Quality Management

UA.DETI.IES - 2019/20

Resources & Credits

- Ian Sommerville,
  Software Engineering, 10th Edition,
  Pearson, 2016
  chapter 24

- Other (online) resources
  - QMS, ISO standards, CMMI

Topics

- What we already know about software engineering?
  - It aims to provide methods for systematically developing **high quality products** with the **high productivity** and **low costs**

- But, can customers trust
  - on our us?
  - on our products?
  - on our company?

Quality assurance

https://kruschecompany.com/what-is-quality-assurance-and-why-you-need-it-immediately/

Software quality management

- Concerned with ensuring that developed software systems are "**fit for purpose**".

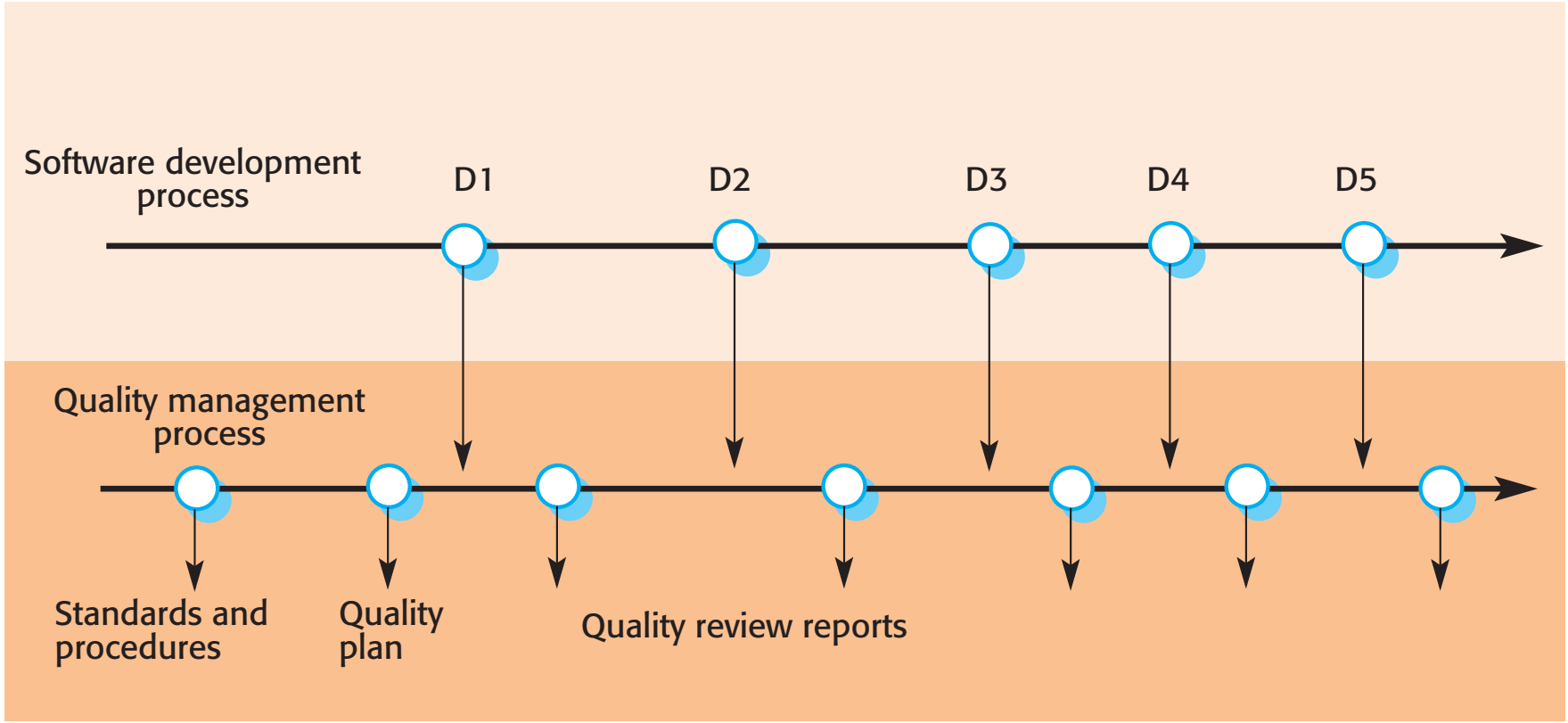
- Principal concerns:
  - At the **organizational level**, establishing a framework of organizational processes and standards that will lead to high-quality software.

