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25000

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**Systems and software engineering —  
Systems and software Quality  
Requirements and Evaluation  
(SQuaRE) — Guide to SQuaRE**

*Ingénierie des systèmes et du logiciel — Exigences de qualité des  
systèmes et du logiciel et évaluation (SQuaRE) — Guide de SQuaRE*

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Reference number  
ISO/IEC 25000:2014(E)





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## Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work. In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of the joint technical committee is to prepare International Standards. Draft International Standards adopted by the joint technical committee are circulated to national bodies for voting. Publication as an International Standard requires approval by at least 75 % of the national bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO and IEC shall not be held responsible for identifying any or all such patent rights.

ISO/IEC 25000 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*, Subcommittee SC 7, *Software and systems engineering*.

This second edition cancels and replaces the first edition (ISO/IEC 25000:2005), of which it constitutes a minor revision.

The SQuaRE series of standards consists of the following divisions under the general title *Systems and Software Quality Requirements and Evaluation (SQuaRE)*:

- ISO/IEC 2500n, *Quality Management Division*,
- ISO/IEC 2501n, *Quality Model Division*,
- ISO/IEC 2502n, *Quality Measurement Division*,
- ISO/IEC 2503n, *Quality Requirements Division*, and
- ISO/IEC 2504n, *Quality Evaluation Division*.

ISO/IEC 25050 to ISO/IEC 25099 are reserved to be used for SQuaRE extension International Standards and/or Technical Reports.

## Introduction

Computers are being used in an increasingly wide variety of application areas, and their intended and correct operation is often critical for business success and/or human safety. Developing or selecting high quality systems and products is therefore of prime importance. Comprehensive specification and evaluation of systems and software product quality is a key factor in ensuring adequate quality. This can be achieved by defining appropriate quality characteristics, while taking account of the intended use of the systems and software product. It is important that every relevant system and software product quality characteristic is specified and evaluated, whenever possible using validated or widely accepted measures.

As quality characteristics and associated measures can be useful not only for evaluating a systems and software product but also for defining quality requirements, the predecessor of SQuaRE, ISO/IEC 9126:1991 has been replaced by two related multipart International Standards: ISO/IEC 9126 (Software product quality) and ISO/IEC 14598 (Software product evaluation). The following points derived from practical use of both series gave the logical impulse for creating the new SQuaRE series of International Standards:

- Both ISO/IEC 9126 and ISO/IEC 14598 have common normative, referential and functional roots.
- ISO/IEC 9126 and ISO/IEC 14598 form a complementary set of standards.
- The independent life cycles of both series have created inconsistencies between them.

The general goal of creating the SQuaRE set of International Standards was to move to a logically organized, enriched and unified series covering two main processes: software quality requirements specification and systems and software quality evaluation, supported by a systems and software quality measurement process. The purpose of the SQuaRE set of International Standards is to assist those developing and acquiring systems and software products with the specification and evaluation of quality requirements. It establishes criteria for the specification of systems and software product quality requirements, their measurement, and evaluation. It includes a two-part quality model for aligning customer definitions of quality with attributes of the development process. In addition, the series provides recommended measures of systems and software product quality attributes that can be used by developers, acquirers, and evaluators.

It has to be stressed that the SQuaRE series of International Standards is dedicated to systems and software product quality only. SQuaRE ISO/IEC 2500n — Quality Management Division addresses systems and software product quality requirements specification, measurement and evaluation, and is separate and distinct from the "Quality Management" of processes, which is defined in the ISO 9000 family of standards.

The major benefits of the SQuaRE series over its predecessor standards include:

- the coordination of guidance on systems and software product quality measurement and evaluation,
- guidance for the specification of systems and software product quality requirements, and
- harmonization with ISO/IEC 15939 in the form of Software product Quality Measurement Reference Model presented in ISO/IEC 25020, *Software engineering — Software product Quality Requirements and Evaluation (SQuaRE) — Measurement reference model and guide*.

The major differences between ISO/IEC 9126, ISO/IEC 14598 and SQuaRE series of International Standards are:

- the introduction of the new general reference model,
- the introduction of dedicated, detailed guides for each division,
- the introduction of systems product quality,
- the introduction of a data quality model,

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- the introduction of Quality Measure Elements within Quality Measurement Division,
- the introduction of the Quality Requirements Division,
- incorporation and revision of the evaluation processes,
- the introduction of guidance of practical use in form of examples,
- coordination and harmonization of the content with ISO/IEC 15939.

SQuaRE consists of the following five divisions:

- ISO/IEC 2500n - Quality Management Division,
- ISO/IEC 2501n - Quality Model Division,
- ISO/IEC 2502n - Quality Measurement Division,
- ISO/IEC 2503n - Quality Requirements Division,
- ISO/IEC 2504n - Quality Evaluation Division, and
- ISO/IEC 25050 to ISO/IEC 25099 - Extension division

SQuaRE provides:

- Terms and definitions,
- Reference models,
- General guide,
- Individual division guides, and
- International Standards for requirements specification, planning and management, measurement and evaluation purposes.

SQuaRE includes International Standards on quality model and measures, as well as on quality requirements and evaluation.

SQuaRE replaces the ISO/IEC 9126 series and the ISO/IEC 14598 series.

This part of SQuaRE series of standards is an International Standard with the goal of providing a common set of reference models, terminology, definitions and guidance for practical use of the associated standards and technical reports.

## Systems and software engineering — Systems and software Quality Requirements and Evaluation (SQuaRE) — Guide to SQuaRE

### 1 Scope

This International Standard provides guidance for the use of the new series of International Standards named *Systems and software Quality Requirements and Evaluation (SQuaRE)*. The purpose of this Guide is to provide a general overview of SQuaRE contents, common reference models and definitions, as well as the relationship among the documents, allowing users of the Guide a good understanding of those series of standards, according to their purpose of use. This International Standard also contains an explanation of the transition process between the old ISO/IEC 9126 and the ISO/IEC 14598 series and SQuaRE.

The SQuaRE series of International Standards is intended for, but not limited to, developers, acquirers and independent evaluators of systems and software products, particularly those responsible for defining systems and software quality requirements and for systems and software product evaluation. It is recommended that users of SQuaRE as well as ISO/IEC 14598 and ISO/IEC 9126 series of standards also use this International Standard as a guide to execute their tasks.

### 2 Conformance

There is no particular conformance clause for this document. Users, for their intended use of SQuaRE series of Standards should follow individual conformance clauses stated in each document of the series.

### 3 Normative references

This International Standard does not require any normative references. All informative references are presented in the Bibliography.

### 4 Terms and definitions

For the purposes of this document, the following definitions apply.

NOTE The definitions are common to all parts of SQuaRE series of International Standards.

#### 4.1 attribute

inherent property or characteristic of an entity that can be distinguished quantitatively or qualitatively by human or automated means

Note 1 to entry: Based on ISO/IEC 15939:2007.

Note 2 to entry: ISO 9000 distinguishes two types of attributes: a permanent characteristic existing inherently in something; and an assigned characteristic of a product, process or system (e.g. the price of a product, the owner of a product). The assigned characteristic is not an inherent quality characteristic of that product, process or system.

