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# Systems and software engineering — Systems and software quality requirements and evaluation (SQuaRE) — Measurement of quality in use

*Ingénierie des systèmes et du logiciel — Exigences de qualité et évaluation des systèmes et du logiciel (SQuaRE) — Mesurage de la qualité lors de l'utilisation*

Reference number
ISO/IEC 25022:2016(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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

The committee responsible for this document is ISO/IEC JTC 1, *Information technology*, SC 7, *Software and systems engineering*.

This first edition of ISO/IEC 25022, which is a part of the SQuaRE series of standards, cancels and replaces ISO/IEC 9126-4:2004, with the following changes:

— measures are given for the revised quality model for quality in use in ISO/IEC 25010;

— measures are categorized as generally applicable, could be used in a wide range of situations, or specialized for specific needs;

— annexes that were common to ISO/IEC 9126-2, ISO/IEC 9126-3, and ISO/IEC 9126-4 have been removed (and might be included in a future revision of ISO/IEC 25020).

The SQuaRE series of standards consists of the following divisions under the general title *Systems and software quality requirements and evaluation:*

— 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

— ISO/IEC 25050 — 25099 SQuaRE Extension Division

Annexes A, B, C, D, E, F and G are for information only.

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# Introduction

This International Standard is a part of the SQuaRE series of International Standards. It provides a set of measures for the characteristics of quality in use (defined in ISO/IEC 25010) that can be used for specifying quality in use requirements (in conjunction with ISO/IEC 25030) and measuring and evaluating quality in use (in conjunction with ISO/IEC 25040 and ISO/IEC 25041).

The quality measures included in this International Standard were selected based on their practical value. They are based on established practice (including, for example, Reference [17]). They are not intended to be exhaustive, and users of this International Standard are encouraged to refine them, if necessary.

**Quality Measurement Division**

This International Standard is a part of ISO/IEC 2502n Quality Measurement Division of SQuaRE series that currently consists of the following International Standards:

— ISO/IEC 25020 — Measurement reference model and guide: provides a reference model and guide for measuring the quality characteristics defined in ISO/IEC 2501n Quality Model Division;

— ISO/IEC 25021 — Quality measure elements: provides a format for specifying Quality Measure Elements and some examples of QMEs that can be used to construct software quality measures;

— ISO/IEC 25022 — Measurement of quality in use: provides measures, including associated measurement functions for the quality characteristics in the quality in use model;

— ISO/IEC 25023 — Measurement of system and software product quality: provides measures, including associated measurement functions and QMEs for the quality characteristics in the product quality model;

— ISO/IEC 25024 — Measurement of data quality: provides measures, including associated measurement functions and QMEs for the quality characteristics in the data quality model.

Figure 1 depicts the relationship between this International Standard and the other standards in the ISO/IEC 2502n division.

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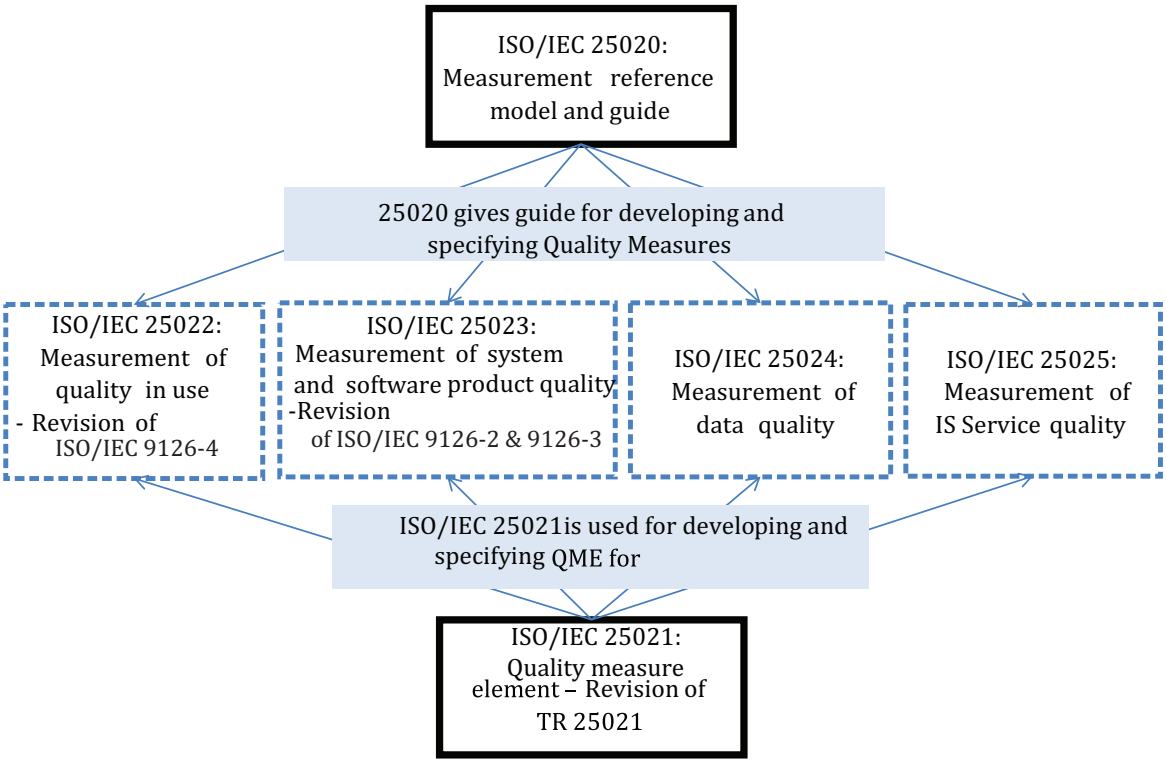



