SENG 350
- Software Architecture & Design

Shuja Mughal

Architectural Quality

Fall 2024

University of Victoria

Just a Reminder

- Milestone 3 deadline is on 5th November 2024
- Team Assessment 3 deadline is on 5th November 2024

University of Victoria

Previously

- Root Cause Analysis
- Goal Question Metric
- Architectural improvement process
- The reuse landscape
- Casual Model
- Architecture Examples

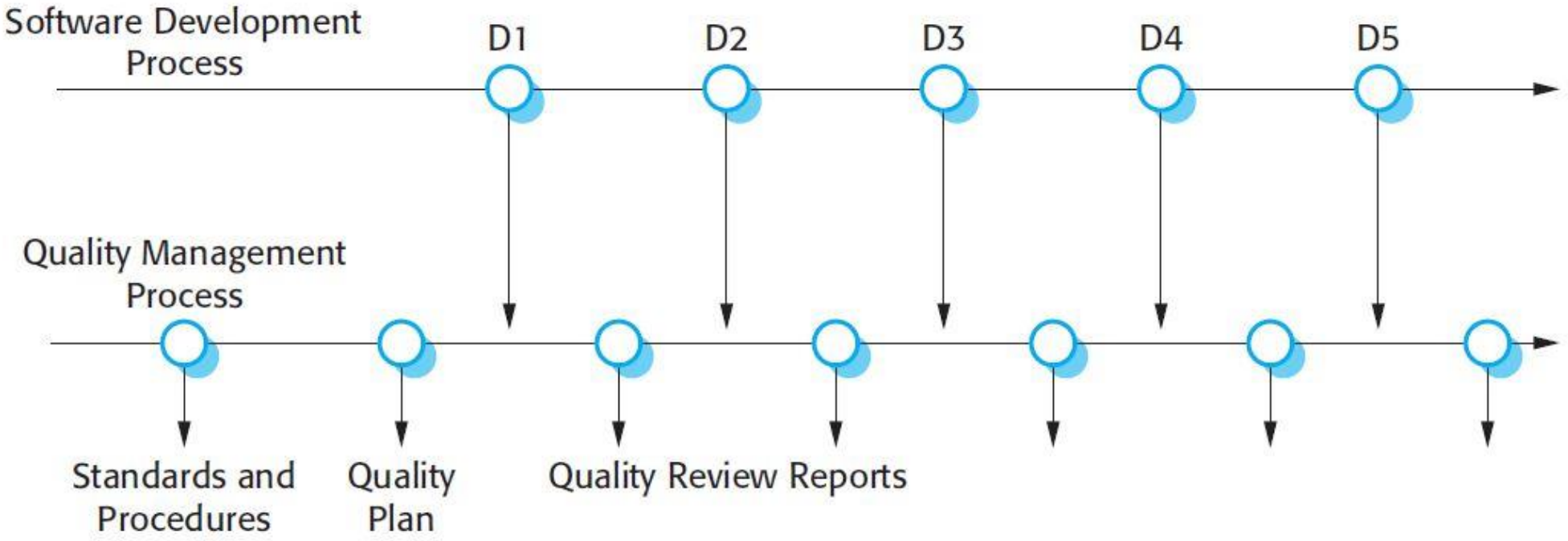
Quality management

- Concerned with ensuring that the required level of quality is achieved in software development deliverables.
- Three principal concerns:
  - Organizational level
  - Project level
  - Product level

Quality management activities

- Provides independent checks on the software development process.
- Checks that the project deliverables ensure that they are consistent with organizational standards and goals.
- The quality team should be independent from the development team so that they can take an objective view of the software.

Quality management and software development



University of Victoria

Quality planning

- Sets out the desired product qualities and how these are assessed.
- Defines the most significant quality attributes.
- The quality plan should define the quality assessment process.
- It should set out which organisational standards should be applied and, where necessary, define new standards to be used.

Quality plans

- Quality plan structure
  - Product introduction and plans;
  - Process descriptions;
  - Quality goals;
  - Risks and risk management;
  - Standards and certifications;
  - Architecture;
- Quality plans should be short, succinct documents
  - If they are too long, no one will read them.

