnerable to fire. It might be estimated that if fire occurred a new computer configuration could be established for $**500,000.** it might also be estimated that there is a **1%** chance that a fire will occur. Installing fire alarms at a cost of **$500** would reduce the chance of fire to **0.5%.**

- **Will the action of installing alarms be worthwhile.**

- We will calculate the RRL for this action and then decide.
- RE = ***(potential damage) ×(probability of occurrence)***
- RE before = $500,000 * 0.01 = $2000
- RE after= $500,000 * 0.005 = $1000
- Cost of risk reduction = $500 (cost of installing the fire alarms)
- RRL= (2000-1000) / 500 = 2
- **Since RRL value > 1 then the action is worthwhile.**

Risk Management (cont’d)

Creating and maintaining the risk register:

- **A risk register:** it contains the findings of project planners of what appear to be the most threatening risks to the project.
- After work starts on a project more risks will appear and will be added to the register.
- Risk registers are reviewed and updated regularly.