  - At the **project level**, ensuring specific quality processes and checking that these planned processes have been followed.

Quality management activities

- Quality management provides an independent check on the software development process.
  - The quality management process checks the project deliverables to 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.
  - This allows them to report on software quality without being influenced by software development issues.

Quality management and software development



Quality planning

- A quality plan sets out the desired product qualities and how these are assessed and defines the most significant quality attributes.
  - It 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 plan structure
  - Product introduction;
  - Product plans;
  - Process descriptions;
  - Quality goals;
  - Risks and risk management.
- Quality plans should be short, succinct documents
  - If they are too long, no-one will read them.

Software quality

- Quality, simplistically, means that a product should meet its specification.
- This is problematical for software systems
  - There is a tension between customer quality requirements (efficiency, reliability, etc.) and developer quality requirements (maintainability, reusability, etc.);
  - Some quality requirements are difficult to specify in an unambiguous way;
  - Software specifications are usually incomplete and often inconsistent.
- The focus may be "fitness for purpose" rather than specification conformance.

Software fitness for purpose

- Has the software been properly tested?
- Is the software sufficiently dependable to be put into use?
- Is the performance of the software acceptable for normal use?
- Is the software usable?
- Is the software well-structured and understandable?
- Have programming and documentation standards been followed in the development process?

Process and product quality

- The quality of a developed product is influenced by the quality of the production process.
- This is important in software development as some product quality attributes are hard to assess.
- However, there is a very complex and poorly understood relationship between software processes and product quality.
  - The application of individual skills and experience is particularly important in software development;
  - External factors such as the novelty of an application or the need for an accelerated development schedule may impair product quality.

Quality Management System (QMS)

- "**Quality**" means "meeting customer requirements."
  - Form, fit, function of products
  - Quality of services provided
  - Prompt delivery
  - Product/service Consistency
  - Customer service
  - Responsiveness to customer complaints

Quality Management System (QMS)

- "**Quality Management**" is the activities performed by the company to ensure those customer requirements are met.
  - Inspections
  - Measurements
  - Customer feedback review
  - Improvement activities

Quality Management System (QMS)

- "**Quality Management System**" means what the organization does to manage its processes, or activities in order that
  - The processes in the company that impact on quality
  - Management of those processes through objectives and metrics
  - Improving those processes to enhance quality and customer satisfaction
  - Comply to regulations
- Everyone is clear about who is responsible for doing what, when, how, why and where.

Standardizing Quality Systems

- Because a company can have any kind of quality system it wants, customers do not know in advance whether the system is good or bad.
  - Does a company inspect its work before delivery?
  - Does a company have a way to handle complaints?
  - Does a company use good raw materials?
  - Are employees properly trained?

