Software Testing Concepts

Factors Affecting Testing Efficiency and Software Quality

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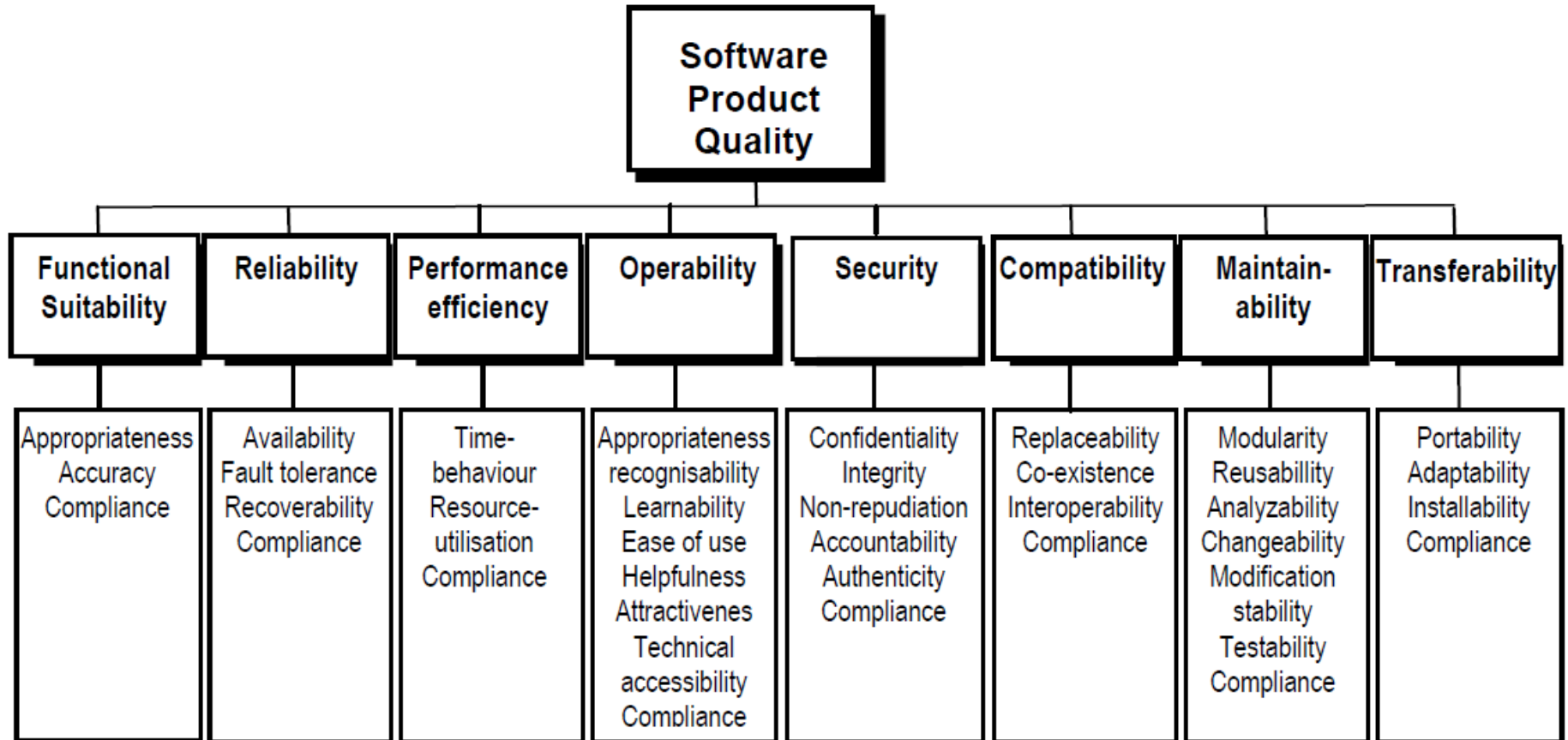SoberIT

*Tekes

Software Quality

What is Software Quality?

- How is it implemented on the software products?
- How is it measured?
- How can it be achieved?
- What affects the perceived quality outcome?
- How is this outcome enhanced?

