Software Engineering

SW Development Risk Analysis and Management

Slide Set to accompany

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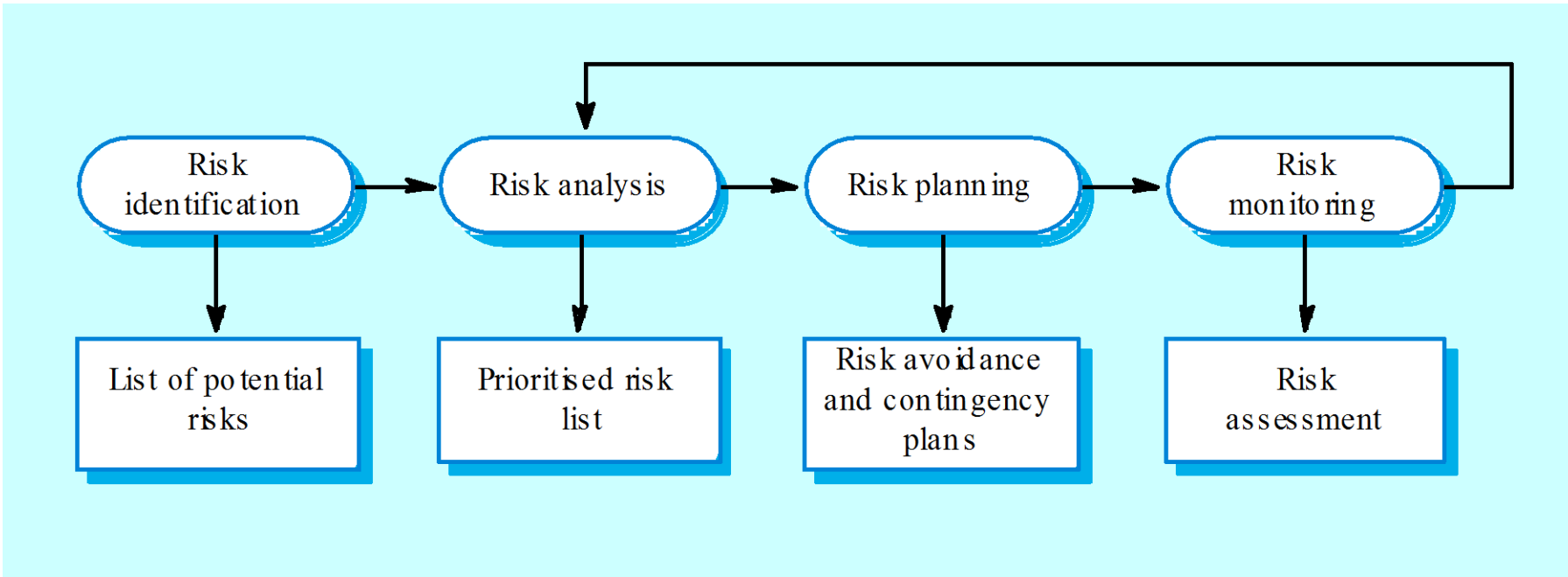
Risk Management Paradigm

The risk management process

- **Risk identification**
  - Identify project, product and business risks;
- **Risk analysis**
  - Assess the likelihood and consequences of these risks;
- **Risk planning**
  - Draw up plans to avoid or minimise the effects of the risk;
- **Risk monitoring, tracking and controlling**
  - Monitor the risks throughout the project;

The risk management process (cont..)



Risk management

- Risk management is concerned with identifying risks and drawing up plans to minimise their effect on a project.
  - Project risks affect schedule or resources;
  - Product risks affect the quality or performance of the software being developed;
  - Business risks affect the organisation developing or procuring the software.

Risk category (based on affect area/field)

- **Project Risks**
  - Risks that affect the project schedule or resources
  - Loss of an experienced designer
  - Finding may take a long time and, consequently, the software design will take longer to complete
- **Product risks**
  - Risks that affect the quality or performance of the software
  - Failure of a purchased component to perform as expected
- **Business risks**
  - Risks that affect the organization developing or procuring the software.
  - A competitor introducing a new product is a business risk

Software risks

Risk	Affects	Description
Staff turnover	Project	Experienced staff will leave the project before it is finished.
Management change	Project	There will be a change of organisational management with different priorities.
Hardware unavailability	Project	Hardware that is essential for the project will not be delivered on schedule.
Requirements change	Project and product	There will be a larger number of changes to the requirements than anticipated.
Specification delays	Project and product	Specifications of essential interfaces are not available on schedule
Size underestimate	Project and product	The size of the system has been underestimated.
CASE tool under-performance	Product	CASE tools which support the project do not perform as anticipated
Technology change	Business	The underlying technology on which the system is built is superseded by new technology.
Product competition	Business	A competitive product is marketed before the system is completed.

Reactive Risk Management

- project team reacts to risks when they occur
- **mitigation**—plan for additional resources in anticipation of fire fighting
- **fix on failure**—resource are found and applied when the risk strikes
- **crisis management**—failure does not respond to applied resources and project is in jeopardy

Proactive Risk Management

- formal risk analysis is performed
- organization corrects the root causes of risk
  - TQM (Total Quality Management) concepts and statistical SQA (Software Quality Assurance)
  - examining risk sources that lie beyond the bounds of the software
  - developing the skill to manage change

Feature Based Risk type Identification/Risk Indicators

- Technology risks.
- People risks.
- Organisational risks.
- Requirements risks.
- Estimation risks.