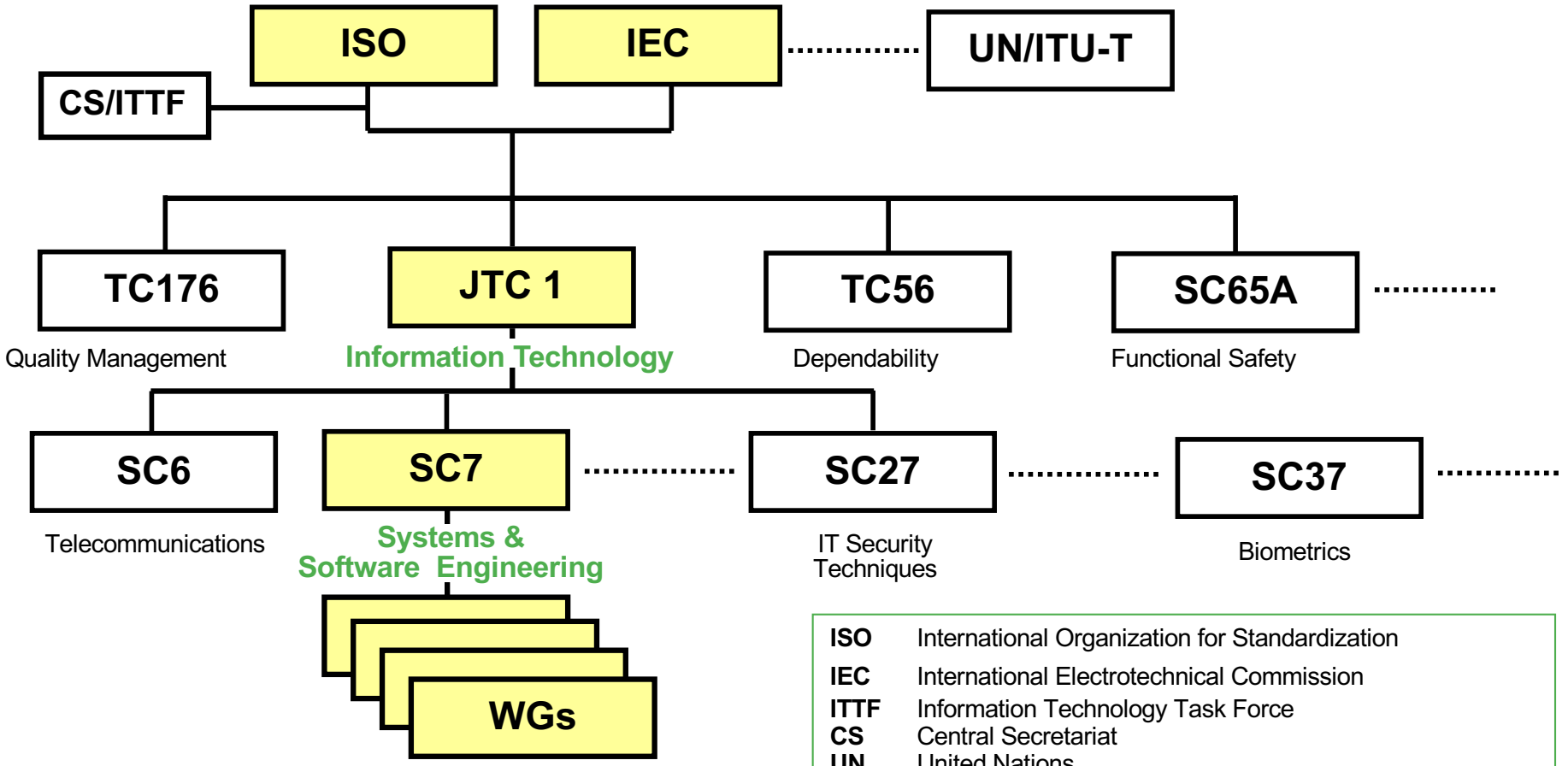
- The world recognized that this was a problem.

International Organization for Standardization (ISO)

- ISO develops all kinds of standards, such as traffic symbols, material standards, inspection practices, and more.
  - It also aimed to standardize quality systems.