Software Quality Model (based on the ISO 25010 draft)

| Software Product Quality							
Functional Suitability	**Reliability**	**Performance efficiency**	**Operability**	**Security**	**Compatibility**	**Maintain-ability**	**Transferability**
Appropriateness Accuracy Compliance	Availability Fault tolerance Recoverability Compliance	Time-behaviour Resource-utilisation Compliance	Appropriateness recognisability Learnability Ease of use Helpfulness Attractivenes Technical accessibility Compliance	Confidentiality Integrity Non-repudiation Accountability Authenticity Compliance	Replaceability Co-existence Interoperability Compliance	Modularity Reusabillity Analyzability Changeability Modification stability Testability Compliance	Portability Adaptability Installability Compliance

Software Quality Model

- Attributes define software quality
- All of the attributes are important, but generally products focus on a certain subset.
- Quality attributes serve also as objectives for testing process:
  - Focus area for testing resources
  - Basis for the testing strategy

# Model for Software Testing (based on the ISO 29119 draft)
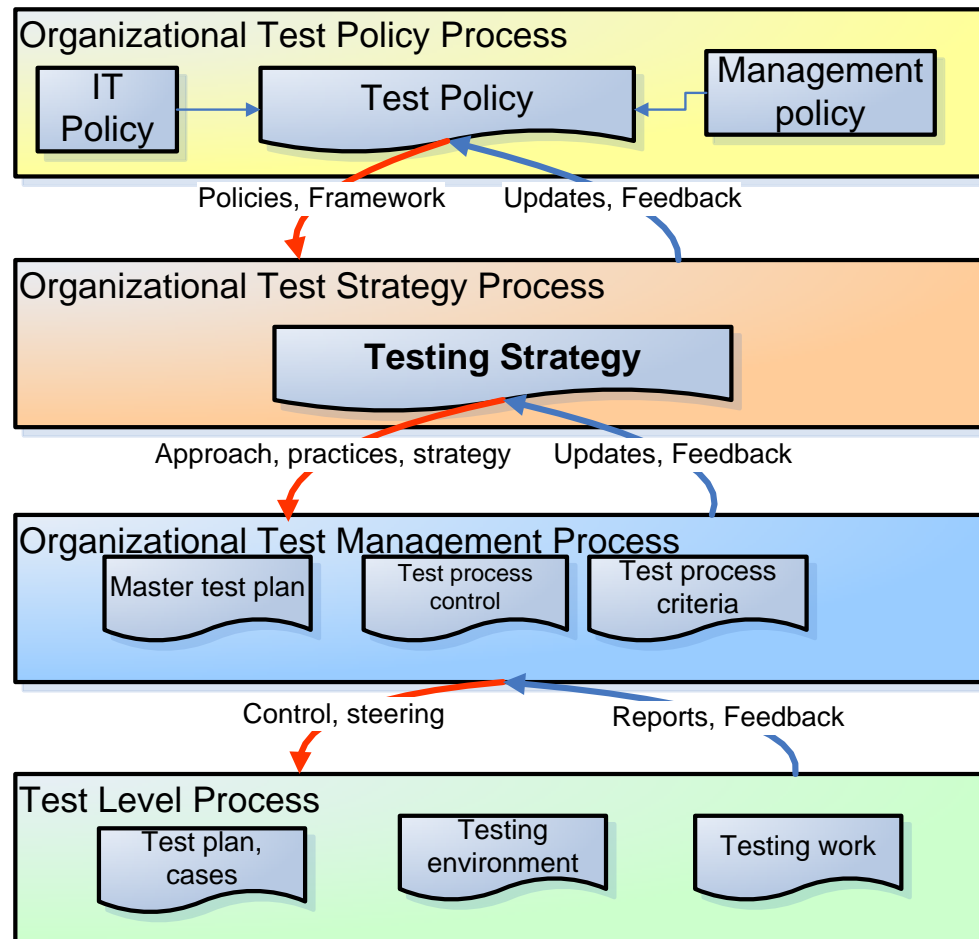
Testing strategy

- Testing strategy is the key component for software testing efficiency.

- Based on the company policies, frameworks and delimiters, defines…
  - What should be done (Quality attributes, objectives)
  - With what this is accomplished (Available resources)
  - How it is accomplished effectively (Testing methods)

- Testing strategy components define the testing process, hence are related to the efficiency.