Risks and risk management

University of Victoria

Risk management

- Risk management is concerned with identifying risks and drawing up plans to minimize their effect on a project.
- A risk is a probability that some adverse circumstance will occur
  - Project risks
  - Product risks
  - Business risks

Examples of common project, product, and business risks

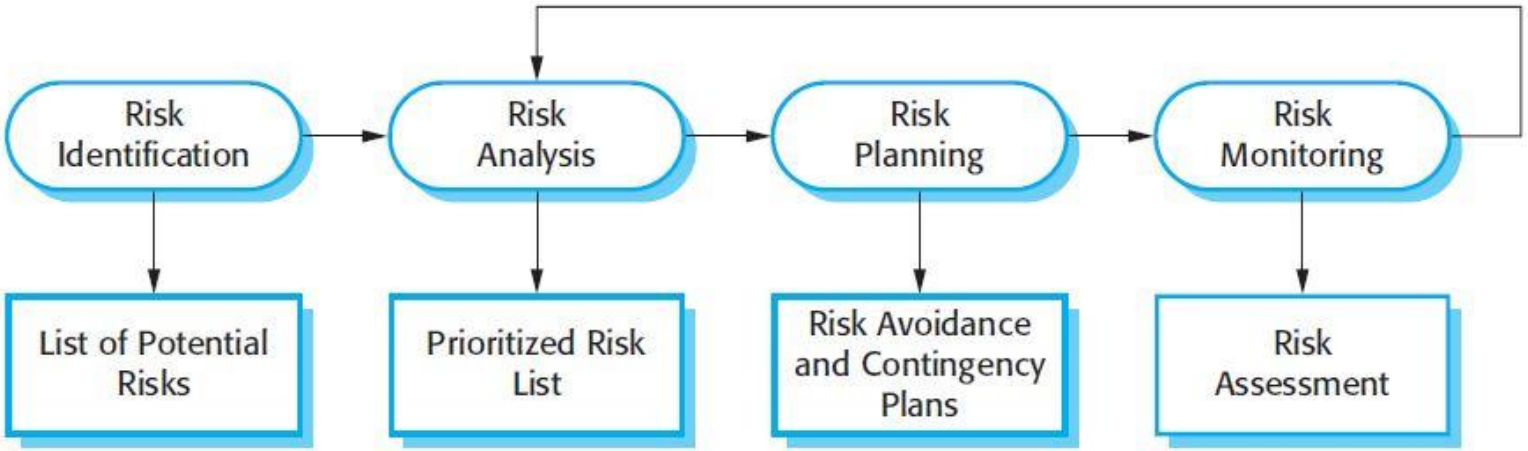
Risk	Affects	Description
Staff turnover	Project	Experienced staff will leave the project before it is finished.
Management change	Project	There will be a change of organizational management with different priorities.
Hardware unavailability	Project	Hardware that is essential for the project will not 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 underperformance	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.

The risk management process

- Risk identification
- Risk analysis
- Risk planning
- Risk monitoring

University of Victoria

The risk management process



University of Victoria

Risk identification

- May be a team activity or based on the individual project manager's experience.
- A checklist of common risks may be used to identify risks in a project
  - Technology risks.
  - People risks.
  - Organisational risks.
  - Requirements risks.
  - Estimation risks.

Examples of different risk types

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

Risk analysis

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

University of Victoria

Risk types and examples

Risk	Probability	Effects
Organizational financial problems force reductions in the project budget (7).	Low	Catastrophic
It is impossible to recruit staff with the skills required for the project (3).	High	Catastrophic
Key staff are ill at critical times in the project (4).	Moderate	Serious
Faults in reusable software components have to be repaired before these components are reused. (2).	Moderate	Serious
Changes to requirements that require major design rework are proposed (10).	Moderate	Serious
The organization is restructured so that different management are responsible for the project (6).	High	Serious
The database used in the system cannot process as many transactions per second as expected (1).	Moderate	Serious

Risk types and examples

Risk	Probability	Effects
The time required to develop the software is underestimated (12).	High	Serious
Software tools cannot be integrated (9).	High	Tolerable
Customers fail to understand the impact of requirements changes (11).	Moderate	Tolerable
Required training for staff is not available (5).	Moderate	Tolerable
The rate of defect repair is underestimated (13).	Moderate	Tolerable
The size of the software is underestimated (14).	High	Tolerable
Code generated by code generation tools is inefficient (8).	Moderate	Insignificant

Risk planning

- Consider each risk and develop a strategy to manage that risk.
- Avoidance strategies
- Minimisation strategies
- Contingency plans

University of Victoria

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.

University of Victoria

Risk indicators

Risk type	Potential indicators
Technology	Late delivery of hardware or support software; many reported technology problems.
People	Poor staff morale; poor relationships amongst team members; high staff turnover.
Organizational	Organizational gossip; lack of action by senior management.
Tools	Reluctance by team members to use tools; complaints about CASE tools; demands for higher-powered workstations.
Requirements	Many requirements change requests; customer complaints.
Estimation	Failure to meet agreed schedule; failure to clear reported defects.

