

Software quality management

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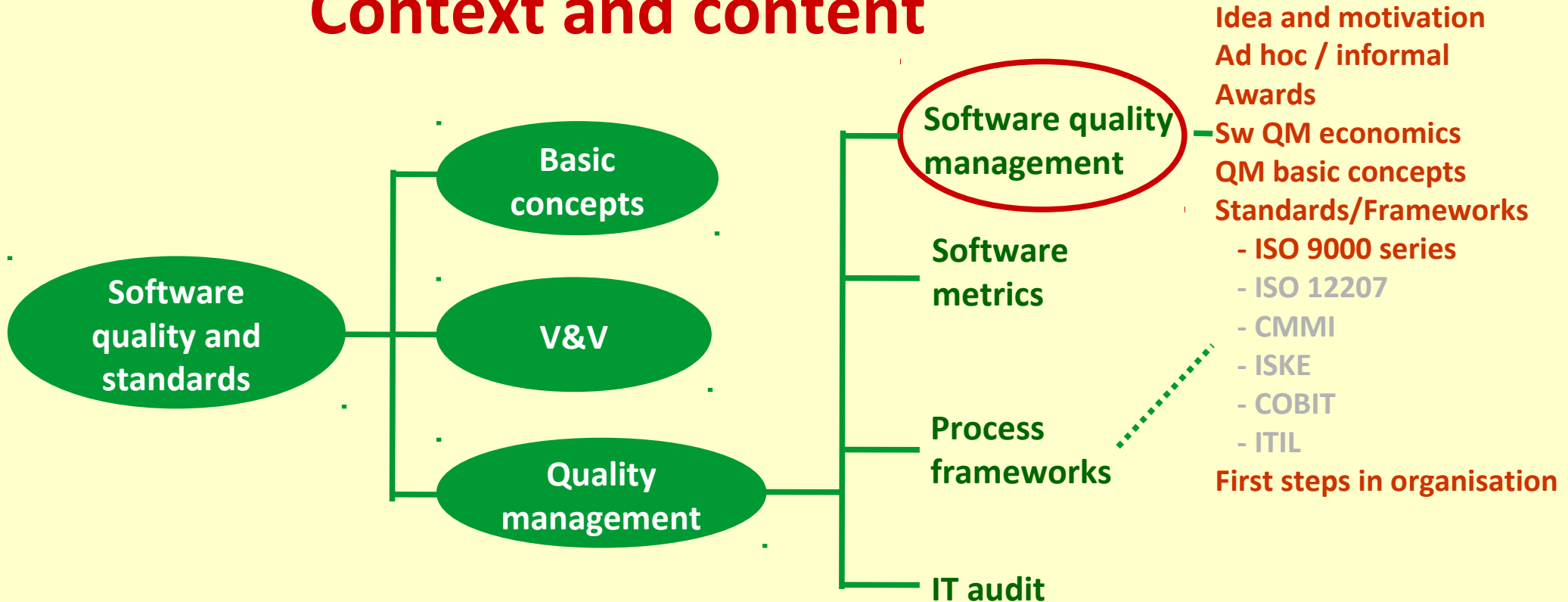
Department of Software Science

Moodle: „Software Quality (Tarkvara kvaliteet)”

Alternate download: tepandi.ee

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Context and content



Requirements=>Q

Business
Process
Product
User
Data ...

Quality

VTV

Quality Manag-nt
Standards
Audit ...

Software

Product
Technology
Environment
Service...

Processes

Development
Purchase
Maintenance...
Frameworks

Degree to which a set of
inherent characteristics
of an object fulfils
requirements (ISO 9000)

Why quality?

- Better product
- Efficient processes
- Competitive advantage
- Market promotion
- Procurement needs
- Needed for export
- ...

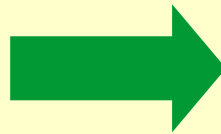
But:

- Speed-speed-speed
- Financial pressure
- No time
- Complex
- ...

Do / why we need quality management?

“We we have development processes, maintenance processes, etc. We do testing, verification and validation, each our activity affects quality”.

- Do we still need specific quality related activities, processes, resources?
- Why are they needed? Why is that difficult?
- Who needs?
- What is needed? How much?