Composition of ISO 29119 levels, testing strategy factors, and attributes
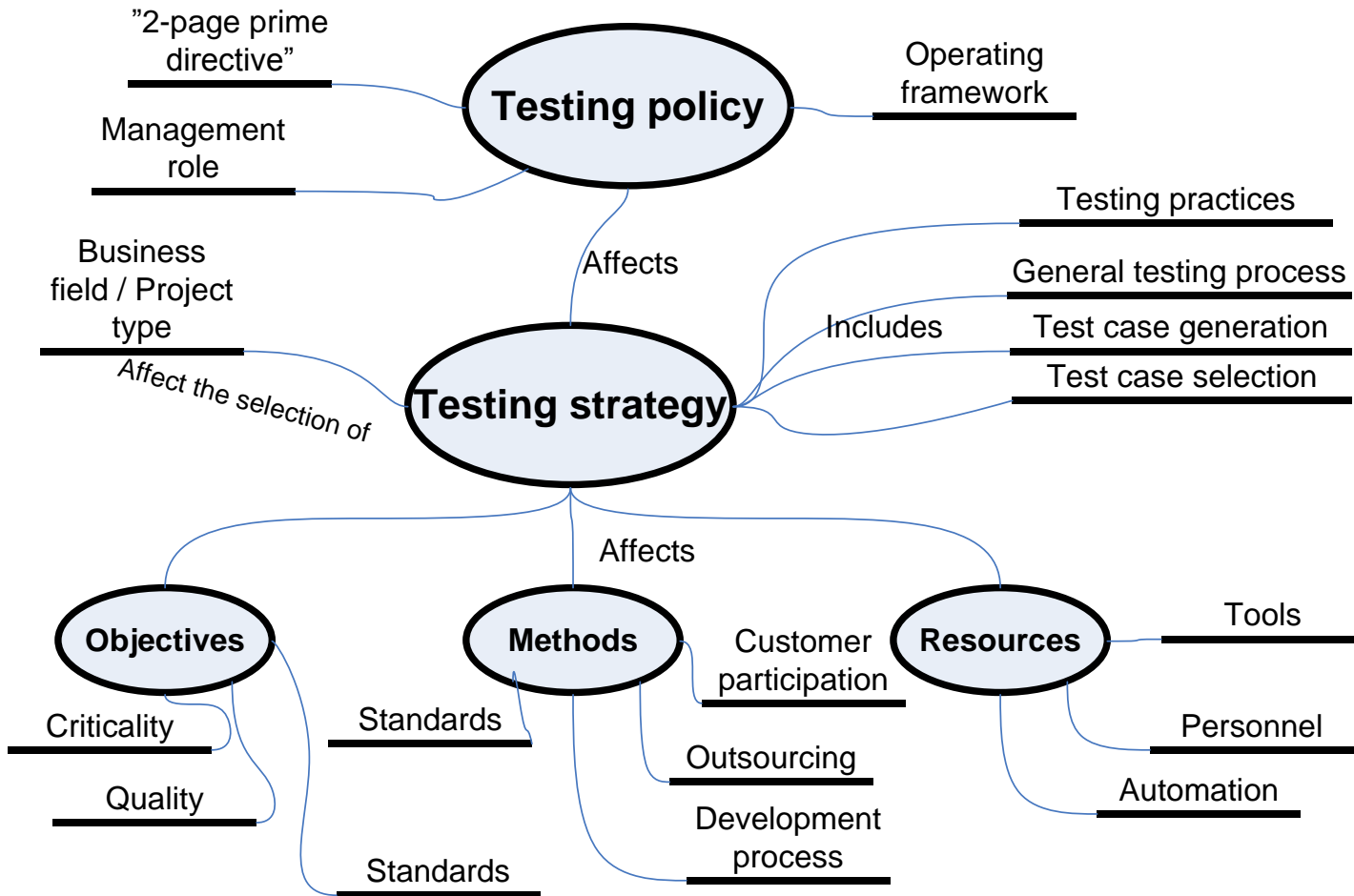
Software testing strategy

So how is the software testing strategy constructed?

- – How do the production method, applied standards, or outsourcing affect the testing strategy in the software process?

- – How do the quality aspects affect the testing strategy and software process?

- – How do the software criticality and business-orientation affect the testing strategy?