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**4.2**

**context of use**

users, tasks, equipment (hardware, software and materials), and the physical and social environments in which a product is used

[SOURCE: ISO 9241-11:1998]

**4.3**

**custom software**

software product developed for a specific application from a user requirements specification

**4.4**

**data**

reinterpretable representation of information in a formalized manner suitable for communication, interpretation or processing

[SOURCE: ISO/IEC 25012:2008]

**4.5**

**data quality**

degree to which the characteristics of data satisfy stated and implied needs when used under specified conditions

**4.6**

**developer**

individual or organisation that performs development activities (including requirements analysis, design, testing through acceptance) during the system or software life cycle process

[SOURCE: ISO/IEC 12207:2008, modified]

**4.7**

**end user**

individual person who ultimately benefits from the outcomes of the system or software

Note 1 to entry: The end user may be a regular operator of the system or software product or a casual user such as a member of the public.

**4.8**

**evaluation method**

procedure describing actions to be performed by the evaluator in order to obtain results for the specified measurement applied to the specified product components or on the product as a whole

**4.9**

**evaluation module**

package of evaluation technology for measuring systems and software quality characteristics, subcharacteristics or attributes

Note 1 to entry: The package includes evaluation methods and techniques, inputs to be evaluated, data to be measured and collected and supporting procedures and tools.

**4.10**

**evaluator**

individual or organisation that performs an evaluation

**4.11**

**external measure of system or software quality**

measure of the degree to which a system or software product enables its behaviour to satisfy stated and implied needs for the system including the software to be used under specified conditions

Note 1 to entry: Attributes of the behaviour can be verified and/or validated by executing the system or software product during testing and operation.



**EXAMPLE** The number of failures found during testing is an external measure of software quality related to the number of faults present in the computer system. The two measures are not necessarily identical since testing may not find all faults, and a fault may give rise to apparently different failures in different circumstances.

#### 4.12

##### **implied needs**

needs that may not have been stated but are actual needs

Note 1 to entry: Some implied needs only become evident when the system or software product is used in particular conditions.

**EXAMPLE** Implied needs include: needs not stated but implied by other stated needs and needs not stated because they are considered to be evident or obvious.

#### 4.13

##### **indicator**

measure that provides an estimate or evaluation of specified attributes derived from a model with respect to defined information needs

[SOURCE: ISO/IEC 15939:2007]

Note 1 to entry: In ISO/IEC 14598 this definition was: "a measure that can be used to estimate or predict another measure".

#### 4.14

##### **information need**

insight necessary to manage objectives, goals, risks, and problems

[SOURCE: ISO/IEC 15939:2007]

#### 4.15

##### **intermediate system or software product**

product of the system or software development process that is used as input to another stage of its development process

**EXAMPLE** Intermediate software products can include static and dynamic models, other documents and source code.

#### 4.16

##### **internal measure of software quality**

measure of the degree to which a set of static attributes of a software product satisfies stated and implied needs for the software product to be used under specified conditions

Note 1 to entry: Static attributes include those that relate to the software architecture, structure and its components.

Note 2 to entry: Static attributes can be verified by review, inspection, simulation and/or automated tools.

**EXAMPLE** Complexity measures and the number, severity, and failure frequency of faults found in a walk through are internal software quality measures made on the product itself.

#### 4.17

##### **maintainer**

individual or organisation that performs maintenance activities

Note 1 to entry: Based on the definition in ISO/IEC 12207:2008.

#### 4.18

##### **measure (noun)**

variable to which a value is assigned as the result of measurement

Note 1 to entry: The term "measures" is used to refer collectively to base measures, derived measures, and indicators.

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[SOURCE: ISO/IEC 15939:2007]

**4.19**

**measure (verb)**

make a measurement

[SOURCE: ISO/IEC 14598-1:1999]

**4.20**

**measurement**

set of operations having the object of determining a value of a measure

[SOURCE: ISO/IEC 15939:2007]

Note 1 to entry: Measurement can include assigning a qualitative category such as the language of a source program (ADA, C, Java, etc.).

**4.21**

**measurement process**

process for establishing, planning, performing and evaluating systems and software measurement within an overall project or organisational measurement structure

[SOURCE: ISO/IEC 15939:2007]

**4.22**

**process**

system of activities, which use resources to transform inputs into outputs

[SOURCE: ISO 9000:2005]

**4.23**

**product**

artifact that is produced, is quantifiable, and can be either an end item in itself or a component item

[SOURCE: Guide to the Project Management Body of Knowledge (PMBOK) Fourth Edition: 2008]

Note 1 to entry: ISO 9000:2005 defines four agreed generic product categories: hardware (e.g. engine mechanical part); software (e.g. computer program); services (e.g. transport); and processed materials (e.g. lubricant). Hardware and processed materials are generally tangible products, while software or services are generally intangible. Most products comprise elements belonging to different generic product categories. Whether the product is then called hardware, processed material, software, or service depends on the dominant element. Results could be components, systems, software, services, rules, documents, or many other items. The result could in some cases be many related individual results.

**4.24**

**quality in use**

degree to which a product or system can be used by specific users to meet their needs to achieve specific goals with effectiveness, efficiency, freedom from risk and satisfaction in specific contexts of use

Note 1 to entry: Before the product is released, quality in use can be specified and measured in a test environment designed and used exclusively by the intended users for their goals and contexts of use, e.g. User Acceptance Testing Environment.

**4.25**

**quality in use measure**

measure of the degree to which a product or system can be used by specific users to meet their needs to achieve specific goals with effectiveness, efficiency, freedom from risk, satisfaction and context coverage in specific contexts of use

#### 4.26

##### **quality measure element**

measure defined in terms of a property and the measurement method for quantifying it, including optionally the transformation by a mathematical function

[SOURCE: ISO/IEC 25021:2012]

Note 1 to entry: The system or software quality characteristic or subcharacteristic of the entity is derived afterwards by calculating a software quality measure.

#### 4.27

##### **quality model**

defined set of characteristics, and of relationships between them, which provides a framework for specifying quality requirements and evaluating quality

#### 4.28

##### **rating**

action of mapping the measured value to the appropriate rating level. Used to determine the rating level associated with the system or software product for a specific quality characteristic

#### 4.29

##### **rating level**

scale point on an ordinal scale, which is used to categorise a measurement scale

Note 1 to entry: The rating level enables software product to be classified (rated) in accordance with the stated or implied needs.

Note 2 to entry: Appropriate rating levels may be associated with the different views of quality i.e. Users', Managers' or Developers'.

#### 4.30

##### **scale**

ordered set of values, continuous or discrete, or a set of categories to which the attribute is mapped

[SOURCE: ISO/IEC 15939:2007]

EXAMPLE Types of scales are: a nominal scale which corresponds to a set of categories; an ordinal scale which corresponds to an ordered set of scale points; an interval scale which corresponds to an ordered scale with equidistant scale points; and a ratio scale which not only has equidistant scale point but also possesses an absolute zero. Measures using nominal or ordinal scales produce qualitative data, and measures using interval and ratio scales produce quantitative data.

