

**Universitat de Lleida**  
Escola Politècnica Superior

---

Quality Management and Improvement  
Activity A: ISO/IEC 25000:2014

---

Jordi Lazo

2 March 2021

Degree in Computer Engineering

# Contents

<b>1</b>	<b>Introduction</b>	<b>2</b>
<b>2</b>	<b>ISO/IEC 25000:2014</b>	<b>2</b>
2.1	What is ISO/IEC 25000:2014 . . . . .	2
2.2	Goal of ISO/IEC 25000:2014 . . . . .	3
2.3	What provides ISO/IEC 25000:2014 . . . . .	4
2.4	Terms and definitions . . . . .	4
<b>3</b>	<b>ISO/IEC 25000:2014 Architecture</b>	<b>5</b>
3.1	ISO/IEC 2500n: Quality Management Division . . . . .	5
3.2	ISO/IEC 2501n: Quality Model Division . . . . .	6
3.3	ISO/IEC 2502n: Quality Measurement Division . . . . .	6
3.4	ISO/IEC 2503n: Quality Requirements Division . . . . .	6
3.5	ISO/IEC 2504n: Quality Evaluation Division . . . . .	7
<b>4</b>	<b>ISO/IEC 25000: Software product quality certification</b>	<b>7</b>
4.1	What is AENOR . . . . .	7
4.2	Software product quality certification . . . . .	8
4.3	Benefits of software certification . . . . .	9
<b>5</b>	<b>ISO/IEC 25010:2011</b>	<b>9</b>
5.1	Product quality model in 25010 . . . . .	9
<b>6</b>	<b>Annex</b>	<b>12</b>
6.1	Example of AENOR certificate . . . . .	12

## List of Figures

1	ISO and IEC logo. . . . .	2
2	Organization of SQuaRE series of International Standards. . . . .	3
3	ISO/IEC 25000 architecture. . . . .	5
4	Process to obtain the AENOR certificate. . . . .	8
5	AENOR ISO/IEC 25000 certifications . . . . .	8
6	ISO/IEC 25010:2011: Quality Models, characteristics and subcharacteristics. . . . .	10
7	ISO/IEC 25000 certificate for CGM CLINICAL ESPAÑA S.L. software by AENOR.[11] . . . . .	12

# 1 Introduction

Software products are initially considered for purchase based on their expected usefulness: their user-visible functions and features. Inevitably they will have practical limitations, in reliability, capacity, performance, maintainability, etc, informally summarised as their Non-functional attributes or ‘quality’. The idea of independent assessment and certification to assist buyers is attractive. This is where the ISO/IEC 25000 standards come in. This family of standards have the objective is to create a common framework to evaluate the quality of the software product.

In this document I will briefly comment on what these standards consist of, what they are composed of and the advantages they have.

## 2 ISO/IEC 25000:2014

### 2.1 What is ISO/IEC 25000:2014

In order to understand what does it mean, first of all is necessary to define what is ISO and IEC.

- ISO: *International Organization for Standardization* is an independent, non-governmental organization, the members of which are the standards organizations of the 165 member countries. It is the world’s largest developer of voluntary international standards and it facilitates world trade by providing common standards among nations. More than twenty thousand standards have been set, covering everything from manufactured products and technology to food safety, agriculture, and healthcare.[1]
- IEC: *International Electrotechnical Commission* is the world’s leading organization for the preparation and publication of international standards for all electrical, electronic and related technologies. These are known collectively as “electrotechnology”. [2]



Figure 1: ISO and IEC logo.

The series of standards **ISO/IEC 25000**, also known as **SQuaRE** (*System and Software Quality Requirements and Evaluation*), has as purpose of creating a framework for the evaluation of software product quality.[3]

It also exist differents standars in IT sector as ISO/IEC 27000. It details requirements for establishing, implementing, maintaining and continually improving an information

security management system (ISMS) – the aim of which is to help organizations make the information assets they hold more secure.[4] However in this document we will explain only the ISO/IEC 25000 series of standards.