Risks and risk types

Risk type	Possible risks
Technology	The database used in the system cannot process as many transactions per second as expected. Software components that should be reused contain defects that limit their functionality.
People	It is impossible to recruit staff with the skills required. Key staff are ill and unavailable at critical times. Required training for staff is not available.
Organisational	The organisation is restructured so that different management are responsible for the project. Organisational financial problems force reductions in the project budget.
Tools	The code generated by CASE tools is inefficient. CASE tools cannot be integrated.
Requirements	Changes to requirements that require major design rework are proposed. Customers fail to understand the impact of requirements changes.
Estimation	The time required to develop the software is underestimated. The rate of defect repair is underestimated. The size of the software is underestimated.

Risk analysis

- Assess probability and seriousness of each risk.
- Probability may be very low, low, moderate, high or very high.
- Risk effects might be catastrophic, serious, tolerable or insignificant.

General Risk analysis

Risk	Probability	Effects
Organisational financial problems force reductions in the project budget.	Low	Catastrophic
It is impossible to recruit staff with the skills required for the project.	High	Catastrophic
Key staff are ill at critical times in the project.	Moderate	Serious
Software components that should be reused contain defects which limit their functionality.	Moderate	Serious
Changes to requirements that require major design rework are proposed.	Moderate	Serious
The organisation is restructured so that different management are responsible for the project.	High	Serious

Risk	Probability	Effects
The database used in the system cannot process as many transactions per second as expected.	Moderate	Serious
The time required to develop the software is underestimated.	High	Serious
CASE tools cannot be integrated.	High	Tolerable
Customers fail to understand the impact of requirements changes.	Moderate	Tolerable
Required training for staff is not available.	Moderate	Tolerable
The rate of defect repair is underestimated.	Moderate	Tolerable
The size of the software is underestimated.	High	Tolerable
The code generated by CASE tools is inefficient.	Moderate	Insignificant

Risk planning

- Consider each risk and develop a strategy to manage that risk.
- Avoidance strategies
  - The probability that the risk will arise is reduced;
- Minimisation strategies
  - The impact of the risk on the project or product will be reduced;
- Contingency plans
  - If the risk arises, contingency plans are plans to deal with that risk;

Risk management strategies

Risk	Strategy
Organisational financial problems	Prepare a briefing document for senior management showing how the project is making a very important contribution to the goals of the business.
Recruitment problems	Alert customer of potential difficulties and the possibility of delays, investigate buying-in components.
Staff illness	Reorganise team so that there is more overlap of work and people therefore understand each other's jobs.
Defective components	Replace potentially defective components with bought-in components of known reliability.

Risk	Strategy
Requirements changes	Derive traceability information to assess requirements change impact, maximise information hiding in the design.
Organisational restructuring	Prepare a briefing document for senior management showing how the project is making a very important contribution to the goals of the business.
Database performance	Investigate the possibility of buying a higher-performance database.
Underestimated development time	Investigate buying in components, investigate use of a program generator

Risk monitoring

- Assess each identified risks regularly to decide whether or not it is becoming less or more probable.
- Also assess whether the effects of the risk have changed.
- Each key risk should be discussed at management progress meetings.

Risk Projection

- *Risk projection*, also called *risk estimation,* attempts to rate each risk in two ways
  - the likelihood or probability that the risk is real
  - the consequences of the problems associated with the risk, should it occur.
- The are four risk projection steps:
  - establish a scale that reflects the perceived likelihood of a risk
  - delineate the consequences of the risk
  - estimate the impact of the risk on the project and the product,
  - note the overall accuracy of the risk projection so that there will be no misunderstandings.

Building a Risk Table

Risk	Probability	Impact	RMMM
			Risk Mitigation Monitoring & Management

Building the Risk Table

- Estimate the probability of occurrence
- Estimate the impact on the project on a scale of 1 to 5, where
  - 1 = low impact on project success
  - 5 = catastrophic impact on project success
- sort the table by probability and impact

Risk Exposure (Impact)

The overall *risk exposure,* RE, is determined using the following relationship [Hal98]:

RE = *P* x *C*

where

P is the probability of occurrence for a risk, and

C is the cost to the project should the risk occur.

Risk Exposure Example

- **Risk identification.** 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.
- **Risk probability.** 80% (likely).
- **Risk impact.** 60 reusable software components were planned. If only 70 percent can be used, 18 components would have to be developed from scratch (in addition to other custom software that has been scheduled for development). Since the average component is 100 LOC and local data indicate that the software engineering cost for each LOC is $14.00, the overall cost (impact) to develop the components would be 18 x 100 x 14 = $25,200.
- **Risk exposure.** RE = 0.80 x 25,200 ~ $20,200.

Risk Mitigation, Monitoring and Management

- mitigation—how can we avoid the risk?
- monitoring—what factors can we track that will enable us to determine if the risk is becoming more or less likely?
- management—what contingency plans do we have if the risk becomes a reality?

END