#### 4.31

##### **software product**

set of computer programs, procedures, and possibly associated documentation and data

[SOURCE: ISO/IEC 12207:2008]

Note 1 to entry: Products include intermediate products, and products intended for users such as developers and maintainers.

Note 2 to entry: In SQuaRE standards software quality has the same meaning as software product quality.

#### 4.32

##### **software product evaluation**

technical operation that consists of producing an assessment of one or more characteristics of a software product according to a specified procedure

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### 4.33

#### **software quality**

capability of software product to satisfy stated and implied needs when used under specified conditions

Note 1 to entry: This definition differs from the ISO 9000:2005 quality definition mainly because the software quality definition refers to the satisfaction of stated and implied needs, while the ISO 9000 quality definition refers to the satisfaction of requirements.

### 4.34

#### **software quality characteristic**

category of software quality attributes that bears on software quality

Note 1 to entry: Software quality characteristics may be refined into multiple levels of subcharacteristics and finally into software quality attributes.

### 4.35

#### **software quality evaluation**

systematic examination of the extent to which a software product is capable of satisfying stated and implied needs

### 4.36

#### **stakeholder**

individual or organisation having a right, share, claim or interest in a system or in its possession of characteristics that meet their needs and expectations

[SOURCE: ISO/IEC 15288:2008]

Note 1 to entry: Stakeholders include, but are not limited to, end users, end user organisations, supporters, developers, producers, trainers, maintainers, disposers, acquirers, supplier organisations and regulatory bodies.

### 4.37

#### **supplier**

individual or organisation that enters into a contract with the acquirer for the supply of a system, software product or software service under the terms of the contract

[SOURCE: ISO/IEC 12207:2008]

### 4.38

#### **system**

combination of interacting elements organised to achieve one or more stated purposes

[SOURCE: ISO/IEC 15288:2008]

Note 1 to entry: A system may be considered as a product or as the services it provides.

Note 2 to entry: In practice, the interpretation of its meaning is frequently clarified by the use of an associative noun, e.g. aircraft system. Alternatively the word system may be substituted simply by a context dependent synonym, e.g. aircraft, though this may then obscure a system principles perspective.

### 4.39

#### **target of process**

system, software product or task executed by system or software product to which measurement or evaluation process is applied

### 4.40

#### **user**

individual or organisation that uses the system or software to perform a specific function

[SOURCE: ISO/IEC 15939:2007]

Note 1 to entry: Users may include operators, recipients of the results of operating the system or software, or developers or maintainers of system or software.

**4.41****validation**

confirmation, through the provision of objective evidence, that the requirements for a specific intended use or application have been fulfilled

[SOURCE: ISO 9000:2005]

Note 1 to entry: Validation in a life cycle context is the set of activities ensuring and gaining confidence that a system is able to accomplish its intended use, goals and objectives. [ISO/IEC 12207:2008]

**4.42****value**

number or category assigned to an attribute of an entity by making a measurement

**4.43****verification**

confirmation, through the provision of objective evidence, that specified requirements have been fulfilled

[SOURCE: ISO 9000:2005]

Note 1 to entry: Verification in a life cycle context is a set of activities that compares a product of the life cycle against the required characteristics for that product. This may include, but is not limited to, specified requirements, design description and the system itself. [ISO/IEC 12207:2008]

## **5 SQuaRE: Systems and software Quality Requirements and Evaluation - the series of standards on product quality requirements and evaluation**

### **5.1 Organisation of SQuaRE series of standards**

This clause presents an overview of the structure and the contents of SQuaRE series of standards. The objective is to give the users of this series of standards necessary information allowing the efficient choice of applicable documents.

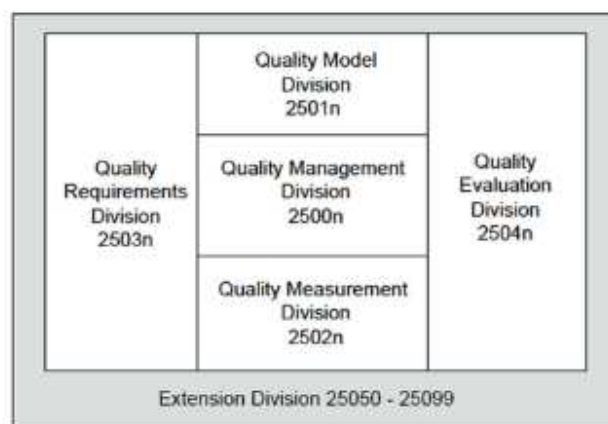


Figure 1 — Organisation of SQuaRE series of standards

Figure 1 illustrates the organisation of the SQuaRE series representing families of standards, further called Divisions.

The Divisions within SQuaRE model are:

- ISO/IEC 2500n - **Quality Management Division**. The International Standards that form this division define all common models, terms and definitions referred to by all other standards from the SQuaRE series. Referring paths (guidance through SQuaRE documents) and high level practical suggestions in applying proper standards to specific application cases offer help to all types of users. The division also provides requirements and guidance for a supporting function, which is responsible for the management of product requirements specification and evaluation.
- ISO/IEC 2501n - **Quality Model Division**. The International Standards that form this division present detailed quality models for systems and software product, quality in use and data. Practical guidance on the use of the quality model is also provided.
- ISO/IEC 2502n - **Quality Measurement Division**. The International Standards that form this division include a system and software product quality measurement reference model, mathematical definitions of quality measures, and practical guidance for their application. This division presents internal measures of software quality, external measures of system or software product quality and quality in use measures. Quality measure elements forming foundations for the latter measures are defined and presented.
- ISO/IEC 2503n - **Quality Requirements Division**. The International Standard that forms this division helps specifying quality requirements. These quality requirements can be used in the process of quality requirements elicitation for a product to be developed or as inputs for an evaluation process. The requirements definition process is mapped to technical processes defined in ISO/IEC 15288:2008.
- ISO/IEC 2504n - **Quality Evaluation Division**. The International Standards that form this division provide requirements, recommendations and guidelines for product evaluation, whether performed by independent evaluators, acquirers or developers. The support for documenting a measure as an Evaluation Module is also presented.
- ISO/IEC 25050-25099-**Extension Division**. SQuaRE extension (ISO/IEC 25050 to ISO/IEC 25099) is designated to contain system or software product quality International Standards and/or Technical Reports that address specific application domains or that can be used to complement one or more SQuaRE International Standards.

## 5.2 SQuaRE: overview of documents within series

The SQuaRE series of standards consists of 14 documents grouped in 5 Divisions within SQuaRE model. This clause presents a short overview of all documents with their classification to Divisions. The documents incorporate provisions from documents mentioned in brackets.

### 5.2.1 ISO/IEC 2500n - Quality Management Division

- 25000 - **Guide to SQuaRE**: Provides the SQuaRE architecture model, terminology, documents overview, intended users and associated parts of the series as well as reference models (ISO/IEC 9126-1 and ISO/IEC 14598-1).
- 25001 - **Planning and management**. Provides requirements and guidance for a supporting function, which is responsible for the management of system or software product requirements specification and evaluation. (ISO/IEC 14598-2).

### 5.2.2 ISO/IEC 2501n - Quality Model Division

- 25010 - **Quality model**: describes the model for system and software product quality and quality in use. The document presents characteristics and subcharacteristics for product quality and for quality in use (ISO/IEC 9126-1 and ISO/IEC 14598-1).

