

DEAPRTMENT OF CSE, CSIT & AI&DS

COURSE NAME – ADAPTIVE SOFTWARE ENGINEERING
COURSE CODE – 23CI2001

Session-25

Topic: Risk Management in Software Engineering Projects

AIM OF THE SESSION

To familiarize students with the basic concept of Risk Management

INSTRUCTIONAL OBJECTIVES

This Session is designed to:

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1. Describe Risk Management
2. List out the various risks involved in software projects
3. Describe the steps to be taken to mitigate and manage the risks.

LEARNING OUTCOMES

At the end of this session, you should be able to:

1. Define Risk Management
2. Describe various risks associated with projects

AGENDA

- ❖ Risk and strategies
- ❖ Software Risk Categorization
- ❖ Seven Principles of Risk Management
- ❖ Risk Management
- ❖ Risk Projection
- ❖ Assessing Risk Impact
- ❖ Risk Refinement
- ❖ Risk Mitigation, Monitoring, and Management (RMMM)

INTRODUCTION

- A risk is a probable problem- it might happen, or it might not. There are main two characteristics of risk
- Uncertainty- the risk may or may not happen that means there are no 100% risks. loss – If the risk occurs in reality , undesirable result or losses will occur

Reactive risk strategies: "Don't worry, I'll think of something" Nothing is done about risks until something goes wrong . The team then flies into action in an attempt to correct the problem rapidly

Proactive risk strategies : Primary objective is to avoid risk and to have a contingency plan in place to handle unavoidable risks in a controlled and effective manner

SOFTWARE RISK CATEGORIZATION

Categories of risks: There are three following categories of risks:

- ❑ **Project risks:** Which effects the project schedule or resources e.g. loss of experienced project designer.
- ❑ **Product risks:** Which effect the quality of the project that is being developed e.g. the failure of a purchased component to perform as expected.
- ❑ **Business Risks:** Which effect the organization developing or procuring the software or e.g. a competitor introducing the a new product is a business risk.

SEVEN PRINCIPLES OF RISK MANAGEMENT

- The Software Engineering Institute (SEI)(www.sei.cmu.edu) identifies seven principles that “provide a framework to accomplish effective risk management.”

They are:

- **Maintain a global perspective:** view software risks within the context of a system in which it is a component and the business problem that it is intended to solve
- **Take a forward-looking view:** think about the risks that may arise in the future (Example: due to changes in the software)
- establish contingency plans so that future events manageable.