Software and Architecture Standards

Standards

- Standards define the required attributes of a product or process.
- They play an important role in quality management.
- Standards may be international, national, organizational, project or product standards.
- Product standards define characteristics that all software components should exhibit e.g. a common programming style.
- Process standards define how the software process should be enacted.

Importance of standards

- Encapsulation of best practice.
- They are a framework for defining what quality means in a particular setting i.e. that organization's view of quality.
- They provide continuity.

University of Victoria

Problems with standards

- Software engineers may not see them as relevant and up-to-date.
- They often involve too much form-filling.
- If they are unsupported by software tools, tedious form-filling work is often involved in maintaining the documentation associated with the standards.

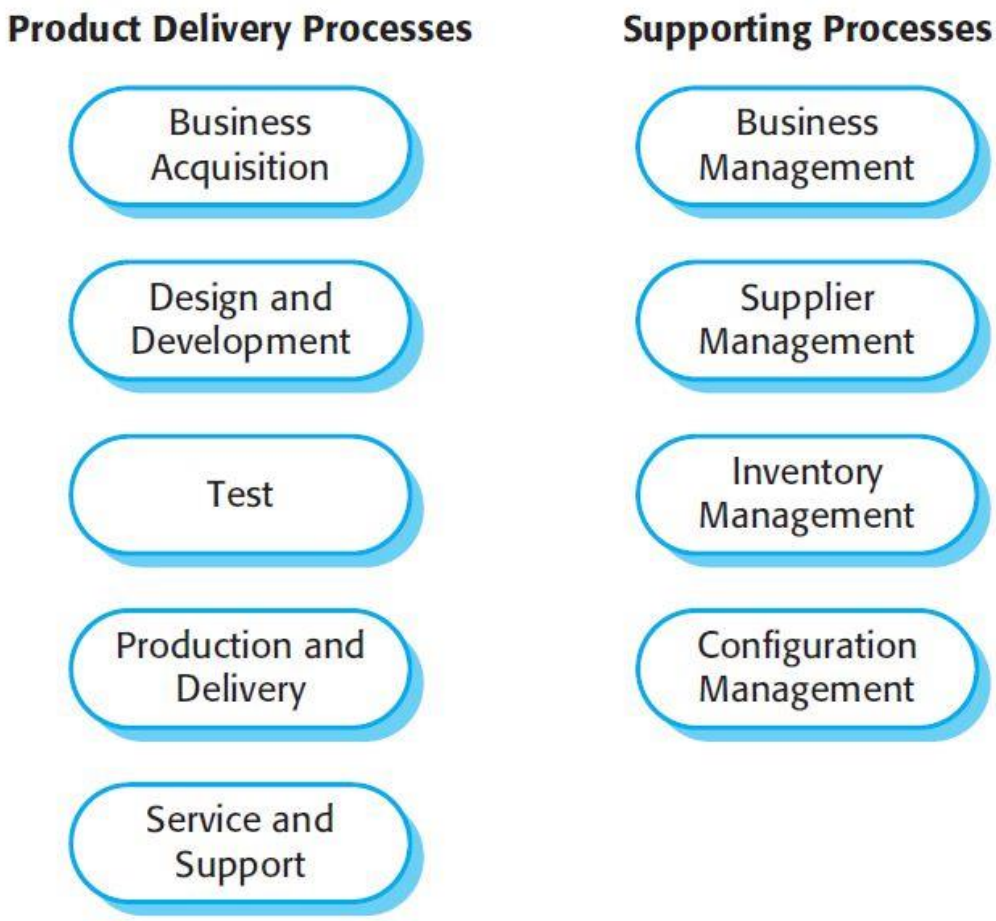
Standards development

- Involve practitioners in development.
- Engineers should understand the rationale underlying a standard.
- Review standards and their usage regularly.
- Detailed standards should have specialized tool support.
  - Web-based forms are not good enough.