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- 25012 - Data quality model: defines a general data quality model for data retained in a structured format within a computer system. The data quality model defined in this International Standard can be used to establish data quality requirements, define data quality measures, or plan and perform data quality evaluations.

### 5.2.3 ISO/IEC 2502n - Quality Measurement Division

- 25020 - Measurement reference model and guide: presents introductory explanation and a reference model that is common to quality measure elements, measures of internal software quality, external system and software quality and quality in use. Also provides guidance to users for selecting or developing, and applying measures from the International Standards (ISO/IEC 9126-1, ISO/IEC TR 9126-2, ISO/IEC TR 9126-3, ISO/IEC TR 9126-4 and ISO/IEC 14598-1). On the date of its publication the document was dedicated to software only, but its content applies to systems as well.
- 25021 - Quality measure elements: presents definitions and specifications of a set of recommended base and derived measures, which are intended to be used during the whole system or software development life cycle. The document describes a set of measures that can be used as an input for the internal software quality, external system or software quality or system or software quality in use measurement.
- 25022 - Measurement of quality in use: describes a set of measures for measuring quality in use in terms of characteristics and subcharacteristics defined in ISO/IEC 25010, and is intended to be used together with ISO/IEC 25010. Provides guidance to use the measures of systems and software quality in use (ISO/IEC TR 9126-4).
- 25023 - Measurement of system and software product quality: defines quality measures for quantitatively measuring system and software product quality in terms of characteristics and subcharacteristics defined in ISO/IEC 25010, and is intended to be used together with ISO/IEC 25010 (ISO/IEC TR 9126-2, -3).
- 25024 - Measurement of data quality: defines quality measures for quantitatively measuring data quality in terms of characteristics defined in ISO/IEC 25012.

### 5.2.4 ISO/IEC 2503n - Quality Requirements Division

- 25030 - Quality requirements: provides requirements and guidance for the process used to specify quality requirements, as well as requirements and recommendations for quality.

### 5.2.5 ISO/IEC 2504n - Quality Evaluation Division

- 25040 - Evaluation process: contains requirements and recommendations for the evaluation of system or software product quality and clarifies the general concepts. It provides a process description for evaluating system or software product quality and states the requirements for the application of this process (ISO/IEC 14598-1).
- 25041 - Evaluation guide for developers, acquirers and independent evaluators: contains specific requirements and recommendations for developers, acquirers and evaluators (ISO/IEC 14598-3, -4, -5).
- 25045 - Evaluation modules for recoverability: provides the specification to evaluate the subcharacteristic of recoverability defined under the characteristic of reliability of the quality model. It determines the external measures of systems and software quality of resiliency and autonomic recovery index when the information system composed of one or more software products' execution transactions is subjected to a series of disturbances.

### 5.2.6 ISO/IEC 25050 to 25099 -SQuARE extension

- 25051 - Requirements for quality of Ready to Use Software Product (RUSP) and instructions for testing: establishes quality requirements for RUSP; requirements for test documentation for the

testing of RUSP, including test plan, test description, and test results; and instruction for conformity evaluation of RUSP (ISO/IEC 12119).

- 25060 - Common Industry Format (CIF) for usability: General framework for usability-related information: describes a potential family of standards, named the Common Industry Formats (CIF), that document the specification and evaluation of the usability of interactive systems. Provides a general overview of the CIF Framework and contents, definitions, and the relationship of the framework elements.
- 25062 - Common Industry Format (CIF) for usability test reports: intended to be used to report the measures obtained from a test of usability as defined in ISO 9241-11: effectiveness, efficiency and satisfaction in a specified context of use.
- 25063 - Common Industry Format (CIF) for usability: Context of use description: specifies the contents of both high-level and detailed descriptions of context of use for an existing, intended, designed or implemented system
- 25064 - Common Industry Format (CIF) for usability: User needs report: describes the Common Industry Format (CIF) for reporting user needs. This document provides specifications for the contents and sample format of user needs reports, including the content elements to be provided.
- 25065 - Common Industry Format (CIF) for usability: User Requirements Specification: describes the Common Industry Format (CIF) for User Requirements Specifications. This international standard provides specification of the format and contents of user requirements specifications, and the relationship of elements
- 25066 - Common Industry Format (CIF) for usability: Usability Evaluation Report: describes the Common Industry Format (CIF) for Evaluation Reports. The purpose of this standard is to provide specifications for the contents of evaluation reports, including definitions and the relationship of elements.

### 5.3 SQuaRE common models

#### 5.3.1 General

The following subclauses present all common models used within the SQuaRE series of standards. As these models form a basis for practical navigation through the series they are further referred by all dedicated and/or detailed standard documents. The following models are presented:

- SQuaRE general reference model - navigation guide through SQuaRE series of standards as a function of user's task(s).
- System and software quality life cycle model - the views of internal quality, external quality and quality in use during the system or software life cycle.
- Quality model structure - categorisation of systems and software quality into characteristics, subcharacteristics and quality attributes.



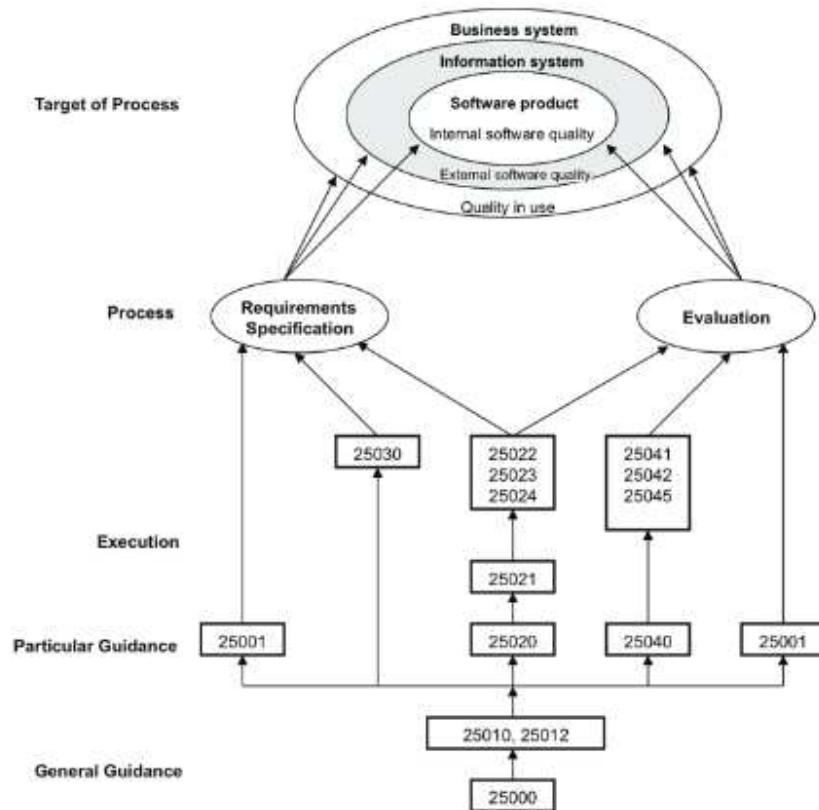


Figure 2 — SQuaRE general reference model

### 5.3.2 SQuaRE general reference model

SQuaRE general reference model (Figure 2) was created to help the users navigate through SQuaRE series of standards.