ISO/IEC 25000 is the result of the evolution of several other standards; specifically from ISO/IEC 9126, which defines a quality model for software product evaluation, and ISO/IEC 14598, which defines the process for software product evaluation. The series of standards ISO/IEC 25000 consists of 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, 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.[5]

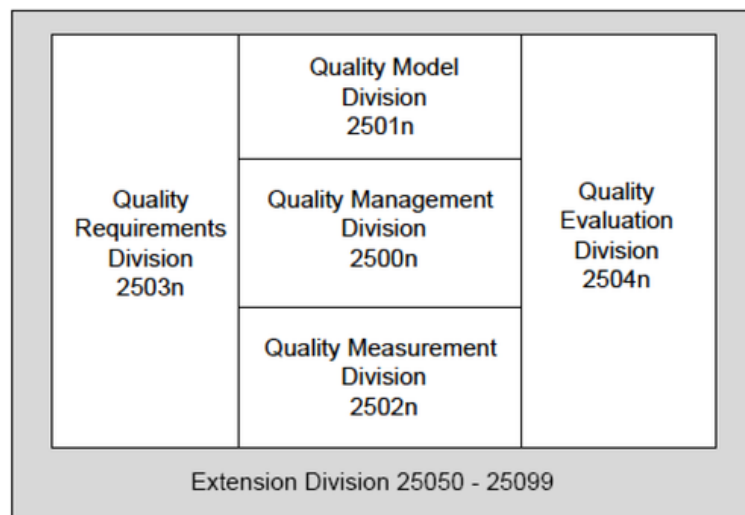


Figure 2: Organization of SQuaRE series of International Standards.

## 2.2 Goal of ISO/IEC 25000:2014

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.[5]

## 2.3 What provides ISO/IEC 25000:2014

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.[5]

## 2.4 Terms and definitions

Small fragment of the original document. Section 4 terms and definitions.

- *Attribute*: inherent property or characteristic of an entity that can be distinguished quantitatively or qualitatively by human or automated means.
- *Context of use*: users, tasks, equipment (hardware, software and materials), and the physical and social environments in which a product is used.
- *Custom software*: software product developed for a specific application from a user requirements specification.
- *Data*: reinterpretable representation of information in a formalized manner suitable for communication, interpretation or processing.
- *Data quality*: degree to which the characteristics of data satisfy stated and implied needs when used under specified conditions.
- *Developer*: individual or organisation that performs development activities (including requirements analysis, design, testing through acceptance) during the system or software life cycle process.