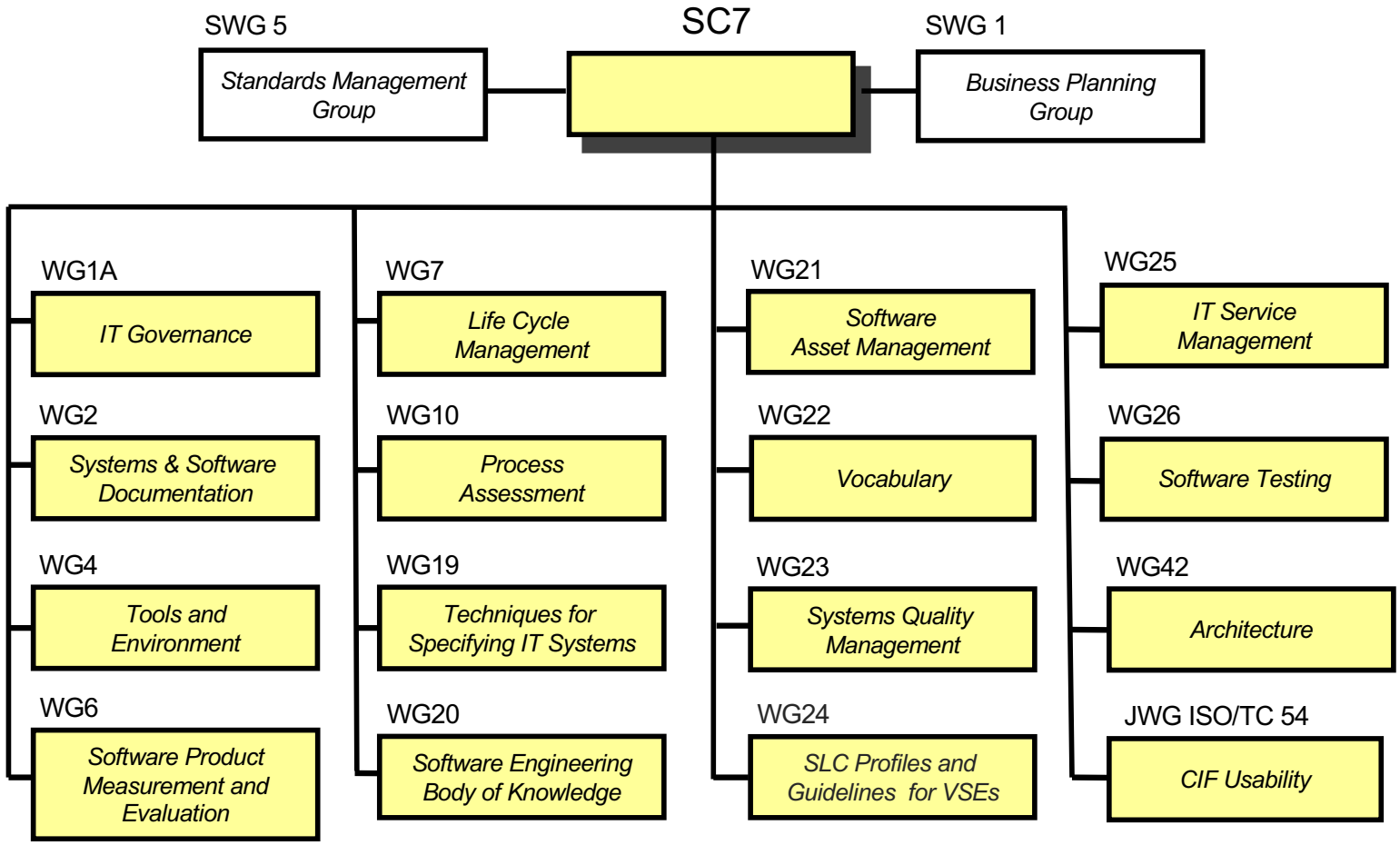
- In 1987 ISO published "ISO 9001" a document (or standard) that lists some internationally-accepted, basic rules for a **model quality system**.
- These rules have been recognized by the world as generally-accepted "good practices"

ISO/IEC outline Structure



ISO	International Organization for Standardization
IEC	International Electrotechnical Commission
ITTF	Information Technology Task Force
CS	Central Secretariat
UN	United Nations
ITU-T	International Telecommunications Union
TC	Technical Committee
SC	Sub Committee
JTC	Joint Technical Committee
WG	Working Group

SC7 Structure



Standards

- Standards play an important role in quality management
  - They define the required attributes of a product or process
- Types of standards
  - International standards
  - National standards
  - Organizational standards
  - Project standards

Importance of standards

- Encapsulation of **best practice**
  - avoiding repetition of past mistakes.
- They are a **framework** for defining what quality means in a particular setting
  - the organization's view of quality.
- They provide **continuity**
  - new staff can understand the organisation by understanding the standards that are used.
- Visible **certification** can attract new customers or be required by existing ones
- **Partnerships** and co-development, particularly in a global environment, are enhanced

Problems with standards

- They may not be seen as relevant and up-to-date by software engineers.
- They often involve too much bureaucratic form filling.
  - small firms' negative perceptions of process model standards are primarily driven by negative views of cost, documentation and bureaucracy
- If they are unsupported by software tools, tedious form filling work is often involved to maintain the documentation associated with the standards.