The choice of the appropriate standards and documents from the SQuaRE series depends upon the user's role and information needs. It is recommended that all users initially consult the general guidance (ISO/IEC 25000) in addition to the parts that are relevant to their specific information need and role.

**NOTE** the requirements specification and evaluation processes are not yet addressing data quality evaluation.

### 5.3.3 System and software product quality life cycle model

The system and software product quality life cycle model (Figure 3) addresses system and software product quality in three principal phases of its life cycle: product under development, product in operation and product in use.

- The phase of a product under development is the subject of internal measures of software quality.
- The phase of a product in operation is the subject of external measures of system and software quality, and
- The phase of a product in use is the subject of software measures of quality in use.

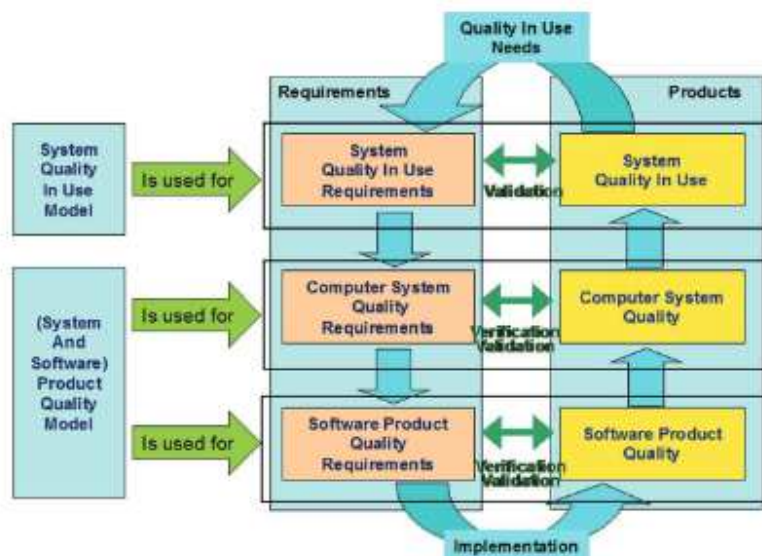


Figure 3 — Systems and software product quality life cycle model

The systems and software product quality life cycle model also indicates that the implementation of systems and software quality requires a process similar to the system or software development process for each type of quality: requirements, implementation and validation of the results.

Quality in use requirements specify the required level of quality from the end user's point of view. These requirements are derived from needs of each context of use. Quality in use requirements are used as the target for validation of the system or software product by the user. Requirements for quality in use characteristics should be stated in the quality requirements specification using quality in use measures and used as criteria when a product is evaluated.

**NOTE** Quality in use requirements contribute to identifying and defining external system or software quality requirements.

External system or software quality requirements specify the required level of quality from the external view. They include requirements derived from user quality requirements, including quality in use requirements. External system or software quality requirements are used as the target for technical verification and validation of the system or software product. Requirements for external

system or software quality characteristics should be stated quantitatively in the quality requirements specification using external measures and used as criteria when a product is evaluated.

NOTE 1 External system or software quality requirements contribute to identifying and defining internal software quality requirements

NOTE 2 External software quality evaluation can be used to predict quality in use.

Internal software quality requirements specify the level of required quality from the internal view of the product. They include requirements derived from external system or software quality requirements. Internal software quality requirements are used to specify properties of intermediate software products. Internal software quality requirements may also be applied to deliverable, non-executable software products such as documentation and manuals. Internal software quality requirements can be used as targets for verification at various stages of development. They can also be used for defining strategies of development and criteria for evaluation and verification during development. This includes the use of additional measures (e.g. for reusability), which are outside of the scope of SQuaRE series of standards. Internal quality requirements should be specified quantitatively in terms of internal measures.

NOTE 1 Internal software quality evaluation can be used to predict external software quality.

#### 5.3.4 Quality model structure

SQuaRE quality model categorises system and software quality into characteristics which are further subdivided into subcharacteristics and/or quality attributes.

SQuaRE quality model consists of three parts, the model for system and software product quality, the model for quality in use and the model for data quality, being presented in details in ISO/IEC 25010 – Systems and software engineering: Software and Software Quality Requirements and Evaluation (SQuaRE) – System and software quality models and ISO/IEC 25012 – Systems and software engineering: Software and Software Quality Requirements and Evaluation (SQuaRE) – data quality model. In these documents the detailed definitions for each quality characteristic and the subcharacteristics of the system or software product and data are given.

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## **Annex A** **(informative)**

### **Relationship between SQuaRE series and other ISO Standards**

#### **A.1 ISO/IEC 12207:2008**

This standard establishes a common framework for software life cycle processes, with well-defined terminology. It contains processes, activities and tasks that are to be applied during the supply, development, operation and maintenance of software products.

During the development process, the developer shall establish and document software requirements, including the quality characteristics specifications. Guidance for specifying quality characteristics may be found in ISO/IEC 25010. ISO/IEC 25022, ISO/IEC 25023 and ISO/IEC 25024 can be used to support assigning quantitative target values for the quality requirements. SQuaRE series of International Standards can also be used during the development process in order to evaluate intermediate and final software products.

#### **A.2 ISO/IEC 15504 series of standards**

ISO/IEC 15504 is a 10 part standard based on experiences gained in the SPICE Project. It can be used for software process assessment and process capability determination.

The first basic assumption is that the quality of a software product is largely influenced by the process used to develop it. Therefore, to improve the quality of a software product, the quality of the software process needs to be improved. The second assumption is that the quality of a software process is the extent to which this process is explicitly defined, managed, measured and continuously improved. This is represented by the capability of a process.

The assessment inputs are defined in ISO/IEC 15504-2 – Performing an assessment. ISO/IEC 25000 series of standards may be used as a reference when assessing the measurement and quality process of the organisation. The standard provides guidance and identifies the Measurement Framework for process capability and the requirements for:

- performing an assessment;
- Process Reference Models;
- Process Assessment Models;
- verifying conformity of process assessment.

#### **A.3 ISO 9000 family of standards**

The ISO 9000 family of standards, listed below, were developed to assist organisations, of all types and sizes, and regardless of product provided, to implement and operate effective quality management systems:

- ISO 9000 describes fundamentals of quality management systems and specifies the terminology for quality management systems;
- ISO/IEC 90003 provides guidance for organisations in the application of ISO 9001:2000 to the acquisition, supply, development, operation and maintenance of computer software;

- ISO 9001 specifies requirements for a quality management system, where an organisation needs to demonstrate its ability to provide products that fulfill customer and applicable regulatory requirements, and aims to enhance customer satisfaction;
- ISO 9004 provides guidelines that consider both the effectiveness and efficiency of the quality management system. The aim of this standard is improvement of the performance of the organisation and satisfaction of customers and other interested parties;
- ISO 19011 provides guidance on auditing quality and environmental management systems.

