BS ISO/IEC 25040:2024

BSI Standards Publication

Systems and software engineering — Systems and software Quality Requirements and Evaluation (SQuaRE) — Quality evaluation framework

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National foreword

This British Standard is the UK implementation of ISO/IEC 25040:2024. It supersedes BS ISO/IEC 25040:2011, which is withdrawn.

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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.

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 or www.iec.ch/members_experts/refdocs).

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This document 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 25040:2011), which has been technically revised.

The main changes are as follows:

— alignment with the other SQuaRE divisions: quality management, model, measurement, and requirements;

— alignment with other standards for system/software life cycle processes and requirements engineering processes;

— expansion of its target entities from software to ICT products, data, and IT services;

— expansion of types of quality evaluation from only requirements conformity to four types: quality evaluation for suitability to a specific use, for qualification to quality standard, for conformity checking to requirements, and for suitability to the market;

— clarification of concepts relating to quality evaluation;

— provision of more practical guidelines for planning a quality evaluation.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html and www.iec.ch/national-committees.

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Introduction

Many systems and services are now deeply embedded into social infrastructures used in daily life. This requires them to achieve much higher quality; for example, connected systems need to be interoperable, secure, reliable, maintainable, and usable. Therefore, quality evaluation becomes ever more important.

The result of quality evaluation is used to objectively judge the value of the target entity in various business situations, including:

— outsourcers judging whether the target entity satisfies their quality requirements, in the case of outsourcing it;

— consumers or acquirers determining which product or service to be selected for their application, in the case of acquisition.

This document provides requirements and recommendations for quality evaluation, as well as guidance for its tasks.

Target entities for quality evaluation include ICT (information and communication technology) products (systems, software products, etc.), data, and IT services. The quality model defined by ISO/IEC 2501n provides comprehensive quality characteristics and subcharacteristics according to the types of target entities. ISO/IEC 2502n defines quality measures corresponding to those quality models.

This document is one of the standards on SQuaRE developed by ISO/IEC JTC 1/SC 7 (ISO/IEC 25000 to ISO/IEC 25099). Figure 1 (adapted from ISO/IEC 25000) illustrates the organization of the standards on SQuaRE developed by ISO/IEC JTC 1/SC 7. Similar standards are grouped into divisions. Each division provides guidance and resources for performing a different function in ensuring system and software product quality.

— 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 International Standards on SQuaRE developed by ISO/IEC JTC 1/SC 7. This division also provides requirements and guidance for a supporting function that is responsible for the management of the requirements, specification, and evaluation of software product quality. Practical guidance on the use of the quality models is also provided.

— ISO/IEC 2501n - quality model division. The International Standards that form this division present detailed quality models for computer systems and software products, data, IT services and quality-in-use.

— ISO/IEC 2502n - quality measurement division. The International Standards that form this division include a quality measurement framework, mathematical definitions of quality measures, and practical guidance for their application. Examples are given of quality measures for internal and external property of product, data, IT services and quality-in-use. Quality measure elements (QME) forming foundations for quality measures for internal and external property of product are defined and presented.

— ISO/IEC 2503n - quality requirements division. The International Standards that form this division help specify quality requirements based on quality models and quality measures. These quality requirements can be used in the process of eliciting quality requirements for information systems and IT services to be developed or as input for an evaluation process.

— ISO/IEC 2504n - quality evaluation division. The International Standards that form this division provide requirements, recommendations and guidelines for quality evaluation for information systems and IT services.

— ISO/IEC 25050 to ISO/IEC 25099 - SQuaRE extension division. These International Standards currently include requirements for quality of ready-to-use software product (RUSP), common industry formats for usability reports, and quality models and measures for new technologies such as cloud services and artificial intelligence.