- – Are there any additional major influences besides those already mentioned?

Practical observations

- ESPA, survey of 31 Finnish software development organizations
  - 12 focus companies three interviews; developer, testing manager, and tester from the same organization unit.
  - Companies from small to large in size, in software development, banking sector, insurance, etc; selected to represent diffent types of organizations
- Goal was to understand which components are relevant to the testing process.
  - Which components are critical for efficient testing?
  - Which aspects could be enhanced for efficiency?
  - Which factors should be defined for testing strategy?

Factors affecting testing strategy and efficiency

- Test methods
- Existing strategies and approaches
- Testing resources
- Development process agility; Agile methods
- Standards
- Outsourcing
- Testing automation
- Testing tools; Quality and availability
- Product quality aspects
- Customer participation in the project

Perceived problems, three most common

- **Automation:** *"There just aren't enough resources to do anything relevant"*
  - Lack of documentation from automation cases
  - No "human observer" for unforeseeable side effects
  - Implementation and upkeep costs vs. manual testing
- **Agile development:** *"We went for it but it degenerated to the level of ad hoc programming, so we just had to reverse our decision."*
  - Contractual obligations
  - Uncontrollable "featuritis"
  - Challenging organizationally
- **Outsourcing:** *"We cannot outsource, as no-one else has the hands-on experience on these systems."*
  - Tacit knowledge
  - Unsupportive process for outsourcing development
  - However, different case with testing services

Enhancement proposals, three most common

- **Acquiring new tools:** *"Our development could use some help with unit- and regression testing"*
  - Tools should help focusing on the actual testing
  - Documentation tools
  - QC Portal
- **Automation:** *"In this [regression testing] the problem is that humans get bored; this should be automated"*
  - Regression testing, repetitive tasks
  - Documentation attachment generation
  - Module interfaces
- **Documentation**: *"The quality changes so much in between projects, that sometimes you just don't know what to do."*
  - Standards for documentation
  - Common, transparent database
  - Contact information for additional information

On outsourcing methods

- **Module acquisition:** *"There is no reason to focus on parts that can be just as easily be bought"*
  - Supportive modules; PDF generators, service interfaces
  - Major channel for open source resources in the otherwise vendor-heavy software development environment.
- **"Insourcing" resources:** *"We buy people to put into projects, because we don't have our own"*
  - Additional resources, usually additional testers for individual projects
  - UI testers from partners, customers
- **Acquiring knowledge**: *"For finance sector, we don't rely just on our own knowledge"*
  - Testing professionals to oversee test case development
  - Experience, knowledge to verify tool output

Agile methods in the testing process

- Much less used than one would expect based on the software development literature!
- **Piloting/Supportive roles:** *"Let's say that we have decided to try it at some point"*
  - Small scale, support roles
  - UI development, adding features to existing software
- **Effect on product quality:** *"In my opinion, the additional development iterations and communication with the client is what makes the quality in the agile development"*
  - The communication is the key in Agile development
  - Client (Customer) has to have a strong opinion or clear view on what they want.
  - However, the better quality is not automatic attribute of the agile process: *"We would probably do the same tests without SCRUM"*

Testing resources in numbers

– Following statistics were collected from the ESPA-survey data (31 OUs):

	Max	Min	Median
Amount of automated testing (vs. manual testing)	90%	0%	10%
Amount of Agile development (vs. plan-driven projects)	100%	0%	30%
Amount of testers per the actual need (needs 3, has 2 = 67%)	100%	10%	75%
Amount of project time allocated solely for testing	70%	0%	25%