ISO 9001 philosophy

- **Document** what you do
  - in conformance with the requirements of the applicable standard
- **Do** what you document
- **Record** what you did
- **Prove** it
  - maintenance of registration requires audits every three years, with mini-audits every six months

ISO 9001 Quality management

- ISO 9001 is a generic standard for quality management.
- Quality refers to all those features of a product (or service) which are required by the customer.
- Quality management means what the organization does to
  - ensure that its products or services satisfy the customer's quality requirements and
  - comply with any regulations applicable to those products or services.
- Quality management also means what the organization does to
  - enhance customer satisfaction, and
  - achieve continual improvement of its performance

Certification

- Companies voluntarily adopt the ISO 9001 rules in order to prove that their systems are:
  - GOOD
  - Based on internationally-accepted criteria
  - Meet minimum requirements for quality
- But… anyone can say they comply to ISO 9001.
  - So "certification" was developed.
- **Certification** (or "registration") to ISO 9001 is accomplished through regular, recurring "audits" by an independent ISO registrar,
  - who comes on-site and inspects the company's compliance with the standards.

Certification

- Certification is not a requirement of ISO 9001

- It is a decision to be taken for business reasons:
  - if it is a contractual, regulatory, or market requirement
  - If it meets customer preferences
  - it is part of a risk management programme, or
  - if it will motivate staff by setting a clear goal.

- Many customers require suppliers to be certified
  - ISO 9001, or/and others.

ISO 9001:2015

- More recent version: 9001:2015
  - It is not a standard for software development!

- It sets out general quality principles
  - describes quality **processes** in general and **procedures** that should be defined.
  - documented in an organizational **quality manual**.

Process Approach (not product)

- ISO 9001 concern the way an organization goes about its work
  - It is not a product standard
  - It is not a service standard
  - It is a process standard
- A **process**: set of interrelated or interacting activities that use inputs to deliver an intended result
  - Inputs and outputs may be tangible (e.g. materials, components or equipment) or intangible (e.g. data, information or knowledge).
- The **process approach** includes establishing the organization's processes to operate as an integrated and complete system.
  - The management system integrates processes and measures to meet objectives
  - Processes define interrelated activities and checks, to deliver intended outputs
  - Detailed planning and controls can be defined and documented as needed, depending on the organization's context.