ISO 9001 standards framework

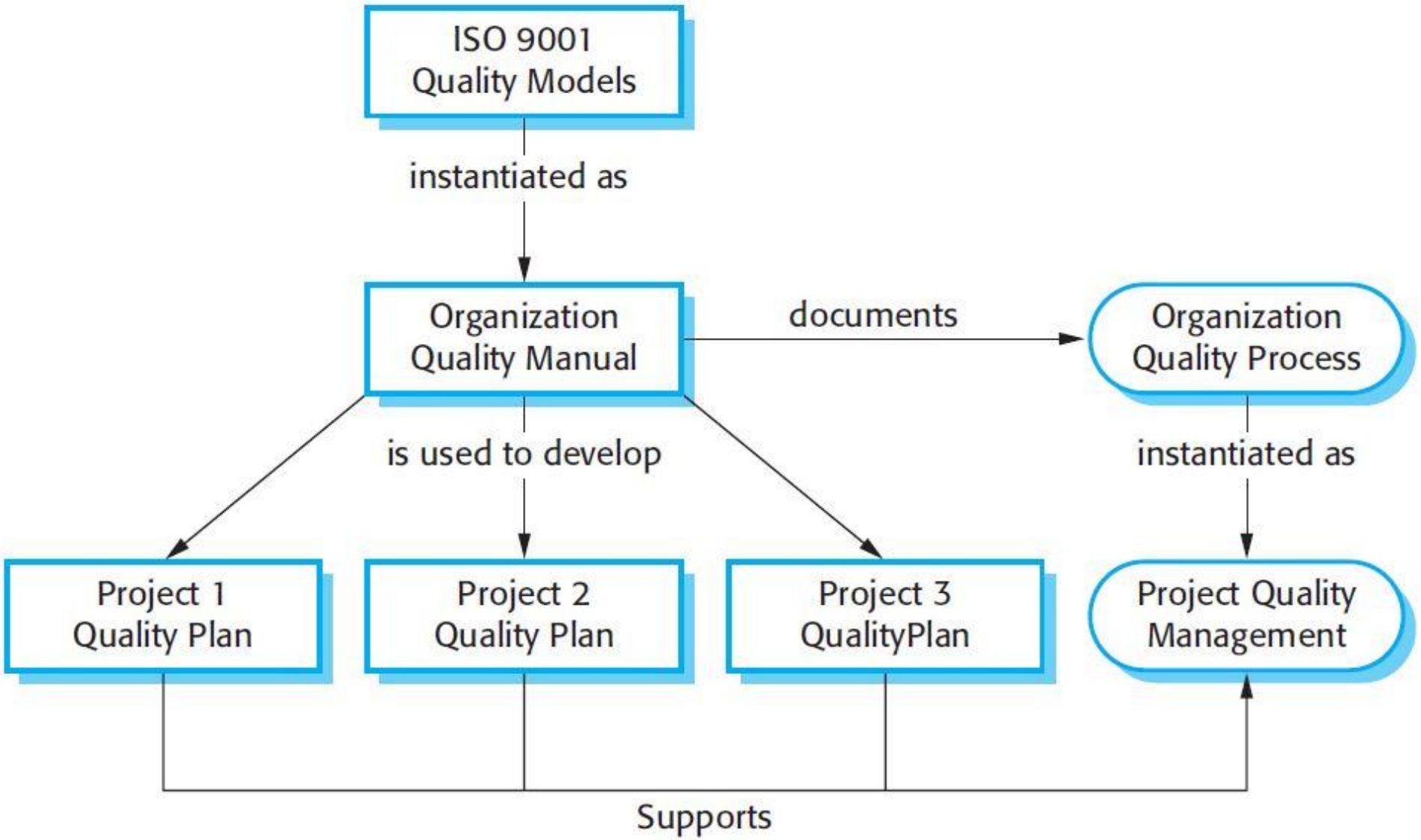
- An international set of standards that can be used to develop quality management systems.
- ISO 9001, the most general of these standards, applies to organizations that design, develop and maintain products, including software.
- The ISO 9001 standard is a framework for developing software standards.
  - It sets out general quality principles, describes quality processes in general and lays out the organizational standards and procedures that should be defined. These should be documented in an organizational quality manual.

ISO 9001 core processes



University of Victoria

ISO 9001 and quality management



ISO 9001 certification

- Quality standards and procedures should be documented in an organizational quality manual.
- An external body may certify that an organization's quality manual conforms to ISO 9000 standards.
- Some customers require suppliers to be ISO 9000 certified although the need for flexibility here is increasingly recognised.

Activity

- Form a group of 3 members.
- Select the projects you are working on.
- Conduct a risk analysis for the selected projects:
  - First, create a table listing possible risks along with their types.
  - Next, develop a risk likelihood table that includes each risk, its probability, and potential effects.
  - Identify and explain the top three risks from the likelihood table to focus on when designing the architecture and system.
- Submit your findings to the team.