**Figure 1 — Structure of the Quality Measurement Division**

### Outline and Organization of SQuaRE Series

The SQuaRE series consists of five main divisions and extension division. The outline of each divisions within the SQuaRE series are as follows.

— ISO/IEC 2500n — Quality Management Division. The standards that form this division define all common models, terms, and definitions referred further by all other standards from SQuaRE series. The division also provides requirements and guidance for the planning and management of a project.

— ISO/IEC 2501n — Quality Model Division. The standards that form this division provide quality models for system/software products, quality in use, and data. An IT service quality model is under development. Practical guidance on the use of the quality model is also provided.

— ISO/IEC 2502n — Quality Measurement Division. The standards that form this division include a system/software product quality measurement reference model, definitions of quality measures, and practical guidance for their application. This division presents internal measures of software quality, external measures of software quality, and quality in use measures. Quality measure elements forming foundations for the quality measures are defined and presented.

— ISO/IEC 2503n — Quality Requirements Division. The standard that forms this division helps specifying quality requirements. These quality requirements can be used in the process of quality requirements elicitation for a system/software product to be developed, designing a process for achieving necessary quality, or as inputs for an evaluation process.

— ISO/IEC 2504n — Quality Evaluation Division. The standards that form this division provide requirements, recommendations, and guidelines for system/software 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 to ISO/IEC 25099 are reserved for SQuaRE extension International Standards, which currently include ISO/IEC 25051 and the ISO/IEC 25060 to ISO/IEC 25069.


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# Systems and software engineering — Systems and software quality requirements and evaluation (SQuaRE) — Measurement of quality in use

## 1 Scope

This International Standard defines quality in use measures for the characteristics defined in ISO/IEC 25010, and is intended to be used together with ISO/IEC 25010. It can be used in conjunction with the ISO/IEC 2503n and the ISO/IEC 2504n standards or to more generally meet user needs with regard to product or system quality.

This International Standard contains the following:

— a basic set of measures for each quality in use characteristic;

— an explanation of how quality in use is measured.

This International Standard provides a suggested set of quality in use measures to be used with the quality in use model in ISO/IEC 25010. They are not intended to be an exhaustive set.

It includes as informative annexes examples of how to measure context coverage (Annex A), options for normalising quality in use measures (Annex B), use of ISO/IEC 25022 for measuring usability in ISO 9241-11 (Annex C), a quality in use evaluation process (Annex D), the relationship between different quality models (Annex E), and quality measurement concepts (Annex F).

The measures are applicable to the use of any human-computer system, including both computer systems in use and software products that form part of the system.

This International Standard does not assign ranges of values of the measures to rated levels or to grades of compliance because these values are defined for each system or product depending, on the context of use and users' needs.

Some attributes could have a desirable range of values, which does not depend on specific user needs but depends on generic factors, for example, human cognitive factors.

The proposed quality in use measures are primarily intended to be used for quality assurance and management of systems and software products based on their effects when actually used. The main users of the measurement results are people managing development, acquisition, evaluation, or maintenance of software and systems.