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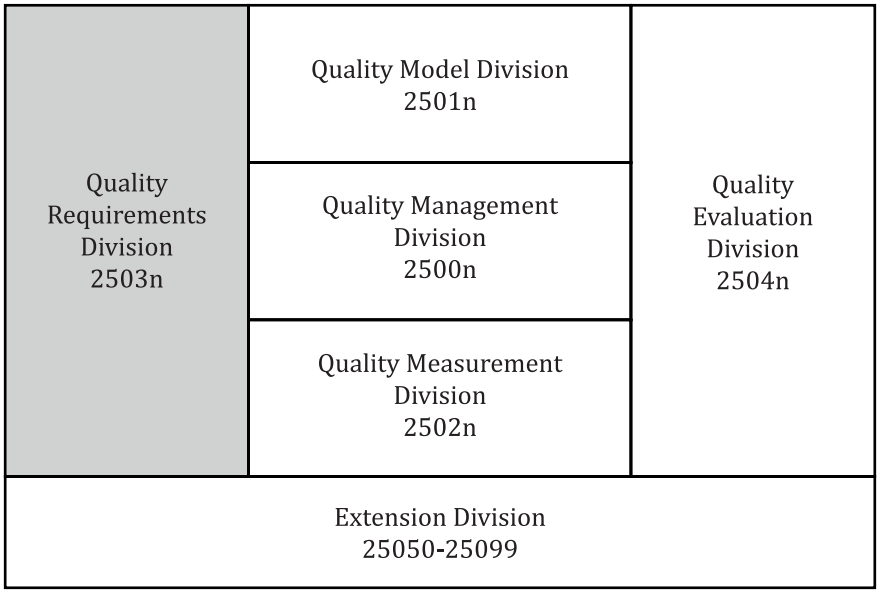

Figure 1 — Organization of standards on SQuaRE developed by ISO/IEC JTC 1/SC 7

The SQuaRE standards can be used in conjunction with ISO/IEC/IEEE 12207 and ISO/IEC/IEEE 15288, particularly the processes for the specification and evaluation of quality requirements. ISO/IEC 25030 describes how quality models and measures can be used for systems and software quality requirements, and ISO/IEC 25040 describes how the quality models and measures can be used for systems and software quality evaluation.

The SQuaRE standards can also be used in conjunction with standards on software process assessment developed by ISO/IEC JTC 1/SC 7, which provide:

— a framework for software product quality definition in the customer-supplier process;

— support for quality review, verification, and validation, as well as a framework for establishing quantitative quality characteristics;

— support for setting organizational quality goals in the management process.

The SQuaRE standards can be used in conjunction with ISO 9001 (which is concerned with quality management system) to provide:

— support for setting quality goals;

— support for design review, verification, and validation.

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Systems and software engineering — Systems and software Quality Requirements and Evaluation (SQuaRE) — Quality evaluation framework

1 Scope

This document provides the framework for quality evaluation of ICT (information and communication technology) products (including software products), data, and IT services, which includes its concepts, and requirements, and recommendations for its processes to be implemented and enhanced.

This document is applicable for those who need to perform quality evaluations on target entities, including development organization (integrators, developers, and quality assurance group), acquirers, IT service providers, and independent evaluators.

This document does not provide specific test methods for quality evaluation or guidance on utilizing evaluation results.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/IEC 25000, *Systems and software engineering — Systems and software Quality Requirements and Evaluation (SQuaRE) — Guide to SQuaRE*

ISO/IEC 25030, *Systems and software engineering — Systems and software quality requirements and evaluation (SQuaRE) — Quality requirements framework*

3 Terms and definitions

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

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1
assessment
action of comprehensively evaluating the target entity based on documented criteria for a specific purpose

Note 1 to entry: Such purposes can include determining acceptance or release of the target entity.

3.2
implementation rating module
quality rating module (3.8) that can be directly applied to target entity

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3.3
information need
insight necessary to manage objectives, goals, risks and problems

[SOURCE: ISO/IEC/IEEE 15939:2017, 3.12]

3.4
integrity level
degree of confidence that the system-of-interest meets the associated integrity level claim

[SOURCE: ISO/IEC/IEEE 15026-3:2023, 3.1, modified — Notes to entry have been removed.]

3.5
measurement source
set of artefacts used for quality measures when performing a *quality evaluation* (3.7)

3.6
quality analysis
analysis of rating results for multiple quality properties to determine the objective score or acceptability for the quality of the target entity

3.7
quality evaluation
systematic examination of the extent to which an entity is capable of fulfilling specified requirements

[SOURCE: ISO/IEC/IEEE 24765:2017, 3.3267, modified — Note 1 to entry has been removed.]

3.8
quality rating module
set of quality measures, operational environment, and methods for conducting quality measurements and quality ratings on a specific category of target entities

3.9
template rating module
quality rating module (3.8) in which the measurement environment and rating method are parameterized for future use

4 Concepts of quality evaluation

4.1 Quality evaluation definition

A quality evaluation involves performing a series of tasks to generate objective and quantitative data regarding the quality of the target entity. This is achieved by measuring, rating, and interpreting the quality attributes of the target entities using established quality models and measures. The ultimate objective of a quality evaluation is to offer crucial and unbiased information that supports comprehensive decision-making during the planning, development, delivery, acceptance, maintenance, and procurement stages of the target entities.