### 3 ISO/IEC 25000:2014 Architecture

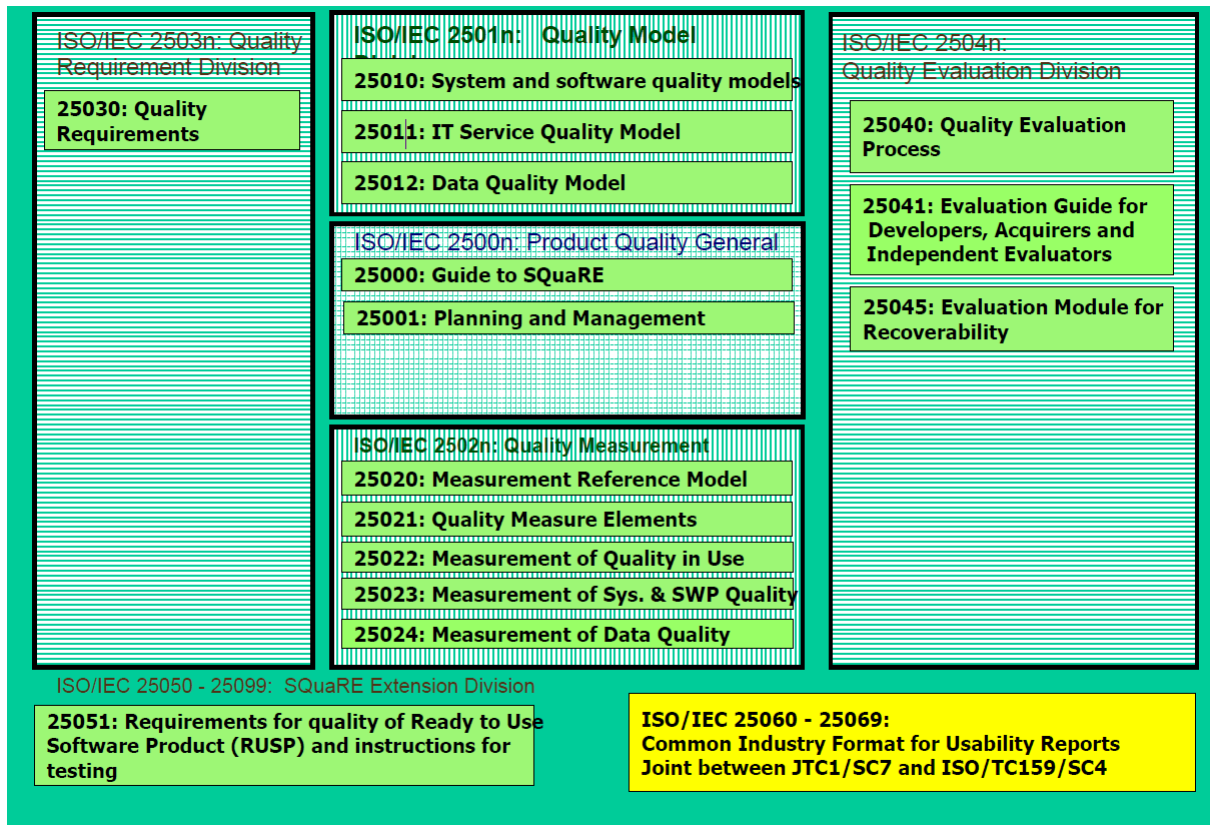


Figure 3: ISO/IEC 25000 architecture.

#### 3.1 ISO/IEC 2500n: Quality Management Division

This division defines 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.[6]

This division consists of two parts:

- ISO/IEC 25000: Guide to 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.
- ISO/IEC 25001: Planning and Management
  - Provides details about the planning and management requirements associated with software product quality requirements and evaluation. Aims to clarify the requirements which should be identified by the organization in order to ensure the success of specifying quality requirements and executing the evaluation.[7]

### 3.2 ISO/IEC 2501n: Quality Model Division

This division states the general requirements for a quality model, recommended model, and guides to customize and use the model.[6]

This division consists of two parts:

- ISO/IEC 25010: System and software quality models
  - A quality in use model composed of five characteristics (11 subc.).
  - A product quality model composed of eight characteristics (31 subc.).
- ISO/IEC 25012: Data quality model
  - The data quality model defined in this International Standard categorizes quality attributes into fifteen characteristics (22 views) considered by two points of view: inherent and system dependent.
- New model released in 2017: 25011 Service quality model.[7]

### 3.3 ISO/IEC 2502n: Quality Measurement Division

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.[6]

This division consists of five parts:

- ISO/IEC 25020: Measurement reference model and guide:
  - The scope of this International Standard is the selection and construction of software product quality measures.
- ISO/IEC 25021: Quality measure elements:
  - Define and/or design an initial set of Quality Measure Elements (QME) to be used throughout the product life.
- ISO/IEC 25022: Quality in use measures
- ISO/IEC 25023: Measurement of system and software product quality
- ISO/IEC 25024: Measurement of data quality[7]

### 3.4 ISO/IEC 2503n: Quality Requirements Division

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.[6]

Enables software product quality to be specified as quality requirements.

The requirements are to be tracked, validated and managed with evaluation from different perspectives by those associated with acquisition, requirements analysis, development, use, evaluation, support, maintenance, quality assurance and audit of software.

Also includes guide to use the model and metrics for requirement definition.

This division consists of one part:

- ISO/IEC 25030: Quality requirements
  - Provides requirements and recommendations for the specification of software product quality requirements.[7]

### **3.5 ISO/IEC 2504n: Quality Evaluation Division**

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.[6]

Contains general requirements for specification and evaluation of software quality and clarifies the general concepts.

This division consists of two parts:

- ISO/IEC 25040: Quality evaluation process
  - Provides a process description for evaluating software product quality and states the requirements for the application of this process.
- ISO/IEC 25041: Evaluation guide for developers, acquirers and independent evaluators
  - Provides requirements, recommendations and guidelines for product quality evaluation specifically for developers, acquirers and independent evaluators.[7]

## **4 ISO/IEC 25000: Software product quality certification**

### **4.1 What is AENOR**

AENOR (*Asociación Española de Normalización y Certificación*) is the official Spanish national standardization organisation, is an entity dedicated to the development of standardization and certification in all Spanish industrial and service sectors.

AENOR is a Spanish member of the following international standardization organizations:

- International Organization for Standardization (ISO).
- International Electrotechnical Commission (IEC).

Likewise, at European level, AENOR is a Spanish member of the following recognized standardization organizations:

- European Committee for Standardization (CEN);



- European Committee for Electrotechnical Standardization (CENELEC).[8]

## 4.2 Software product quality certification

Certification of software product quality with ISO/IEC 25000 enables companies that develop software to find out about the quality of their products and allows companies that purchase software to choose a solution based on their requirements.