Examples

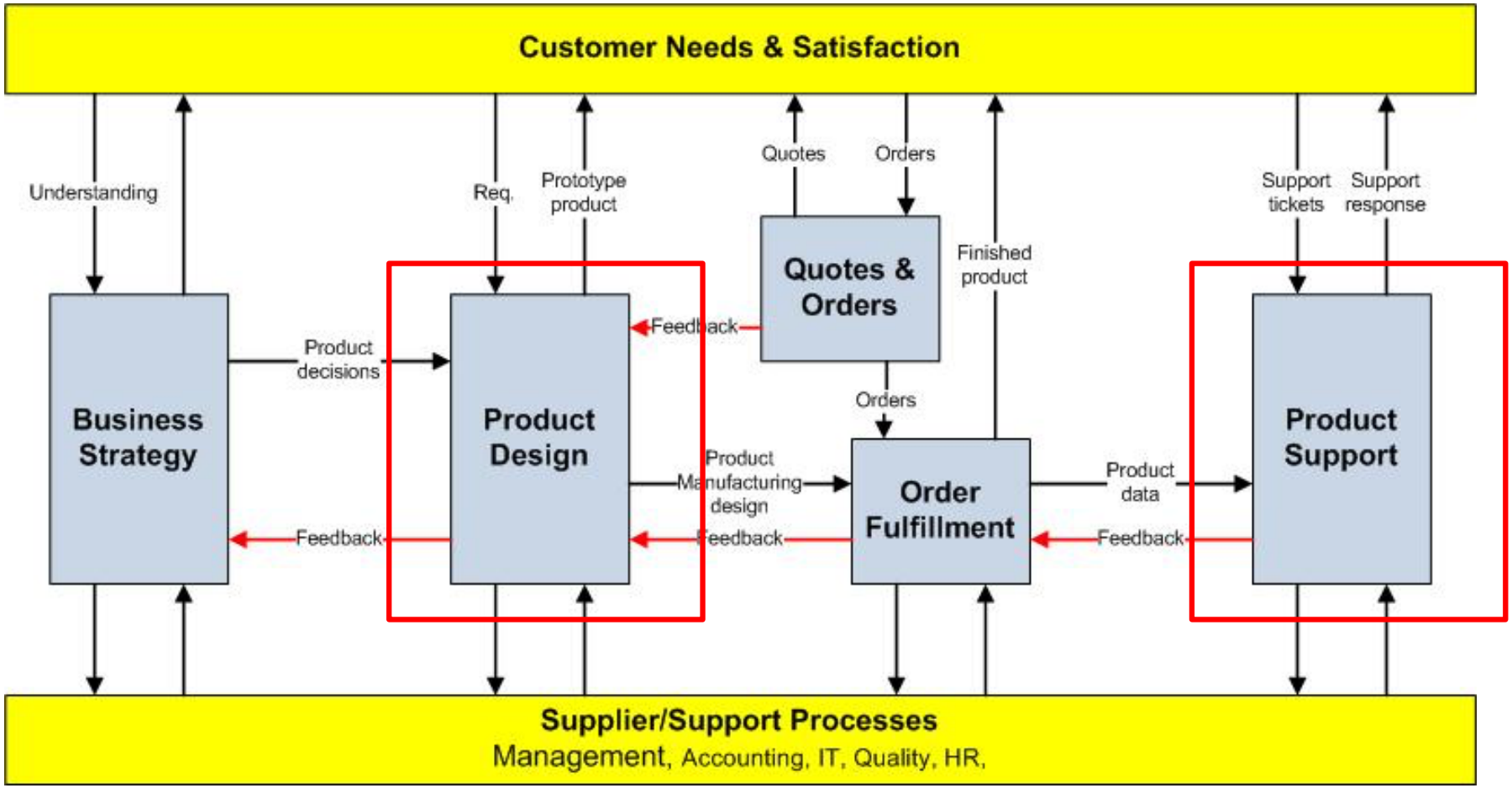
Joe's Pizza

- Amount of dough, cheese, etc.
- Spices used
- Oven temperature
- Bake time
- Boxes used
- Delivery methods (pick up, deliver by car, etc.)