QM may require wider view of the process from all employees (CEO to developer to cleaner)

It may be in conflict with direct employee tasks

It may involve recognition and admitting employee own errors

It may be rather in interest of the whole company than of an employee

It may require leaving the employee comfort zone

It may require specific organisational culture

It may give a business advantage

Historic approaches to quality

USA, Europe

- Results oriented
- Innovation
- Assurance, statistics

Japan

- Process oriented
- Continuous improvement /
Kaizen / eliminate waste

QM = see everything as processes and improve

Steve Jobs on Joseph Juran and quality: The things that we've learned most from Dr Juran are to look at everything as a repetitive process, to instrument that process and find out how it is running, and then start to take it apart and put it back again in ways that dramatically improve its effectiveness ... a very straightforward way, no magic...

Joseph Juran:

- Applying the Pareto principle (80:20 rule) in quality: "the vital few and the useful many"
- Quality management: education and training of managers. Human relations problems are the ones to isolate. Resistance to change is the root cause of quality issues
- Cost of poor quality. To avoid: quality planning, control, assurance, and improvement

=> Processes and process frameworks

<http://www.youtube.com/watch?v=XbkMcvnNq3g>

Ad hoc and informal QM techniques (cont-d)

Ad hoc “Let us develop an IT development standard for our company”:
advantages / disadvantages?

Examples of informal approaches:

Philip B. Crosby

- Do it right first time
- Zero defects
- Quality is free

A. Feigenbaum: “Quality - a way of managing the organisation”

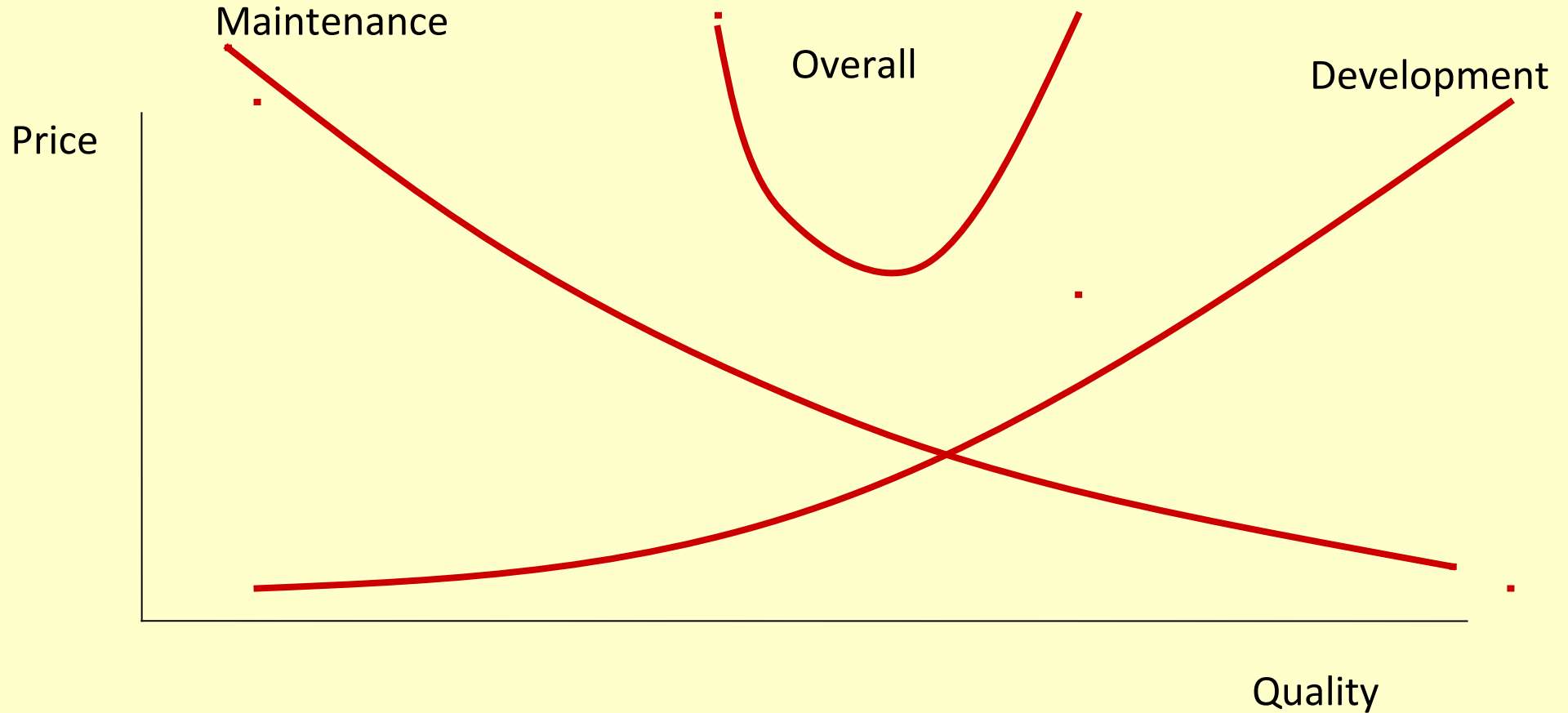
Henry Ford: „Quality means doing it right when no one is looking”