4.2 Quality model and quality measures for quality evaluation

The SQuaRE standards offer quality models and measures, as presented in Table 1, specifically designed for these three types of target entities which are ICT products, data, and IT services.

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Table 1 — Target entity types and their associated quality models and measures

Target entity type	Quality to be evaluated	Quality model	Quality measures
IT service / ICT product	Quality-in-use	ISO/IEC 25019 Quality-in-use model	ISO/IEC 25022 Measurement of quality-in-use
IT service	IT service quality	ISO/IEC TS 25011 IT service quality models	ISO/IEC TS 25025 Measurement of IT service quality
ICT product	Product quality	ISO/IEC 25010 Product quality model	ISO/IEC 25023 Measurement of system and software product quality
Data	Data quality	ISO/IEC 25012 Data quality model	ISO/IEC 25024 Measurement of data quality

The quality model presents a framework that outlines the essential quality characteristics that the target entity should possess. Quality measurement serves as a method for quantifying these quality characteristics based on the established quality model. In the case of an ICT product or IT service as the target entity, the quality-in-use model can be utilized to evaluate the impact of the target entity during usage.

NOTE 1 When evaluating ICT products (or IT services), the quality-in-use model or the product quality model (or IT service quality model) can be selected depending on the purpose of the quality evaluation. When evaluating data quality, the data quality model is the only option.

When evaluating a particular target entity, the important quality (sub)characteristics vary by its category.

NOTE 2 ISO/IEC TR 12182 provides a framework for categorizations of IT systems and software, and a guide for its application.

EXAMPLE In the case of a server device as the target entity, usability is not a significant factor as there are no direct user interactions involved. When evaluating the time behaviour of the server, the relevant information requirement shifts from response time to the throughput of requests handled by the server.

Quality properties represent the information needs pertaining to the quality of the target entity. These properties are measured and quantified using quality measures. It is worth noting that in certain cases, multiple measures can correspond to a single quality property. Various measurement methods, including testing, inspection, static analysis, and document survey, are utilized. See Figure 2.

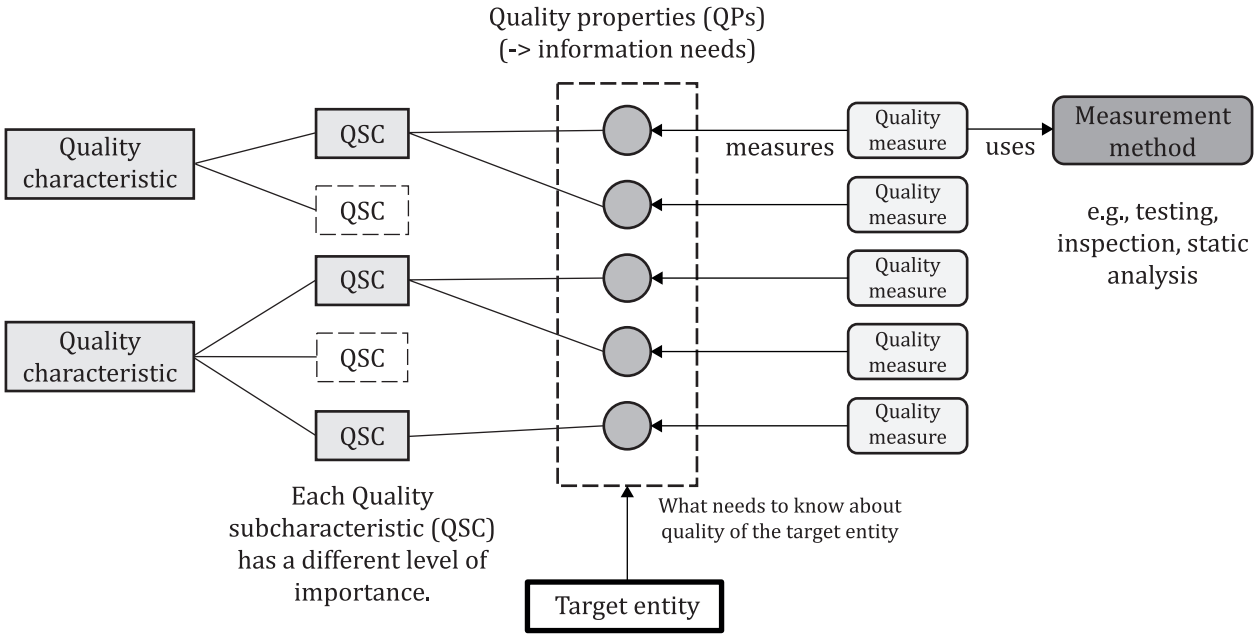

Figure 2 — Relationship among quality characteristics, quality properties and quality measures