The main users of this International Standard are people carrying out specification and evaluation activities as part of the following:

— development: including requirements analysis, design, and testing through acceptance during the life cycle process;

— quality management: systematic examination of the product or computer system, for example, when evaluating quality in use as part of quality assurance and quality control;

— supply: a contract with the acquirer for the supply of a system, software product, or software service under the terms of a contract, for example, when validating quality at qualification test;

— acquisition: including product selection and acceptance testing, when acquiring or procuring a system, software product, or software service from a supplier;

— maintenance: improvement of the product based on quality in use measures.

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## 2 Conformance

Any quality requirement specification or quality evaluation that conforms to this International Standard shall:

a) select the quality in use characteristics and/or subcharacteristics to be specified or evaluated as defined in ISO/IEC 25010;

b) for each selected characteristic or subcharacteristic, all the General (G) quality measures defined in Clause 8 should be used. If any are excluded, then provide a rationale;

c) select any Special (S) quality measures that are relevant;

d) if any quality measure is modified, provide the rationale for any changes;

e) define any additional quality measures to be used that are not included in this International Standard;

f) define precisely how each quality measure is operationalized (for example details of the measurement method or questionnaire used).

NOTE It is important to use the same measurement method when making comparisons.

## 3 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/IEC 25010, *Systems and software engineering — Systems and software Quality Requirements and Evaluation (SQuaRE) — System and software quality models*

## 4 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC 25000 and ISO/IEC 25010 and the following apply.

NOTE The essential definitions from ISO/IEC 25000 SQuaRE series and the other ISO standards are reproduced here.

**4.1**
**context completeness**
degree to which a product or system can be used with the required levels of effectiveness, efficiency, satisfaction, and freedom from risk in each of the specified contexts of use

Note 1 to entry: Context completeness is a subcharacteristic of context coverage.

[SOURCE: ISO/IEC 25010:2011, modified — Added “the required levels of” and changed “all” to “each of” for clarification.]

**4.2**
**context coverage**
degree to which a product or system can be used with effectiveness, efficiency, satisfaction, and freedom from risk in both specified contexts of use and in contexts beyond those initially explicitly identified

Note 1 to entry: Context of use is relevant to both quality in use and some product quality (sub)characteristics (where it is referred to as “specified conditions”).

[SOURCE: ISO/IEC 25010:2011, 4.1.5]


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**4.3**
**customer**
relationship with the supplier of an organization or person that receives or uses a product or service

Note 1 to entry: The relationship can include a warranty or agreeing to the terms and conditions of a service.

**4.4**
**effectiveness**
accuracy and completeness with which users achieve specified goals

[SOURCE: ISO 9241-11:1998]

**4.5**
**efficiency**
resources expended in relation to the accuracy and completeness with which users achieve goals

Note 1 to entry: Relevant resources can include time to complete the task (human resources), materials, or the financial cost of usage.

[SOURCE: ISO 9241-11:1998, modified — note 1 to entry added]

**4.6**
**context of use**
users, tasks, equipment (hardware, software and materials), and the physical and social environments in which a system, product or service is used

[SOURCE: ISO 9241-11:1998, 3.5, modified — With "product" replaced by "system, product or service".]

**4.7**
**flexibility**
degree to which a product or system can be used with acceptable levels of effectiveness, efficiency, freedom from risk, and satisfaction in contexts beyond those initially specified in the requirements

Note 1 to entry: Flexibility is a subcharacteristic of context coverage.

[SOURCE: ISO/IEC 25010:2011, modified — Added "acceptable levels of" for clarification.]

**4.8**
**formative evaluation**
evaluation designed and used to improve the object of evaluation, especially when it is still being developed

[SOURCE: ISO/TS 18152:2010, 4.6]

**4.9**
**freedom from risk**
degree to which the quality of a product or system mitigates or avoids potential risks to economic status, human life, health, or the environment

Note 1 to entry: Risk is a function of the probability of occurrence of a given threat and the potential adverse consequences of that threat's occurrence.

Note 2 to entry: The risks considered by the SQuaRE series are those arising from insufficient product quality.

Note 3 to entry: Freedom from risk includes reduction of potential risks to the user, organisation or project.

[SOURCE: ISO/IEC 25010:2011, modified — Added "quality of" and "or avoids" for clarification.]

**4.10**
**goal**
intended outcome

[SOURCE: ISO 9241-11:1998]

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**4.11**
**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.

Note 2 to entry: In this International Standard, when the word "measure" is used qualified by a characteristic or subcharacteristic, it refers to a quality measure.