Philip B. Crosby: steps to quality

- 1) Management commitment
- 2) Quality improvement team
- 3) Quality measurement
- 4) Cost of quality evaluation
- 5) Quality awareness
- 6) Corrective action
- 7) Establish an ad-hoc committee for the Zero Defects Programme
- 8) Supervisor training
- 9) Zero Defects Day
- 10) Goal setting
- 11) Error cause removal
- 12) Recognition
- 13) Quality Councils
- 14) Do it over again

<http://www.agiledevelopment.org/download/qp1205crosby.pdf>

Cost of quality



Awards and other

- **The European Quality Award**
- **The Malcolm Baldrige National Award for Quality (USA)**
- **Estonian quality award**

European Foundation for Quality Management (EFQM) Excellence Model

Enablers

- **Leadership**
- **Strategy**
- **People**
- **Partnerships and resources**
- **Processes, products and services**

Results

- **Customer results**
- **People results**
- **Society results**
- **Business results**

Learning, creativity, innovation

www.efqm.org

The Malcolm Baldrige National Quality Award (USA)

Baldrige Criteria for Performance Excellence

- Leadership
- Strategic planning
- Customer and market focus
- Measurement, analysis, and knowledge management
- Human resource focus
- Process management
- Business/organizational performance results

Waiter, is it sheep or pork ribs?

- Can you taste the difference?
- No
- Is it then important?

Waiter, is it sugar or
strychnine?

■ ...



Notes on (consumer) software quality economics

Metcalfe's law: the value of a network is proportional to the square of the number of users of the system

Often large costs to users from switching technologies, which leads to user lock-in

In a market in which there is asymmetric information with respect to quality, the bad may drive out the good

=> „Winner takes it all” [... it may be profitable to ship poor quality software sometimes]

=> „We'll ship it on Wednesday and get it right by version 3”

Quality means different things to different users - it is difficult to find a product that would be suitable for everyone

Basic concepts: Quality, policy, management system

Quality - degree to which a set of inherent characteristics of an object fulfils requirements

Policy - intentions and direction of an organization as formally expressed by its top management

Management system - set of interrelated or interacting elements of an organization to establish policies and objectives, and processes to achieve those objectives. The management system elements establish the organization's structure, roles and responsibilities, planning, operation, policies, practices, rules, beliefs, objectives and processes to achieve those objectives

(Based on ISO 9000:2015)

Quality management [...and minimum level]

Quality management - management with regard to quality, can include establishing quality policies and quality objectives, as well as processes to achieve these quality objectives [... at least, management has a position on quality]

Quality policy - policy related to quality. Generally the quality policy is consistent with the overall policy of the organization, can be aligned with the organization's vision and mission and provides a framework for the setting of quality objectives [... at least, this position has been formulated and communicated]

Quality management system - part of a management system with regard to quality [... at least, responsibilities have been assigned]

Quality control - part of quality management focused on fulfilling quality requirements [... at least, the persons responsible are working towards quality]

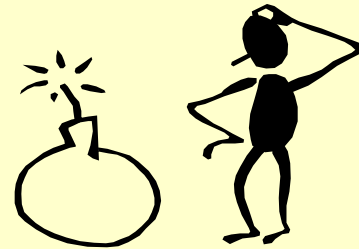
Quality assurance - part of quality management focused on providing confidence that quality requirements will be fulfilled [...at least, there is feedback on how the policies are implemented]

(Based on ISO 9000:2015)

Case study: a company needs to buy a secure server

Availability requirements not specified – excessive costs?