To perform this certification, AENOR uses AQC Lab, first laboratory in Spain accredited by the Spanish National Accreditation Entity (ENAC) to assess the quality of software applications under the group of standards known as ISO/IEC 25000, which focus on maintainability and functional suitability (functionality). AENOR assesses the laboratory report on the quality of the software product at issue and, in the event the assessment is satisfactory, a viability check will be performed, either in situ or online, of the resources and technical capacity of the company that created the software product. Once this process has been completed, AENOR will issue a certificate of conformity under Standard ISO/IEC 25000.[9]

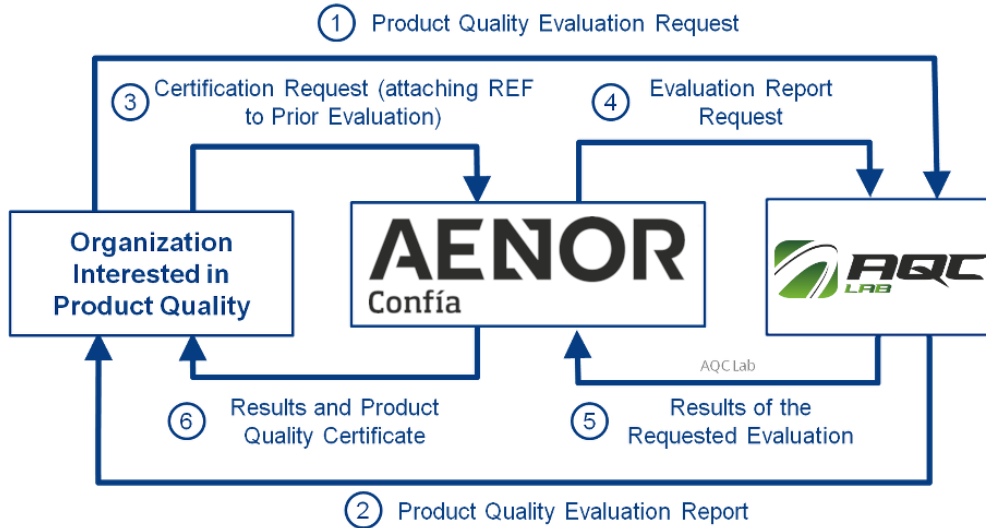


Figure 4: Process to obtain the AENOR certificate.



(a) AENOR Conform Mark Functional Adaptation



(b) AENOR Software Maintainability Conform Mark

Figure 5: AENOR ISO/IEC 25000 certifications

### 4.3 Benefits of software certification

- Setting oneself apart from the competition, ensuring delivery times and reduction of product faults after implementation in production.
- Being able to establish service level agreements, defining certain quality parameters that the product must fulfil before being delivered.
- Debugging software product faults prior to delivery, which means cost savings in the subsequent maintenance stage.
- Assessing and controlling the performance of the developed software product, ensuring that it will be able to generate results taking into account the established time and resource constraints.
- Ensuring that the developed software product meets security requirements (confidentiality, integrity, authenticity, non-repudiation, etc.).
- Checking that the product developed will be able to be put into production without compromising other systems and maintaining compatibility with required interfaces.[9]

## 5 ISO/IEC 25010:2011

Finally, in this section, I will briefly comment on what the ISO/IEC 25010:2011 standard consists of because when creating software it is important to take into account the characteristics of this standard that define if a software has good quality or not.

ISO/IEC 25010:2011 provides the models for assessing software product. This is an important contribution towards establishing the delivery performance of software processes and proposed improvements.

### 5.1 Product quality model in 25010

*Quality in use* is the degree to which a product or system can be used by specific users to meet their needs to achieve specific goals.

*Product quality* categorizes product quality properties into eight characteristics. Each characteristic is composed of a set of related subcharacteristics (see Figure 6).[10]

Quality in use	Product quality	Product quality (cont.)
<ul style="list-style-type: none"> <li>• Effectiveness</li> <li>• Efficiency</li> <li>• Satisfaction <ul style="list-style-type: none"> <li>– Usefulness</li> <li>– Trust</li> <li>– Pleasure</li> <li>– Comfort</li> </ul> </li> <li>• Freedom from risk <ul style="list-style-type: none"> <li>– Economic risk mitigation</li> <li>– Health and safety risk mitigation</li> <li>– Environmental risk mitigation</li> </ul> </li> <li>• Context coverage <ul style="list-style-type: none"> <li>– Context completeness</li> <li>– Flexibility</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Functional suitability <ul style="list-style-type: none"> <li>– Functional completeness</li> <li>– Functional correctness</li> <li>– Functional appropriateness</li> </ul> </li> <li>• Performance efficiency <ul style="list-style-type: none"> <li>– Time behaviour</li> <li>– Resource utilization</li> <li>– Capacity</li> </ul> </li> <li>• Compatibility <ul style="list-style-type: none"> <li>– Co-existence</li> <li>– Interoperability</li> </ul> </li> <li>• Usability <ul style="list-style-type: none"> <li>– Appropriateness recognisability</li> <li>– Learnability</li> <li>– Operability</li> <li>– User error protection</li> <li>– User interface aesthetics</li> <li>– Accessibility</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Reliability <ul style="list-style-type: none"> <li>– Maturity</li> <li>– Availability</li> <li>– Fault tolerance</li> <li>– Recoverability</li> </ul> </li> <li>• Security <ul style="list-style-type: none"> <li>– Confidentiality</li> <li>– Integrity</li> <li>– Non-repudiation</li> <li>– Accountability</li> <li>– Authenticity</li> </ul> </li> <li>• Maintainability <ul style="list-style-type: none"> <li>– Modularity</li> <li>– Reusability</li> <li>– Analysability</li> <li>– Modifiability</li> <li>– Testability</li> </ul> </li> <li>• Portability <ul style="list-style-type: none"> <li>– Adaptability</li> <li>– Installability</li> <li>– Replaceability</li> </ul> </li> </ul>