ABC Machine Shop

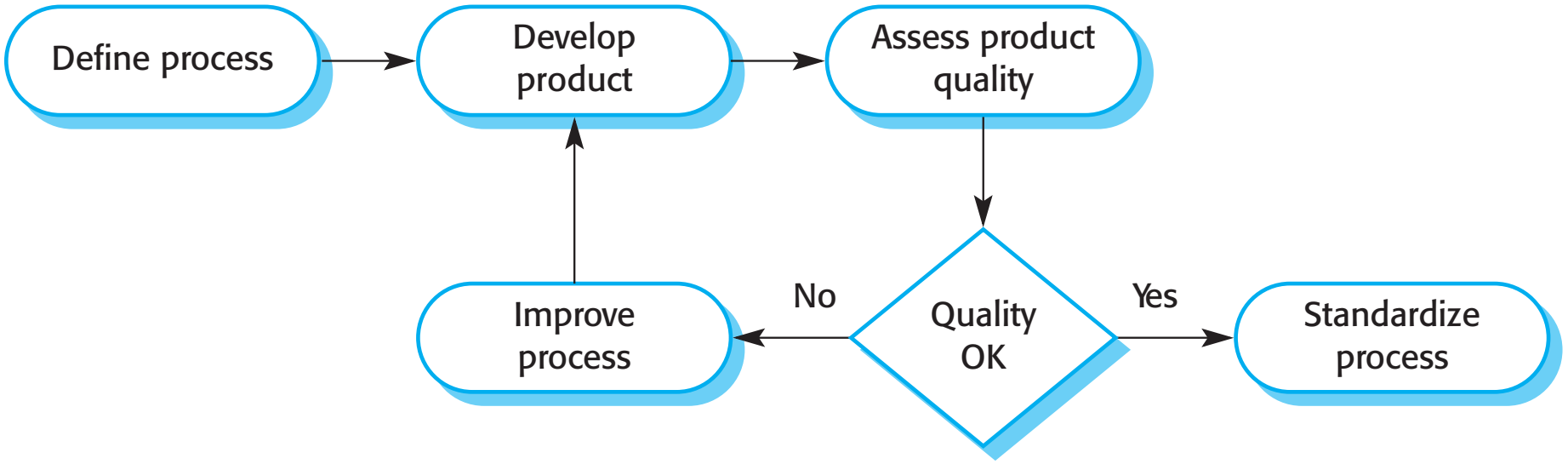
- Make parts according to prints
- Use raw materials from approved suppliers
- Inspect parts before shipment
- Repair defects found
- Package properly
- Ship all parts express