At the board meeting



„Better say nothing, do not make a fool of myself”

With QM system: „Our service levels? Why not sufficient? What alternatives? Best option? ...”

The quality management system may exist under different titles

Management is interested and insists on quality

Responsibilities are assigned

Employees are aware, quality is discussed

Methodologies /standards are in place (eg, Scrum, Lean, Kaizen, Kanban, TQM, ITIL, ISO 12207,...)

Quality is tested and validated

Informal approaches, awards, standards...

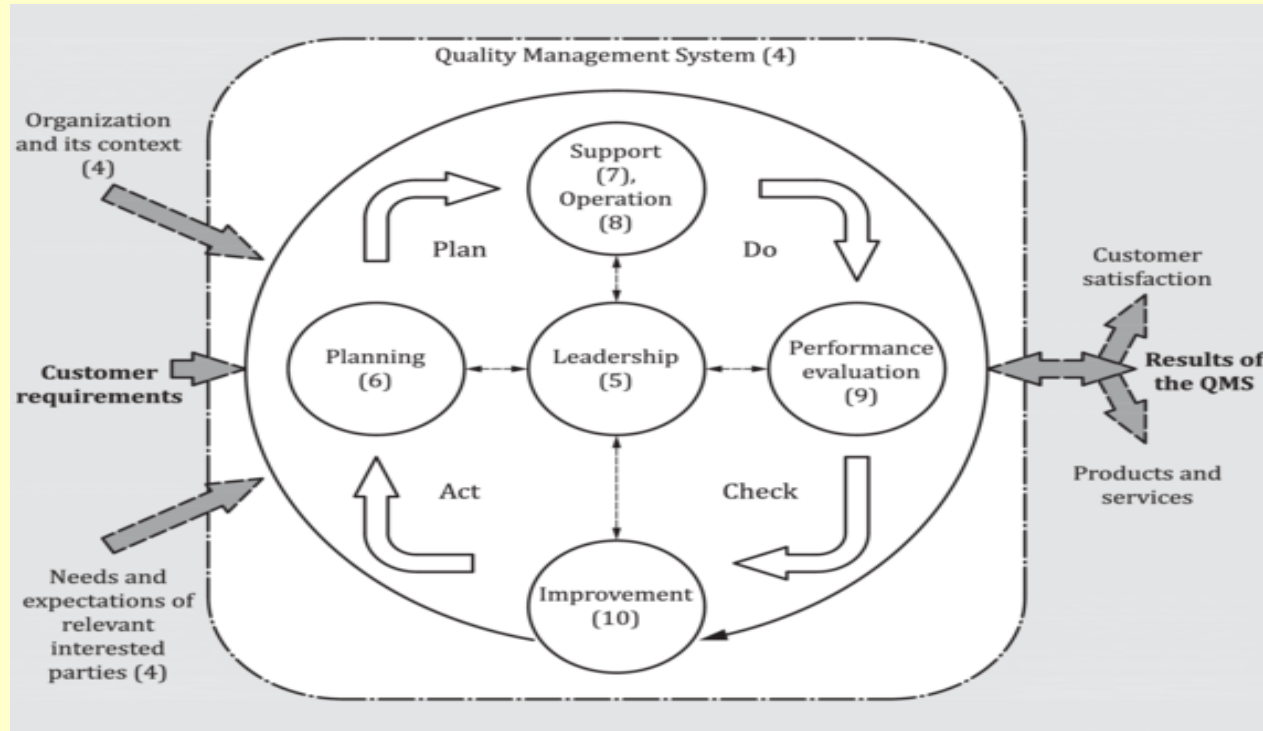
ISO 9000 series: a family of quality management systems standards

- **Process improvement in the company**
- **Systematic quality management (also in IT area)**
- **Certification and PR**
- **Also useful if the orientation is on export**
- **Avoid focusing on certification only!**