Figure 6: ISO/IEC 25010:2011: Quality Models, characteristics and subcharacteristics.

- *Effectiveness*: accuracy and completeness with which users achieve specified goals.
- *Efficiency*: resources expended in relation to the accuracy and completeness with which users achieve goals.
- *Satisfaction*: degree to which user needs are satisfied when a product or system is used in a specified context of use (includes attitudes towards use of the product).
- *Freedom from risk*: degree to which a product or system mitigates the potential risk to economic status, human life, health, or the environment.
- *Flexibility*: degree to which a product or system can be used with effectiveness, efficiency, freedom from risk and satisfaction in contexts beyond those initially specified in the requirements.
- *Functional suitability*: degree to which a product or system provides functions that meet stated and implied needs when used under specified conditions.
- *Performance efficiency*: performance relative to the amount of resources used under stated conditions.
- *Compatibility*: degree to which a product, system or component can exchange information with other products, systems or components, and/or perform its required functions, while sharing the same hardware or software environment.
- *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.

- *Reliability*: degree to which a system, product or component performs specified functions under specified conditions for a specified period of time.
- *Security*: degree to which a product or system protects information and data so that persons or other products or systems have the degree of data access appropriate to their types and levels of authorisation.
- *Maintainability*: degree of effectiveness and efficiency with which a product or system can be modified by the intended maintainers.
- *Portability*: degree of effectiveness and efficiency with which a system, product or component can be transferred from one hardware, software or other operational or usage environment to another.

## 6 Annex

### 6.1 Example of AENOR certificate



Figure 7: ISO/IEC 25000 certificate for CGM CLINICAL ESPAÑA S.L. software by AENOR.[11]

## References

- [1] Wikipedia. *International Organization for Standardization*.  
[https://en.wikipedia.org/wiki/International\\_Organization\\_for\\_Standardization](https://en.wikipedia.org/wiki/International_Organization_for_Standardization)
- [2] IEC. *Who we are*.  
<https://www.iec.ch/who-we-are>
- [3] ISO 25000. *The ISO/IEC 25000 series of standards*.  
<https://iso25000.com/index.php/en/iso-25000-standards>
- [4] Wikipedia. *ISO/IEC 27000*.  
[https://en.wikipedia.org/wiki/ISO/IEC\\_27000](https://en.wikipedia.org/wiki/ISO/IEC_27000)
- [5] ISO. *ISO/IEC 25000:2014(en) Systems and software engineering - Systems and software Quality Requirements and Evaluation (SQuaRE) - Guide to SQuaRE*.  
<https://www.iso.org/standard/64764.html>
- [6] ISO. *ISO/IEC 25001:2014(en) Systems and software engineering - Systems and software Quality Requirements and Evaluation (SQuaRE) - Planning and management*.  
<https://www.iso.org/standard/64787.html>
- [7] Risto Nevalainen. *ISO/IEC 25000 (SQUARE): Measurement of Product Quality (software, system, service, data)*,  
Ohjelmistotuotannon ja järjestelmäkehityksen standardit nyt 18.10.2017.
- [8] Wikipedia. *AENOR*.  
<https://en.wikipedia.org/wiki/AENOR>
- [9] AENOR. *ISO 25000: Software product quality certification*.  
<https://www.en.aenor.com>
- [10] ISO. *ISO/IEC 25010:2011(en) Systems and software engineering - Systems and software Quality Requirements and Evaluation (SQuaRE) - System and software quality models*.  
<https://www.iso.org/standard/35733.html>
- [11] ISO 25000. *CGM Clinical España consigue el certificado ISO/IEC 25000 para su software CGM SELENE DISCERN*.  
<https://iso25000.com/index.php/noticias/>