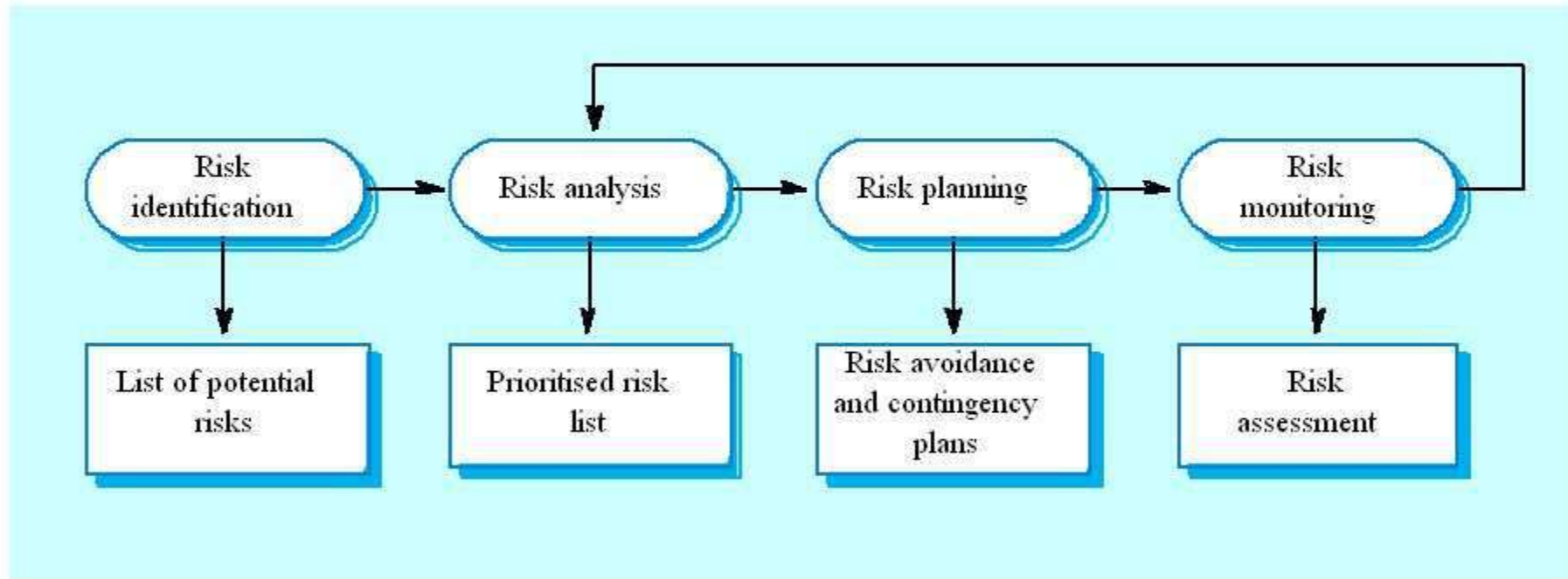
SEVEN PRINCIPLES OF RISK MANAGEMENT

- **Encourage open communication:** if someone states a potential risk, don't discount it. If a risk is proposed in an informal manner, consider it. Encourage all stakeholders and users to suggest risks at any time.
- **Integrate:** a consideration of risk must be integrated into the software process.
- **Emphasize a continuous process:** the team must be vigilant throughout the software process, modifying identified risks as more information is known and adding new ones as better insight is achieved.

SEVEN PRINCIPLES OF RISK MANAGEMENT

- **Develop a shared product vision:**if all stakeholders share the same vision of the software, it is likely that better risk identification and assessment will occur.
- **Encourage teamwork:**the talents, skills, and knowledge of all stakeholders should be pooled when risk management activities are conducted

The risk management process



RISK MANAGEMENT

- Risk management is a sequence of steps that help a software team to understand , analyze and manage uncertainty.
- It perform certain activities
- Risk management consists of
 - i)Risk Identification
 - ii)Risk Projection
 - iii)Risk Refinement
 - iv)RMMM

RISK IDENTIFICATION:

- ☐ Risk identification is the first stage of risk management and it concerned with identifying possible risks to the project.
- ☐ May be a team activities or based on the individual project manager's experience.
- ☐ A checklist of different types of risks may be used to identify risks in a project.
 - Technology risks
 - People risks
 - Organizational risks
 - Tools risks
 - Requirements risks
 - Estimation risks



Examples of different risk types

Risk type	Possible risks
Technology	<p>The database used in the system cannot process as many transactions per second as expected. (1)</p> <p>Reusable software components contain defects that mean they cannot be reused as planned. (2)</p>
People	<p>It is impossible to recruit staff with the skills required. (3)</p> <p>Key staff are ill and unavailable at critical times. (4)</p> <p>Required training for staff is not available. (5)</p>
Organizational	<p>The organization is restructured so that different management are responsible for the project. (6)</p> <p>Organizational financial problems force reductions in the project budget. (7)</p>
Tools	<p>The code generated by software code generation tools is inefficient. (8)</p> <p>Software tools cannot work together in an integrated way. (9)</p>
Requirements	<p>Changes to requirements that require major design rework are proposed. (10)</p> <p>Customers fail to understand the impact of requirements changes. (11)</p>
Estimation	<p>The time required to develop the software is underestimated. (12)</p> <p>The rate of defect repair is underestimated. (13)</p> <p>The size of the software is underestimated. (14)</p>

RISK ANALYSIS AND PRIORITIZATION

It is a process that consists of the following steps:

- Identifying the problems causing risk in projects
 - Identifying the probability of occurrence of problem
 - Identifying the impact of problem
 - Assigning values to step 2 and step 3 in the range of 1 to 10
 - Calculate the risk exposure factor which is the product of values of step 2 and step 3
- Prepare a table consisting of all the values and order risk on the basis of risk exposure factor

RISK PROJECTION

- Risk projection, also called *risk estimation*, attempts to rate each risk in two ways—
- (1) the likelihood or probability that the risk is real and
- (2) the consequences of the
- problems associated with the risk, should it occur. You work along with other managers
- and technical staff to perform four risk projection steps:
- 1. Establish a scale that reflects the perceived likelihood of a risk.
- 2. Delineate the consequences of the risk.
- 3. Estimate the impact of the risk on the project and the product.
- 4. Assess the overall accuracy of the risk projection so that there will be no misunderstandings.

CONTENTS OF A RISK TABLE

- A risk table provides a project manager with a simple technique for risk projection
- It consists of five columns –
- Risk Summary – short description of the risk
- Risk Category – one of seven risk categories

Probability – estimation of risk occurrence based on group input – Impact –

(1) catastrophic

(2) critical

(3) marginal

(4) negligible

RMMM – Pointer to a paragraph in the

Risk	riskcategory	probability	impact	RMMM

Components Category		Performance	Support	Cost	Schedule
Catastrophic	1	Failure to meet the requirement would result in mission failure		Failure results in increased costs and schedule delays with expected values in excess of \$500K	
	2	Significant degradation to nonachievement of technical performance	Nonresponsive or unsupportable software	Significant financial shortages, budget overrun likely	Unachievable IOC
Critical	1	Failure to meet the requirement would degrade system performance to a point where mission success is questionable		Failure results in operational delays and/or increased costs with expected value of \$100K to \$500K	
	2	Some reduction in technical performance	Minor delays in software modifications	Some shortage of financial resources, possible overruns	Possible slippage in IOC
Marginal	1	Failure to meet the requirement would result in degradation of secondary mission		Costs, impacts, and/or recoverable schedule slips with expected value of \$1K to \$100K	
	2	Minimal to small reduction in technical performance	Responsive software support	Sufficient financial resources	Realistic, achievable schedule
Negligible	1	Failure to meet the requirement would create inconvenience or nonoperational impact		Error results in minor cost and/or schedule impact with expected value of less than \$1K	
	2	No reduction in technical performance	Easily supportable software	Possible budget underrun	Early achievable IOC

Note: (1) The potential consequence of undetected software errors or faults.
(2) The potential consequence if the desired outcome is not achieved.

RISK PROJECTION STEPS

- Risk projection (or estimation) attempts to rate each risk in two ways
 - The probability that the risk is real –
 - The consequence of the problems associated with the risk, should it occur
-
- Risk Projection/Estimation Steps
 - Establish a scale that reflects the perceived likelihood of a risk (e.g., 1-low, 10-high)
 - 1) Delineate the consequences of the risk
 - 2) Estimate the impact of the risk on the project and product
 - 3) Note the overall accuracy of the risk projection so that there will be no misunderstandings

DEVELOPING A RISK TABLE

- List all risks in the first column (by way of the help of the risk item checklists)
- Mark the category of each risk
- Estimate the probability of each risk occurring
- Assess the impact of each risk based on an averaging of the four risk components to determine an overall impact value
- Sort the rows by probability and impact in descending order
- Draw a horizontal cutoff line in the table that indicates the risks that will be given further attention

Risks	Category	Probability	Impact	RMMM
Size estimate may be significantly low	PS	60%	2	
Larger number of users than planned	PS	30%	3	
Less reuse than planned	PS	70%	2	
End-users resist system	BU	40%	3	
Delivery deadline will be tightened	BU	50%	2	
Funding will be lost	CU	40%	1	
Customer will change requirements	PS	80%	2	
Technology will not meet expectations	TE	30%	1	
Lack of training on tools	DE	80%	3	
Staff inexperienced	ST	30%	2	
Staff turnover will be high	ST	60%	2	
•				
•				