ISO 9000 series: history and present situation

- First version 1987 => renewed 1994 (~ 20 standards) => renewed 2000 => current
- ISO 9000:2005, Quality management systems. Fundamentals and Vocabulary
- ISO 9001:2008, ISO 9001: 2015, Quality management systems. Requirements
- ISO 9004:2009, Managing for the sustained success of an organization -- A quality management approach
- + more, e.g. ISO/IEC 90003:2014, Software engineering — Guidelines for the application of ISO 9001:2000 to computer software

ISO 9001:2015 in the PDCA cycle



NOTE Numbers in brackets refer to the clauses in ISO 9001:2015

Source: <https://www.iso.org/obp/ui/#iso:std:iso:9001:ed-5:v1:en>

Process quality depends on

- parties, resources
- employees, leadership/ activities
- products / services
- business results, customers, society, ...
- + PDCA, ...

Risk-based thinking

Risk - effect of uncertainty

An effect is a deviation from the expected — positive or negative.

Risk is often characterized by reference to potential events and consequences, or a combination of these.

Risk is often expressed in terms of a combination of the consequences of an event (including changes in circumstances) and the associated likelihood of occurrence.

The word “ risk ” is sometimes used when there is the possibility of only negative consequences.

Source: <https://www.iso.org/obp/ui/#iso:std:iso:9000:ed-4:v1:en>

ISO 9001:2015 - potential benefits

- Ability to consistently provide products and services that meet customer and applicable statutory and regulatory requirements
- Facilitating opportunities to enhance customer satisfaction
- Addressing risks and opportunities associated with its context and objectives
- Ability to demonstrate conformity to specified quality management system requirements

Source: <https://www.iso.org/obp/ui/#iso:std:iso:9001:ed-5:v1:en>

It is not the intent of ISO 9001:2015 to imply...

- need for uniformity in the structure of different quality management systems;
- need for alignment of documentation to the clause structure of this International Standard;
- need for the use of the specific terminology of this International Standard within the organization.

Source: <https://www.iso.org/obp/ui/#iso:std:iso:9001:ed-5:v1:en>

ISO 90003 at a glance

- 1-3. Scope, references, terms
- 4. Quality management system
- 5. Management responsibility
- 6. Resource management
- 7. Product realization
- 8. Measurement, analysis and improvement
- Annexes

ISO 90003: Software life cycle

- Processes, activities and tasks should be planned and performed using life cycle models suitable to the nature of a software project, considering size, complexity, safety, risk and integrity.
- ISO 9001:2008 is intended for application irrespective of the life cycle models used and is not intended to indicate a specific life cycle model or process sequence.

Certification infrastructure

Accreditation

UKAS - UK's National Accreditation Body
EAK - Estonian Accreditation Centre
...

Sertification

Bureau Veritas Eesti OÜ (EAK)
Inspecta Estonia OÜ
Chamber Certification Assessment Services Limited
Hong Kong Quality Assurance Agency
...

Enterprises

Cybernetica AS
Aktors OÜ
...

There is no “ISO 9000 certification”

ISO 9001 is effective if...

- The main purpose is quality, not certification
- Leadership is involved, ISO 9001 is a management tool
- Whole organization is involved
 - understanding advantages
 - making decisions
- System is profitable
- Expenses/profits are measured
- Consultants advise, do not decide

ISO 9001 certificates in Estonia (www.eaq.ee)

2017: 1107 (ISO 9001:2008 + ISO 9001:2015).

2016: 999 (ISO 9001:2008 + ISO 9001:2015).

2012: 981, 2011 (ISO 9001: 2000 + 2008 + 2009): 906

- Software – 26 (2017, incl AS Fujitsu Estonia, AS Reach-U, OÜ Regio, Cybernetica AS, Helmes AS, Icefire OÜ, Nortal AS, Nortal Oy)...20 (2010)
- IT – 7 (2017), 4 (2010)
- Who from the big ones are not here? Why?