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4.3 Measurement source

A measurement source is a set of artefacts used for quality measurement when conducting a quality evaluation. The measurement source depends on what is available at the time of the evaluation. Design artefacts (design specifications, prototypes, inspection-related documents, test specifications, etc.) are available even when the target entities themselves do not yet exist. On the other hand, final products (executable objects, source code, data, usage manuals, maintenance manuals, results of inspection and/or testing, etc.) are available near their delivery. The measurement source determines the applicable quality measures.

NOTE Annex A shows a list of artefacts that can be included in measurement sources, what can be measured from them, and information on how to measure them.

4.4 Tasks of quality evaluation

Quality evaluation consists of the following three tasks (see Figure 3).

— Quality measurement: quantitatively measuring the quality property of the target entity using specific quality measure. Its objective is to obtain objective and quantitative information about the quality properties of the target entity.

— Quality rating: comparing the measured values obtained from quality measurement against predetermined quality rating levels to determine the appropriate quality level for each quality property of the target entity. For instance, the measured response time is classified as the level of "excellent" if it falls within the range corresponding to the level.

— Quality analysis: analysing the quality rating results obtained from multiple quality properties. The focus is on assessing the acceptability of the target entity, taking into account each individual quality characteristic or subcharacteristic, as well as the overall quality. This analysis also includes identifying strengths and weaknesses for each quality attribute and generating recommendations based on the assessment findings.

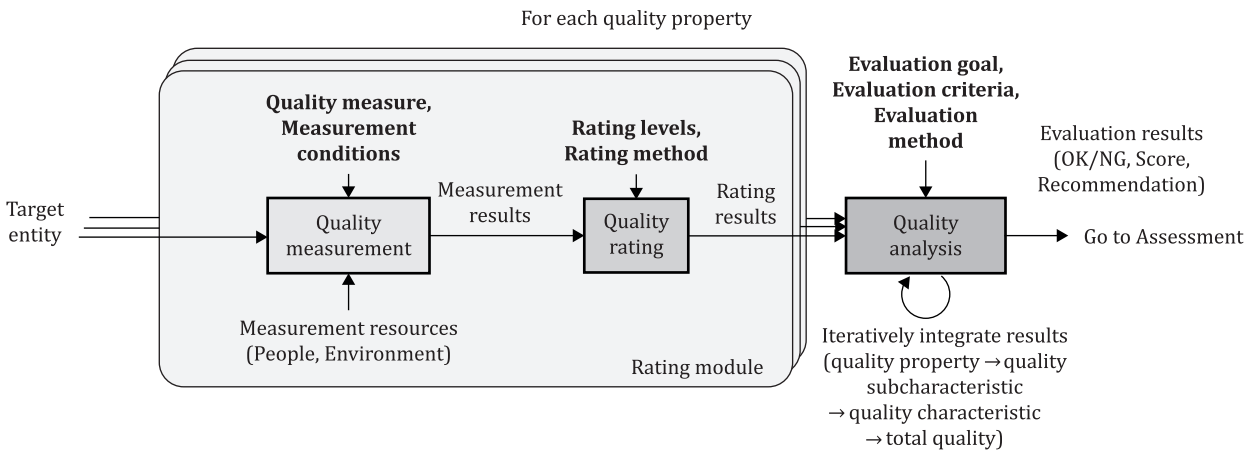

Figure 3 — Tasks of quality evaluation

4.5 Quality rating module

A quality rating module is a cohesive collection of measures, operational environment, and rating methods for performing quality measurements and ratings on a category of target entities. By utilizing the quality rating module, one can obtain quality rating results that align with the specified information needs.

The following are elements that a quality rating module can encompass:

— quality (sub)characteristics to be evaluated;

— categories of target entities eligible for evaluation;

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