Example of Organization Processes

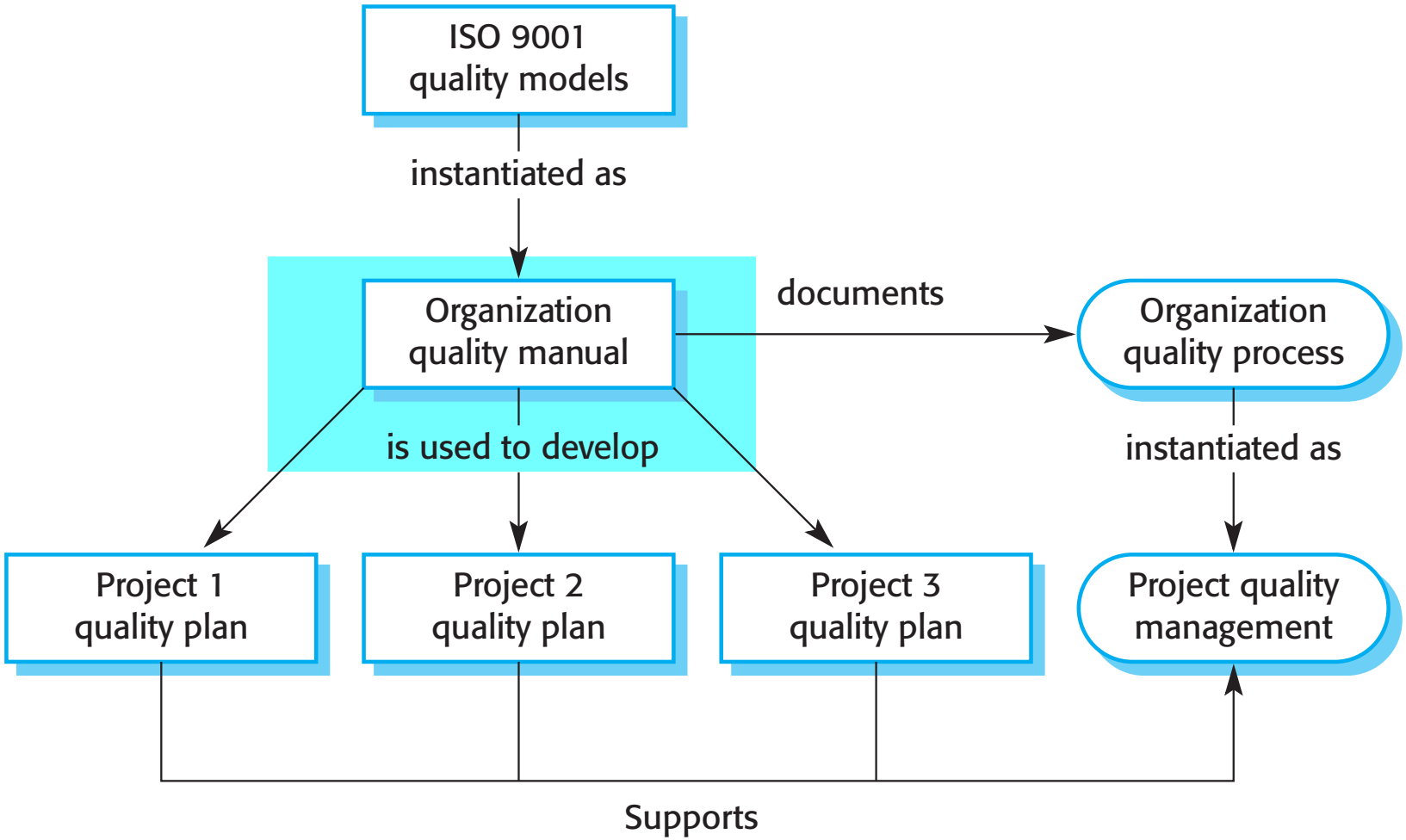


https://www.bizmanualz.com/obtain-iso-certification/how-to-start-your-iso-9001-certification.html

Process-based quality



ISO 9001 and quality manual



Software quality and ISO 9001

- The ISO 9001 certification defines quality to be conformance to standards.
- It takes no account of quality as experienced by users of the software.
  - For example, a company could define test coverage standards specifying that all methods in objects must be called at least once.
- So long as the defined testing procedures are followed and test records maintained, the company could be ISO 9001 certified.
- So..
  - solid Software Engineering practices need to be aligned with the QMS.

Quality management and agile development

- Quality management in agile development is informal rather than document-based.
  - It relies on establishing a quality culture, where all team members feel responsible for software quality and take actions to ensure that quality is maintained.
- But … standards have also evolved to cope with this "mismatch".
- ISO 9001 doesn't require masses of processes and documentation
  - only that we have enough to succeed, and that we follow what you do have.
  - It can be beneficial to agile software development, and vice versa.

Quality management and agile development

- It is possible to bring the best of business process management, agile methodologies, and ISO standards into one practical method of process management.
- For that "Agile ISO", we need a system which allow to:
  - build rich **process** libraries with multiple folders, subfolders, and managed permissions.
  - build large detailed **procedures** filled with work instructions, media, and reference guides.
  - **see** when a process was followed, who followed it, and what progress was made on it.
  - see the **revision** histories for set procedures, so you know how they were updated, when, and by whom.
  - enforce certain **procedural paths** through things like stop tasks and conditional logic.
  - create new processes, **assign** them to individuals or teams, and **collaborate** on their construction and execution.
  - **update** a process model for a procedure and immediately push the new revision live for use.

(Many) Other standards

- ISO/IEC/IEEE 12207:2017
  - An international standard for software lifecycle processes
    - https://www.iso.org/standard/63712.html
- ISO/IEC 27001
  - Information security management system
    - https://www.iso.org/isoiec-27001-information-security.html
- ISO 13485:2016
  - Medical devices requirements for regulatory purposes
    - https://www.iso.org/standard/59752.html
- ISO/IEC 24773:2019
  - Software and systems engineering
    - https://www.iso.org/standard/69724.html
- CMMI – Capability Maturity Model Integration
  - Process level improvement (with 5 levels).
    - https://cmmiinstitute.com

Summary

- **Software Quality** Management System refers to the activities used by companies to manage the delivery of high-quality products.
  - it should support whole software development life cycle: collecting the requirements, design the solution, solution implementation, change management and closing project.
- **Standards** provide guidelines and recommendations for organization, products, and processes.
- A **Certification** is provided by an external body to ensure that the standard is being followed.