On testing resources

- **Amount of personnel:** "*In the projects where I have been, there has been no human resource issues.*"
  - Generally the larger companies, which focus on the software production business, have sufficient amount of available personnel.
  - Smaller companies, or companies which develop software as a part of their own services, have tendency for some shortcomings
  - One reason for this could be that large software companies have in-house resources to train new testing personnel if needed
- **Domain knowledge:** *"The testing tasks are the easy part; knowing the industry is what makes tester efficient"*
  - In general, there seems to be no industry area for software development, where inside knowledge is not a major component
  - However, in some cases the "not knowing" is seen as a beneficial testing ability of it's own.
- **Testing tools:** *"Our document database was practically not used before [management tool], but now we are getting somewhere"*
  - Test case management, databases, drivers, stubs
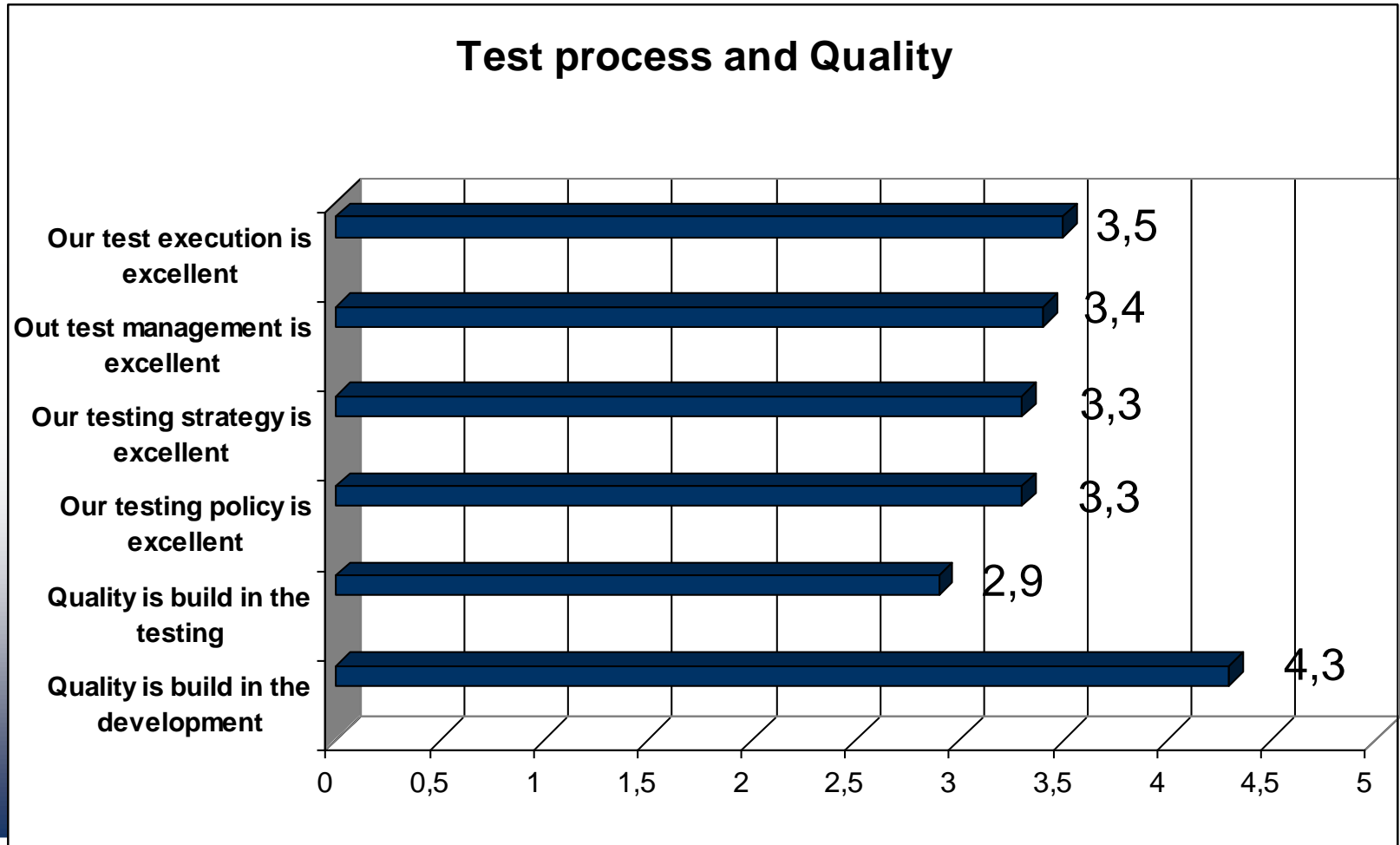 - Usually there was no immediate need for new tools, just "it would be practical to have this for that"