Impact values:
 1—catastrophic
 2—critical
 3—marginal
 4—negligible

ASSESSING RISK IMPACT

- The overall risk exposure formula is $RE = P \times C$
- – P = the probability of occurrence for a risk
- – C = the cost to the project should the risk actually occur

Example

- P = 80% probability that 18 of 60 software
 - components will have to be developed
 - C = Total cost of developing 18 components is
 - \$25,000
-
- $RE = .80 \times \$25,000 = \$20,000$

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- During early stages of project planning, a risk may be stated quite generally. As time passes and more is learned about the project and the risk, it may be possible to refine the risk into a set of more detailed risks, each somewhat easier to mitigate, monitor, and manage.
 - One way to do this is to represent the risk in *condition-transition-consequence*
 - the risk is stated in the following form:
 - **Given that <condition> then there is concern that (possibly) <consequence>**
 - Using the CTC format you could write:
 - Given that all reusable software components must conform to specific design standards and that some do not conform, then there is concern that (possibly) only 70 percent of the planned reusable modules may actually be integrated into the as-built system, resulting in the need to custom engineer the remaining 30 percent of components.

RISK REFINEMENT

- This general condition can be refined in the following manner:
- **Subcondition 1.** Certain reusable components were developed by a third party with no knowledge of internal design standards.
- **Subcondition 2.** The design standard for component interfaces has not been solidified and may not conform to certain existing reusable components.
- **Subcondition 3.** Certain reusable components have been implemented in a language that is not supported on the target environment

Risk Monitoring

- ❑ Risk monitoring involves regularly assessing the each identified risks to decide whether or not that risk is becoming more or less probable, and whether the effects of the risks have changed.
- ❑ Other factors (Indicators) need to have a look that gives the clue about the risks probability and its effect, and these factors (Indicators) are dependent with the types of the risks.
- ❑ Each key risk should be discussed at management progress meetings.

THE RMM PLAN

Risk information sheet			
Risk ID: P02-4-32	Date: 5/9/02	Prob: 80%	Impact: high
Description: Only 70 percent of the software components scheduled for reuse will, in fact, be integrated into the application. The remaining functionality will have to be custom developed.			
Refinement/context: Subcondition 1: Certain reusable components were developed by a third party with no knowledge of internal design standards. Subcondition 2: The design standard for component interfaces has not been solidified and may not conform to certain existing reusable components. Subcondition 3: Certain reusable components have been implemented in a language that is not supported on the target environment.			
Mitigation/monitoring: 1. Contact third party to determine conformance with design standards. 2. Press for interface standards completion; consider component structure when deciding on interface protocol. 3. Check to determine number of components in subcondition 3 category; check to determine if language support can be acquired.			
Management/contingency plan/trigger: RE computed to be \$20,200. Allocate this amount within project contingency cost. Develop revised schedule assuming that 18 additional components will have to be custom built; allocate staff accordingly. Trigger: Mitigation steps unproductive as of 7/1/02			
Current status: 5/12/02: Mitigation steps initiated.			
Originator: D. Gagne		Assigned: B. Laster	

TERMINAL QUESTIONS

1. Define Risk management
2. Explain Assessing risk impact
3. Explain risk management and monitoring
4. Explain RMMM plan in detail
5. Elaborate on risk projection steps.

REFERENCES FOR FURTHER LEARNING OF THE SESSION

- **Reference Books:**
- **TEXT BOOKS:**
- Roger S.Pressman, “Software Engineering – A Practitioner’s Approach” 7th Edition, Mc Graw Hill,(2014).
- Ian Sommerville, “Software Engineering”, Tenth Edition, Pearson Education, (2015).
- **Reference Book**
- Agile and Iterative Development: A Manager's Guide, Craig Larman, Addison-Wesley
- **WEB REFERNCES/MOOCs:**
- <https://www.digite.com/kanban/what-is-kanban/>
- <http://www.scaledagileframework.com>
- <https://www.guru99.com/test-driven-development.html>

THANK YOU



Team – Adaptive Software Engineering