[SOURCE: ISO/IEC 15939:2007, modified — note 2 to entry added]

**4.12**
**measurement**
set of operations having the object of determining a value of a measure

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

[SOURCE: ISO/IEC 15939:2007, modified — note 1 to entry modified from original]

**4.13**
**measurement function**
algorithm or calculation performed to combine two or more quality measurement elements

[SOURCE: ISO/IEC 25021:2012]

**4.14**
**psychometrics**
field of study concerned with the theory and technique for developing valid and reliable psychological measures

**4.15**
**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, satisfaction, and freedom from risk in specific contexts of use

Note 1 to entry: The quality in use of a software product or system can be measured and evaluated by the effect of the target system or software products when used by users of the implemented system or during field testing or prototype testing.

Note 2 to entry: When quality in use is specified, it relates to specified users meeting their needs to achieve specified goals with effectiveness, efficiency, satisfaction, and freedom from risk in specified contexts of use.

[SOURCE: ISO/IEC 25010:2011, modified — notes 1 and 2 to entry added]

**4.16**
**quality measure**
measure that is defined as a measurement function of two or more values of quality measure elements

[SOURCE: ISO/IEC 25021:2012]

**4.17**
**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]


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**4.18**
**quality model**
defined set of characteristics, and of relationships between them, which provides a framework for specifying quality requirements and evaluating quality

[SOURCE: ISO/IEC 25000:2014]

**4.19**
**satisfaction**
degree to which user needs are satisfied when a product or system is used in a specified context of use

Note 1 to entry: For a user who does not directly interact with the product or system, only purpose accomplishment and trust are relevant.

Note 2 to entry: Satisfaction is the user's response to interaction with the product or system, and includes attitudes towards use of the product.

Note 3 to entry: Users include: primary users who interact with the system to achieve the primary goals, secondary users who provide support, and indirect users who receive output, but do not interact with the system.

Note 4 to entry: In this International Standard, user's needs include their desires and expectations associated with use of a product, system, or service. Exceeding desires and expectations is a means of significantly increasing satisfaction and improving the user experience.

[SOURCE: ISO/IEC 25010:2011, modified — notes 3 and 4 to entry added]

**4.20**
**stakeholder satisfaction**
degree to which stakeholder needs are satisfied when a product or system is used in a specified context of use

Note 1 to entry: Users of a product or system are one type of stakeholder, so user satisfaction is one type of stakeholder satisfaction.

[SOURCE: ISO/IEC 25010:2011, modified — Definition for the term "satisfaction" modified to refer to stakeholders.]

**4.21**
**summative evaluation**
evaluation designed to present conclusions about the merit or worth of the object of evaluation

Note 1 to entry: The results can be used to produce recommendations about whether it should be retained, altered, or eliminated.

Note 2 to entry: It is possible to design a method to provide a combined formative and summative evaluation.

Note 3 to entry: A summative test method is used to perform a summative evaluation.

[SOURCE: ISO/TS 20282-2:2013, 4.17]

**4.22**
**system**
combination of interacting elements organised to achieve one or more stated purposes

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.

[SOURCE: ISO/IEC 15288:2015, modified — note 3 to entry deleted.]

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**4.23**
**task**
activities required to achieve a goal

Note 1 to entry: These activities can be physical or cognitive.

Note 2 to entry: Job responsibilities can determine goals and tasks.

[SOURCE: ISO 9241-11:1998]

**4.24**
**usability**
degree to which a product or system can be used by specified users to achieve specified goals with effectiveness, efficiency, and satisfaction in a specified context of use

Note 1 to entry: Adapted from ISO 9241-210.

Note 2 to entry: Usability can either be specified or measured as a product quality characteristic in terms of its subcharacteristics, or specified or measured directly by measures that are a subset of quality in use.

[SOURCE: ISO/IEC 25010:2011]

**4.25**
**use error**
act or omission of an act that results in a different system response than intended by the manufacturer or expected by the user

[SOURCE: IEC 62366:2007, modified — With “medical device” replaced by “system”.]

**4.26**
**user**
individual or group that benefits from a system during its utilization

[SOURCE: ISO/IEC 15939:2007]

# 5 Abbreviated terms

The following abbreviation is used in this International Standard.

QME Quality Measure Element

# 6 Use of quality in use measures

## 6.1 Applications of quality in use

This International Standard provides suggested measures for the characteristics and subcharacteristics in the ISO/IEC 25010 quality in use model.

— Effectiveness

— Efficiency

— Satisfaction

  — Usefulness

  — Trust

  — Pleasure (user experience)

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