Other options: some ICT related frameworks in Estonia

- ⇒ ISO 9001 - Certified in Estonia: 1107 organisations, software: 26
- ⇒ ISO 27001 - 5
- ⇒ ISO 20000-1 - 1 ITIL - ITSMF members: 24
- ⇒ ISKE - compulsory for state and local administration databases
- ⇒ COBIT - CISA/CISM/... 70 members in ISACA EE branch
- ⇒ ISO/IEC 12207 - base standard for many ICT process frameworks
- ⇒ most large ICT organisations involved

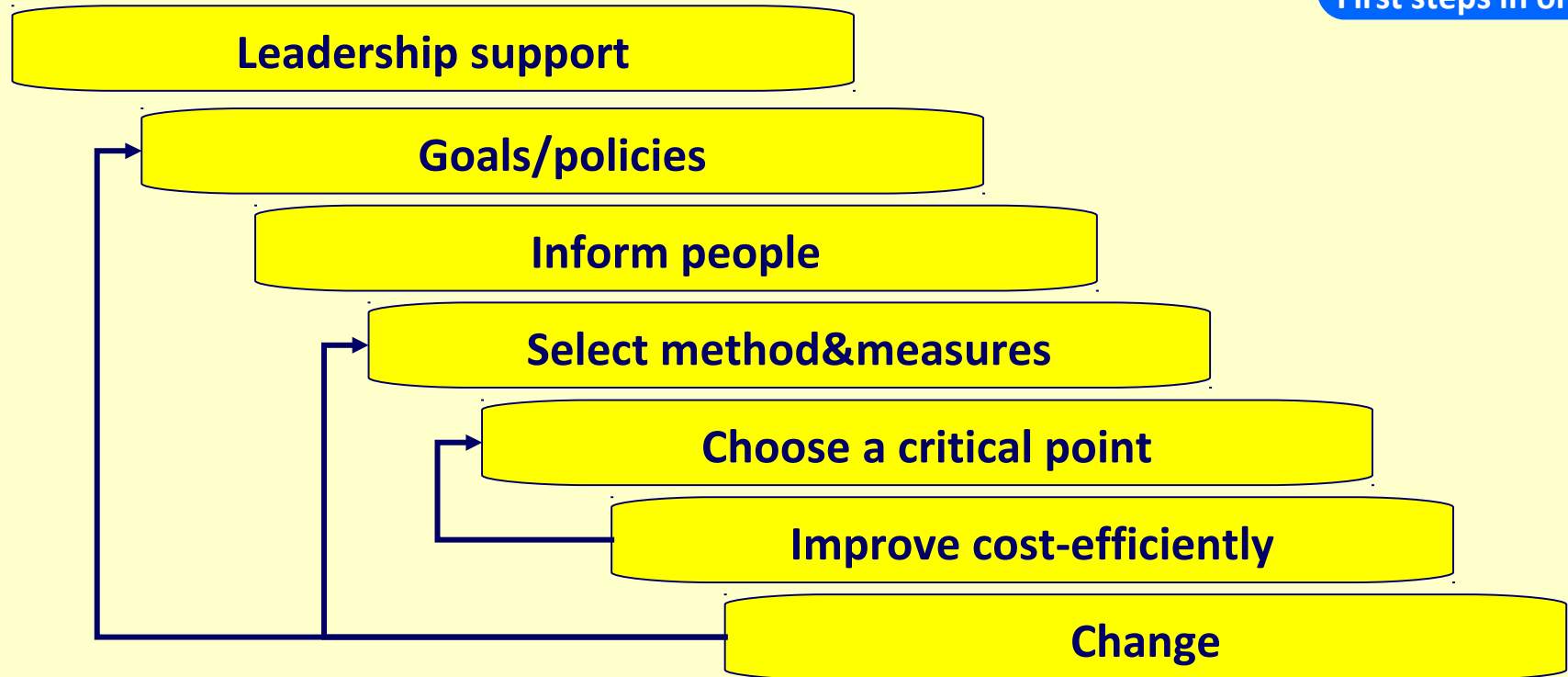
Case studies

A large software project is stuck, the partners do not adhere to the project agreements. Could standards help?

A state agency is not satisfied with its internal IT organization and documentation, how to improve?

An IT company wants to participate in EU tenders, is it possible to increase competitiveness?

Quality management – first steps in company



Customers* are not pleased, better quality is required

A thorough undertaking or small-scale?