On testing strategies

- **Test case selection:** *"we usually have a dedicated test case designer who's job it is to make the decision"*
  - Two prevalent strategies: "New features first" or "Critical features first"
  - In most cases, if the customer had any influence on the project, this was the place where it affected in practice.
- **Explorative testing:** *"Yes we do it quite commonly, actually."*
  - In many cases, the explorative testing was seen as one of the best ways to ensure product quality
  - "The dumb tests" to ensure that there are no obvious errors
  - For some reason, has a bad, or rather "unprofessional" reputation
- **Error analysis and classification:** *"There are many combinations, so we classify the error scenarios and secure the most critical ones"*
  - Error analysis and classification to focus resources
  - Both in development and in the upkeep
  - In general, a way to ensure realistic timetables and resource allocations
  - In most cases, error analysis results could affect the project process

On test process and quality

Test process and Quality

Category	Value
Our test execution is excellent	3,5
Out test management is excellent	3,4
Our testing strategy is excellent	3,3
Our testing policy is excellent	3,3
Quality is build in the testing	2,9
Quality is build in the development	4,3

Scale: 0, 0,5, 1, 1,5, 2, 2,5, 3, 3,5, 4, 4,5, 5

On standards in testing process

– Somewhat smaller role in the actual testing process than one would expect.

– **In-house standard:** *"Our standards are more like self-designed guidelines"*

  • Testing standards usually not directly based on any standards
  • Some parts, practices adopted but foundation on own guidelines.

– Usually the standard is not directed to the testing process, but rather to the product quality aspects: *"Our standard is aimed to the QC, but it also helps with the testing process"*

– 61% of the companies had some formal method or process, and 13% used some official measurements or applied parts of a formal process.

Customers in the project

- **Customer participation in the testing process:** *"Our customer does their own conformation tests"*
  - Usually customer either does their own check-ups or defines a framework for the test process
  - The on-site testing for finalizing product development is seen as an important asset for testing process
- **Customer influence on the outcome quality:** *"The customer should participate early on the definition and actually review the plans before implementation"*
  - Customer has the best opportunity to affect to the outcome quality in the definition phases, so that the project starts to the "right direction"
  - Other ways to influence are the error feedback, active participation and knowledge transfer.
  - Direct contact to the development is unusual and in some cases, even seen intrusive.
  - 69% of the companies thought that the definition phase was the most influential time for the customer to affect the final quality.

Conclusions, Quality and Objectives

- So in a short recap, what is the software quality and how does it make the testing more efficient?

- Quality in the software product is a composition of several quality attributes.

- **These quality attributes define the project objectives for software process;**
  - which are then verified in the development…
  - and validated in the testing.
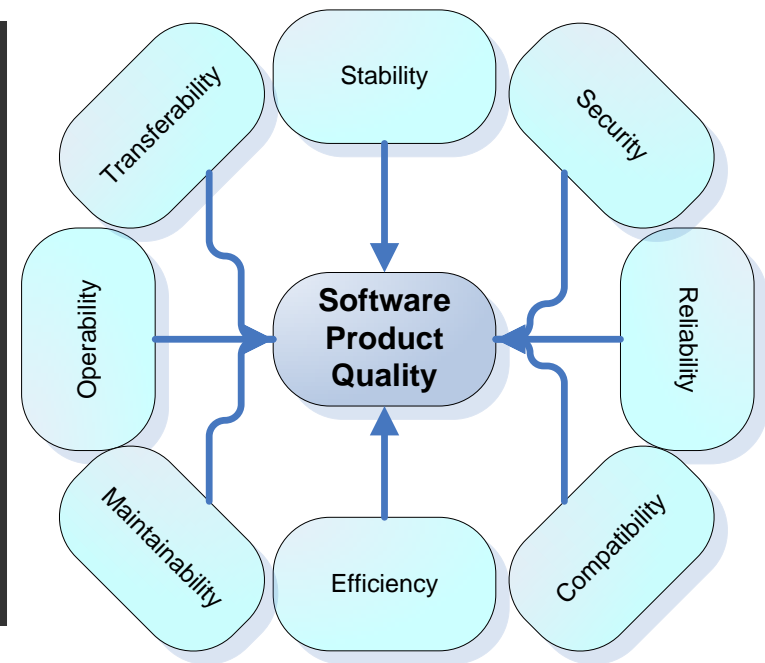
Conclusions, Testing strategy

- The testing strategy is a operating plan to define the objectives, methods, and resources to achieve these project objectives efficiently within the policy-based framework.