Together they form a coherent set of quality management system standards facilitating mutual understanding in national and international trade. The quality management system requirements specified in these International Standards are complementary to requirements for products, such as those specified in ISO/IEC JTC 1/SC 7 Software and System Engineering standards. The quality management system approach encourages organisations to analyse customer requirements, define the processes that contribute to the achievement of a product, which is acceptable to the customer, and keep these processes under control. A quality management system provides the framework for continual improvement, to increase the probability of enhancing customer satisfaction and improve the competitive advantage of the organisation. It provides confidence to the organisation and its customers that it is able to provide products that consistently fulfill requirements.

ISO 9000 describes fundamentals of quality management systems, which form the subject of the ISO 9000 family of standards, and defines related terms. This International Standard is applicable to the following: a) organisations seeking advantage through the implementation of a quality management system, b) organisations seeking confidence from their suppliers that their product requirements will be satisfied, c) users of the products, d) those concerned with a mutual understanding of the terminology used in quality management (e.g. suppliers, customers, regulators), e) those internal or external to the organisation who assess the quality management system or audit it for conformity with the requirements of ISO 9001 (e.g. auditors, regulators, certification/registration bodies), f) those internal or external to the organisation, who give advice or training on the quality management system appropriate to that organisation, and: g) developers of related standards.

ISO/IEC 90003 provides guidance for organisations in the application of ISO 9001:2000 to the acquisition, supply, development, operation and maintenance of computer software.

The guidance applies to computer system:

- as part of a commercial contract with another organisation;
- as a product available for a market sector;
- in support of the business processes of the organisation;
- as software embedded in a hardware product; and
- for provision of software operations, maintenance and support services

Frequent references are provided, to additional guidance in the standards for Software Engineering defined by ISO/IEC/JTC1/SC7, in particular, ISO/IEC 9126, ISO/IEC 12207, ISO/IEC 15939 and ISO/IEC 15504.

This International Standard identifies the issues which should be addressed and is independent of the technology, life cycle models, development processes, sequence of activities, or organisation structure used by an organisation. The guidance and identified issues are intended to be comprehensive but not exhaustive. Where the scope of an organisation's activities includes areas other than computer software development, the relationship between the computer software elements of that organisation's quality management system and the remaining aspects should be clearly documented within the quality management system as a whole.



## ISO/IEC 25000:2014(E)

ISO 9001 specifies requirements for a quality management system where an organisation:

- needs to demonstrate its ability to consistently provide product that meets customer and applicable regulatory requirements, and
- aims to enhance customer satisfaction through the effective application of the system, including
  - processes for continual improvement of the system and the assurance of conformity to customer and
  - applicable regulatory requirements.

All requirements of this International Standard are generic and are intended to be applicable to all organisations, regardless of type, size and product provided. Where any requirement(s) of this International Standard cannot be applied due to the nature of the organisation and its product, these can be considered for exclusion, but such exclusions are limited to a specified subset of the requirements. Such exclusions must be justified, and cannot affect the organisation's ability, or responsibility, to provide product that meets customer and applicable regulatory requirements.

ISO 9004 provides guidelines beyond the requirements given in ISO 9001, in order to consider both the effectiveness and efficiency of a quality management system, and consequently the potential for improvement of the performance of the organisation. When compared to ISO 9001, the objectives of customer satisfaction and product quality are extended to include the satisfaction of interested parties and the performance of the organisation.

**NOTE** In the context of this International Standard, "interested parties" is defined as a person or group having an interest in the performance or success of the organisation (e.g. customers, owners, people in the organisation, suppliers, bankers, unions, partners or society).

This International Standard is applicable to the processes of the organisation and consequently, the quality management principles on which it is based can be deployed throughout the organisation. The focus of this International Standard is the achievement of ongoing improvement, measured through the satisfaction of customers and other interested parties.

This International Standard consists of guidance and recommendations and is not intended for certification, regulatory or contractual use, or as a guide to the implementation of ISO 9001.

ISO 19011 provides guidance on the principles of auditing, the management of audit programs, the conduct of quality management system audits and environmental management system audits as well as the competence of quality and environmental management system auditors.

It is applicable to all organisations having a need to conduct and manage internal or external software quality and/or environmental management system audits.

The application of this International Standard to other types of audits/evaluations/assessments is possible, in principle, but special consideration should be paid to defining the competence needed by the audit team members in such cases.

## A.4 ISO/IEC 15939:2007

SQuaRE series of standards has a close relationship with ISO/IEC 15939 since the measurement related definitions have been harmonised and the measurement process from ISO/IEC 15939 can be tailored for the evaluation process defined in SQuaRE.

ISO/IEC 15939 defines the common processes and activities that are necessary to successfully identify, define, select, apply, validate, and improve software measures within an overall project or organisational measurement structure. It will also identify those principles and characteristics of the measurement process required to effectively address software technical and managerial information needs within a project or organisational context.

The purpose of ISO/IEC 15939 standard is to:

- provide a commonly defined but tailorable measurement process, which supports the implementation of specific measures required by software engineering domains,
- establish the characteristics of a measurement process which support the aggregation of process and product measurement data into meaningful information,
- establish a basis for the collection and use of measurement data over a range of projects to support project estimation and tracking, product evaluation, and process assessment and improvement requirements,
- define common measurement terminology applicable to all users and to the entire life cycle.

#### A.5 ISO/IEC 15288:2008

ISO/IEC 15288 establishes a common framework for describing the life cycle systems created by humans. It defines a set of processes and associated terminology. These processes can be applied at any level in the hierarchy of a system's structure. Selected sets of these processes can be applied throughout the life cycle for managing and performing the stages of a system's life cycle. The difference between ISO/IEC 12207 and 15288 is the emphasis to Stakeholder Requirements Definition Process. The purpose of ISO/IEC 15288 specifically in the Technical Process is to:

- define the requirements for a system that can provide the services needed by users and other stakeholder in a defined environment,
- transform the stakeholder, requirement-driven view of desired services into a technical view of a required product that could deliver those services,
- synthesise a solution that satisfies system requirements by architectural design,
- produce a specified system element,
- assemble a system that is consistent with the architectural design,
- confirm that the specified design requirements are fulfilled by the system,
- establish a capability to provide services specified by stakeholder requirements in the operational environment,
- provide objective evidence that the services provided by a system when in use comply with stakeholder requirements,
- sustain the capability of the system to provide a service.

The process used for developing quality requirements in ISO/IEC 25030 is based on the technical processes in ISO/IEC 15288. On the other hand, the quality requirements and evaluation process defined in SQuaRE can be used to help the "Stakeholder Requirements Definition Process" and "Validation process" in ISO/IEC 15288.

#### A.6 ISO/IEC 29119 series of standards

The purpose of ISO/IEC 29119 Software Testing is to define an internationally-agreed standard for software testing that can be used by any organization when performing any form of software testing. As of today the series consist of:

- ISO/IEC 29119-1 Software and systems engineering -- Software testing -- Part 1: Concepts and definitions
- ISO/IEC 29119-2 Software and systems engineering -- Software testing -- Part 2: Test process

## ISO/IEC 25000:2014(E)

- ISO/IEC 29119-3 Software and systems engineering -- Software testing -- Part 3: Test documentation
- ISO/IEC 29119-4 Software and systems engineering -- Software testing -- Part 4: Test techniques

Part 1 is informative providing definitions, context and guidance for the other parts. The document includes a description of the concepts of software testing and ways to apply the software testing process defined in this standard.