**Thorough: Is formal
acknowledgement required?**

**Small-scale: Use informal
approach, standards**

**Required: consider ISO
9000, other certifications,
quality awards**

**Not required: consider all
options**

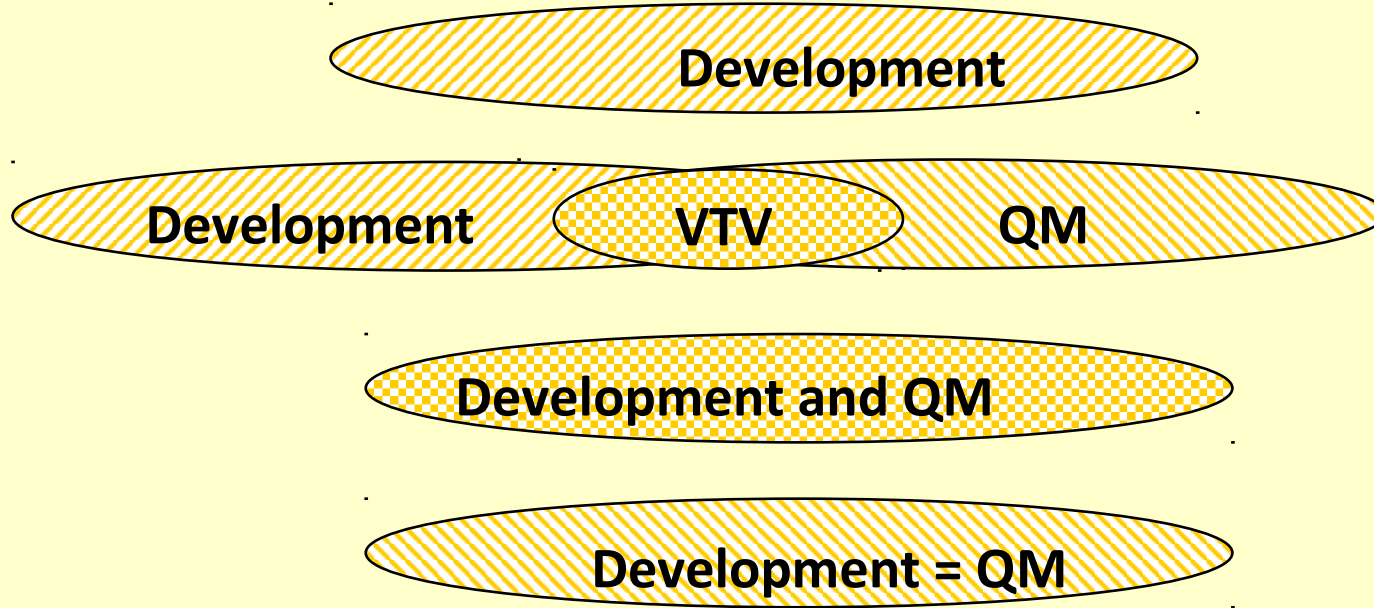
*** Internal or external**

Software development and quality

It is not possible to test quality into a product– the result depends on

- **infrastructure (hardware, software, communications,...)**
- **processes (development, procurement, maintenance, ...)**
- **stakeholders (procurers, developers, maintainers, ...)**
- **project factors (volume, resources, deadlines,...)**
- **software development methods and tools**
- **organizational methods and tools**
- **software specific quality management**
- **standards**
- **...**

Development and quality management: possibilities



Summary: software quality management

Quality and quality management (QM): concepts and economics

Steve Jobs, Philip Crosby, Armand Feigenbaum, Joseph Juran

EFQM Excellence Award, Estonian Quality Award, Baldrige Criteria for Performance Excellence

ISO 9000 series /ISO 9001 / ISO 90003

Quality management – first steps in company

Additional reading (examples)

Daniel Galin, Software Quality assurance from theory to implementation, Pearson - Addison-Wesley. Chapters 22, 23.2, 25.

Ian Sommerville. Software Engineering. Ninth Edition. Addison-Wesley, Ch 24.

Guide to the Software Engineering Body of Knowledge (SWEBOK), IEEE. Chapter 10.

Stefan Wagner. Software Product Quality Control. Springer, www.it-ebooks.info.

Certified Tester Foundation Level Syllabus, ISTQB. Chapter 1.1.4.