- Within the objectives, methods, and resources, there are several attributes, which all affect the testing efficiency.

Policies, Objectives

Testing Strategy

Framework, Context

Objectives

Methods

Resources
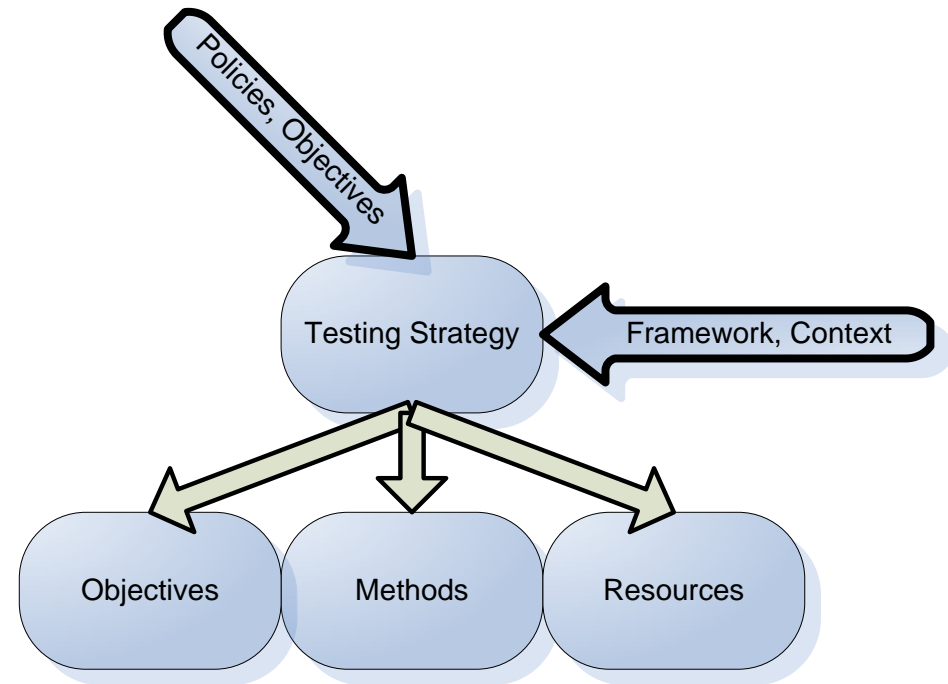
Conclusions, Testing efficiency

Finally, the testing process efficiency is an amalgam of these attributes:

To increase the testing efficiency, the organization needs to identify and improve the relevant, but weak attributes.
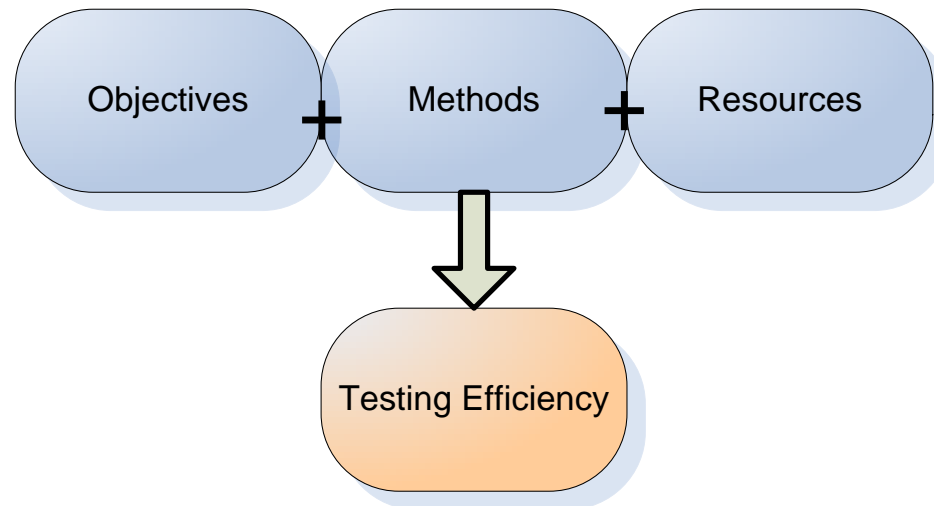
The End?

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More information is available at

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