The test process model that this part of the standard is based on is defined in detail in ISO/IEC 29119-2 Test Process. ISO/IEC 29119-2 covers the software testing processes at the organizational level, test management level and for dynamic test levels.

Templates and examples of test documentation that are produced during the testing process are defined in ISO/IEC 29119-3 Test Documentation. Software testing techniques that can be used during testing are defined in ISO/IEC 29119-4 Test Techniques.

The interrelations between ISO/IEC 29119 series and ISO/IEC 25000 SQuaRE series may be observed particularly in ISO/IEC 29119-4:— Test Techniques, where the testing of quality characteristics is being discussed. From more practical software engineering perspective it is usually recommended that software tests and software quality measurements and evaluation be combined into one coherent and effective test campaign.



## Annex B (informative)

### History and transition process between ISO/IEC 9126, ISO/ IEC 14598 and ISO/IEC 25000 SQuaRE series of standards

#### B.1 History

The ISO/IEC 25000 SQuaRE series was originally created at the WG6 Kanazawa meeting in 1999 and revised at the Madrid meeting in 2000. The need for a unified series of standards in software quality domain has been verified during the analysis of existing ISO 9126 and ISO 14598 series that has been concluded by the list of several necessary improvements.

The proposal after first adjustment and further building a necessary framework was approved at JTC 1/SC7 Madrid plenary meeting. During WG6 Prague meeting, in November 2000, the version was revised and more detailed content was defined.

During JTC1/SC7 Nagoya plenary meeting in May 2001 new numbers were assigned to the SQuaRE documents. The compatibility among different guides within the series was discussed and addressed in the new version. This version was later issued to WD and CD registration.

During JTC1/SC7 Busan, Korea plenary meeting in May 2002, the final numbering of the series has been approved and applied. The major revisions of all the documents within the series have also been commenced. From this moment on the continuous development of the series began and is being continued to date with majority of standards already published.

#### B.2 Relationship between ISO/IEC 9126 and ISO/IEC 14598 series and SQuaRE series of standards

The purpose of information presented in [Table B.1](#) is to give a clear guidance to experienced users of ISO/IEC 9126 and ISO/IEC 14598 helping easily translate their existing practice into seamless use of SQuaRE series of standards.

**Table B.1 — Relationship and transition process between SQuaRE series of standards and  
ISO/IEC 9126, ISO/IEC 14598**

ISO/IEC 25000 SQuaRE Series	ISO/IEC 9126 and ISO/IEC 14598 Series
ISO/IEC 25000 Guide to SQuaRE	ISO/IEC 9126-1, ISO/IEC 14598-1
ISO/IEC 25001 Planning and management	ISO/IEC 14598-2
ISO/IEC 25010 System and software quality models	ISO/IEC 9126-1
ISO/IEC 25012 Data Quality model	N/A
ISO/IEC 25020 Measurement reference model and guide	ISO/IEC 9126-1, -2, -3, -4
ISO/IEC 25021 Quality measure elements	N/A
ISO/IEC 25022 Measurement of quality in use	ISO/IEC TR 9126-4
ISO/IEC 25023 Measurement of system and software product quality	ISO/IEC TR 9126-2, -3
ISO/IEC 25024 Measurement of data quality	N/A
ISO/IEC 25030 Quality requirements	N/A

Table B.1 (continued)

ISO/IEC 25000 SQuaRE Series	ISO/IEC 9126 and ISO/IEC 14598 Series
ISO/IEC 25040 Evaluation process	ISO/IEC 14598-1
ISO/IEC 25041 Evaluation guides for developers, acquirers and independent evaluators	ISO/IEC 14598-3, -4, -5
ISO/IEC 25045 Evaluation module for recoverability	N/A

The left column lists all standards from SQuaRE series while the right column indicates parts from ISO/IEC 9126 and ISO/IEC 14598 that relate to them (by either being incorporated into the new SQuaRE series or being entirely replaced).

## Annex C (informative)

### Examples of the application of ISO/IEC 25000 SQuaRE series of standards

The particular examples are presented in form of matrix where the column defines the TYPE OF USER, the row the TYPE OF TASK and fields of intersection contain standards that support execution of the TASK

Table C.1 — Examples of the application of ISO/IEC 25000 SQuaRE series of standards

TASK	USER: Developer	USER: Acquirer	USER: Evaluator
Definition of general quality requirements	ISO/IEC 25000	ISO/IEC 25000	ISO/IEC 25000
	ISO/IEC 25010	ISO/IEC 25010	ISO/IEC 25010
	ISO/IEC 25012	ISO/IEC 25012	ISO/IEC 25012
	ISO/IEC 25030	ISO/IEC 25030	ISO/IEC 25030
	ISO/IEC 25041 (optional)	ISO/IEC 25041 (optional)	ISO/IEC 25041 (optional)
Definition of user quality requirements	ISO/IEC 25000	ISO/IEC 25000	ISO/IEC 25000
	ISO/IEC 25010	ISO/IEC 25010	ISO/IEC 25010
Validation of completeness of quality requirements definition	ISO/IEC 25012	ISO/IEC 25012	ISO/IEC 25012
	ISO/IEC 25020	ISO/IEC 25020	ISO/IEC 25020
	ISO/IEC 25021	ISO/IEC 25021	ISO/IEC 25021
	ISO/IEC 25022	ISO/IEC 25022	ISO/IEC 25022
	ISO/IEC 25023	ISO/IEC 25023	ISO/IEC 25023
	ISO/IEC 25024	ISO/IEC 25024	ISO/IEC 25024
	ISO/IEC 25030	ISO/IEC 25030	ISO/IEC 25030
	ISO/IEC 25041 (optional)	ISO/IEC 25041 (optional)	ISO/IEC 25041 (optional)
Evaluation of system or software product during development	ISO/IEC 25000	NA	ISO/IEC 25000
	ISO/IEC 25001		ISO/IEC 25001
	ISO/IEC 25010		ISO/IEC 25010
	ISO/IEC 25012		ISO/IEC 25012
	ISO/IEC 25020		ISO/IEC 25020
	ISO/IEC 25030		ISO/IEC 25030
	ISO/IEC 25040		ISO/IEC 25040
	ISO/IEC 25021		ISO/IEC 25021
	ISO/IEC 25022 and/or		ISO/IEC 25022 and/or
	ISO/IEC 25023 and/or		ISO/IEC 25023 and/or
	ISO/IEC 25024		ISO/IEC 25024
	ISO/IEC 25041		ISO/IEC 25041

Table C.1 (continued)

TASK	USER: Developer	USER: Acquirer	USER: Evaluator
Evaluation of system or software product after development	ISO/IEC 25000	NA	ISO/IEC 25000
	ISO/IEC 25001		ISO/IEC 25001
	ISO/IEC 25010		ISO/IEC 25010
	ISO/IEC 25012		ISO/IEC 25012
	ISO/IEC 25020		ISO/IEC 25020
	ISO/IEC 25030		ISO/IEC 25030
	ISO/IEC 25040		ISO/IEC 25040
	ISO/IEC 25021		ISO/IEC 25021
	ISO/IEC 25023		ISO/IEC 25023
	ISO/IEC 25024		ISO/IEC 25024
	ISO/IEC 25041		ISO/IEC 25041
Evaluation of results of using the system or software product	NA	ISO/IEC 25000	ISO/IEC 25000
		ISO/IEC 25001	ISO/IEC 25001
		ISO/IEC 25010	ISO/IEC 25010
		ISO/IEC 25012	ISO/IEC 25012
		ISO/IEC 25020	ISO/IEC 25020
		ISO/IEC 25030	ISO/IEC 25030
		ISO/IEC 25040	ISO/IEC 25040
		ISO/IEC 25021	ISO/IEC 25021
		ISO/IEC 25023	ISO/IEC 25023
		ISO/IEC 25024	ISO/IEC 25024
		ISO/IEC 25041	ISO/IEC 25041
Acquisition of custom system or software product with evaluation during development	NA	ISO/IEC 25000	ISO/IEC 25000
		ISO/IEC 25001	ISO/IEC 25001
		ISO/IEC 25010	ISO/IEC 25010
		ISO/IEC 25012	ISO/IEC 25012
		ISO/IEC 25020	ISO/IEC 25020
		ISO/IEC 25030	ISO/IEC 25030
		ISO/IEC 25040	ISO/IEC 25040
		ISO/IEC 25021	ISO/IEC 25021
		ISO/IEC 25022	ISO/IEC 25022
		ISO/IEC 25023	ISO/IEC 25023
		ISO/IEC 25024	ISO/IEC 25024
		ISO/IEC 25041	ISO/IEC 25041

Table C.1 (continued)

TASK	USER: Developer	USER: Acquirer	USER: Evaluator
Acquisition of ready-to-use software product (RUSP)	NA	ISO/IEC 25000	ISO/IEC 25000
		ISO/IEC 25001	ISO/IEC 25001
		ISO/IEC 25010	ISO/IEC 25010
		ISO/IEC 25012	ISO/IEC 25012
		ISO/IEC 25020	ISO/IEC 25020
		ISO/IEC 25021	ISO/IEC 25021
		ISO/IEC 25023	ISO/IEC 25023
		ISO/IEC 25030	ISO/IEC 25030
		ISO/IEC 25040	ISO/IEC 25040
		ISO/IEC 25024	ISO/IEC 25024
		ISO/IEC 25041	ISO/IEC 25041
Maintenance of system or software product NOTE The role of Maintainer may be played either by Developer or Acquirer (Acquirer's dedicated entity)	ISO/IEC 25000	ISO/IEC 25000	NA
	ISO/IEC 25010	ISO/IEC 25010	
	ISO/IEC 25012	ISO/IEC 25012	
	ISO/IEC 25020	ISO/IEC 25020	
	ISO/IEC 25030	ISO/IEC 25030	
	ISO/IEC 25021	ISO/IEC 25021	
	ISO/IEC 25022	ISO/IEC 25022	
	ISO/IEC 25023	ISO/IEC 25023	
	ISO/IEC 25024	ISO/IEC 25024	

## Annex D (informative)

### Background and needs for SQuaRE series

#### D.1 Rapid evolution of Information Technologies

This Annex presents rapid evolution of Information Technologies as background of needs for systems and software quality improvement, which justifies need for SQuaRE series of international standards.

Rapid ICT evolution causes an emergence of many new concepts of application systems and software products.

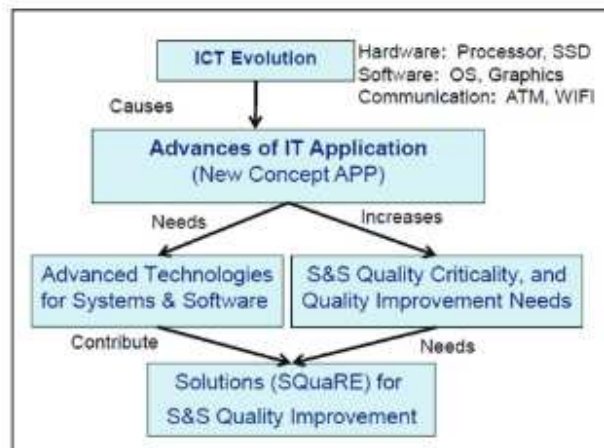


Figure D.1 — Cause effects diagram on ICT evolution and needs for SQuaRE

The first quality model ISO/IEC 9126 was published in 1991, its revision ISO/IEC 9126-1 was published a decade later in 2001 and the most recent ISO/IEC 25010 SQuaRE quality model published in 2011 is based on these standards. Information and Communication Technologies have made really remarkable evolution. Table D.1 shows some examples of such evolution. Microprocessor speed has become 2000 times faster during 20 years, VLSI memory is 4000 times larger and speed of communication network grew more than 100000 times.

Table D.1 — ICT evolution examples

	1991	2001	2011
Micro Processor	80486SX 25 MHz 20 MIPS	Pentium IV 2 GHz	Intel Core i5 2.8 GHz 50 KMIPS
VLSI Memory	640 KB ~ 10 MB	256 MB	2~4 GB
Display	CRT 640×400	LCD XGA(1024×768) ~ 1280×1024	LCD SXGA: 1280×1024, 1920×1080
Hard Disk / SSD Storage	20~40 MB	80 GB	SSD: 256 GB ~ HDD: 1 TB ~
Communication Network	9600 bps Internet	ASDL 12 Mbps	Optical Network 100 Mbps ~ 1 Gbps WIFI: 40 Mbps

The enormous progress and evolution have enabled new applications, for example, video movie, Internet shopping and cloud computing. In order to develop such new application systems and software products, new systems and software technologies are required.

## D.2 Needs for quality improvement

In general, new application systems need larger, more complex and higher quality software. Almost every software product, such as MS-Word, Google, Adobe Acrobat, have become larger and larger as the product versions up.

Every application system and software product needs different quality property based on its purpose and context of use. Figure D.2 shows brief image of relations between application S&SP and important quality characteristics and sub-characteristics.

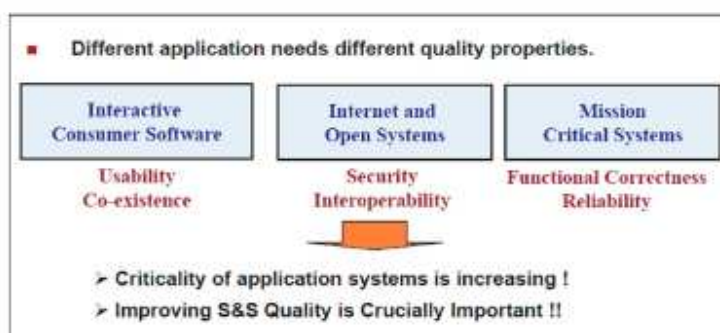


Figure D.2 — Quality needs for different Application

For example, for interactive consumer software, such as word processor, usability and co-existence with other software, such as mailing software, considered important. For Internet and open systems, security and interoperability are most important.

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