

Australian/New Zealand Standard™

**Systems and software engineering—
Systems and software Quality
Requirements and Evaluation
(SQuaRE)—Quality measure elements**



AS/NZS ISO/IEC 25021:2013

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PREFACE

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee IT-015, Software and Systems Engineering.

The objective of this Standard is to define and/or design an initial set of Quality Measure Elements (QME) to be used throughout the product life cycle for the purpose of Systems and Software Quality Requirements and Evaluation (SQuaRE). The document also gives a set of rules to design a QME or verify the design of an existing QME.

This Standard is identical with, and has been reproduced from ISO/IEC 25021:2012, *Systems and software engineering—Systems and software Quality Requirements and Evaluation (SQuaRE)—Quality measure elements*.

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- (b) A full point substitutes for a comma when referring to a decimal marker.

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<i>Reference to International Standard</i>		<i>Australian/New Zealand Standard</i>	
ISO/IEC		AS/NZS ISO/IEC	
15939	Systems and software engineering—Measurement process	15939	Systems and software engineering—Measurement process
25000	Software engineering—Software product Quality Requirements and Evaluation (SQuaRE)—Guide to SQuaRE	25000	Software engineering—Software product Quality Requirements and Evaluation (SQuaRE)—Guide to SQuaRE
25010	Systems and software engineering—Systems and software Quality Requirements and Evaluation (SQuaRE)—System and software quality models	25010	Systems and software engineering—Systems and software Quality Requirements and Evaluation (SQuaRE)—System and software quality models
25020	Software engineering—Software product Quality Requirements and Evaluation (SQuaRE)—Measurement reference model and guide	25020	Software engineering—Software product Quality Requirements and Evaluation (SQuaRE)—Measurement reference model and guide

The term ‘informative’ has been used in this Standard to define the application of the annex to which it applies. An ‘informative’ annex is only for information and guidance.

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INTRODUCTION

The purpose of this International Standard is to define and/or design an initial set of Quality Measure Elements (QME) to be used throughout the product life cycle for the purpose of Systems and Software Quality Requirements and Evaluation (SQuaRE). The document also gives a set of rules to design a QME or verify the design of an existing QME. The content of this document constitutes the link between the ISO/IEC 9126 series of standards and the subsequent SQuaRE series of standards.

A number of QMEs for quality measures that quantify some of the characteristic and subcharacteristic represent an initial list, which is to be used during the construction of the quality measures as referenced in ISO/IEC TR 9126-2, ISO/IEC TR 9126-3 and ISO/IEC TR 9126-4. Quality measures presented in the SQuaRE series (Figures 1, 2) were extracted from ISO/IEC TR 9126 series but it is not the only source. When evaluating selected quality measures, the user should first understand the definition of each property related to a QME used within the selected quality measures.

The main purposes of defining and using the Quality Measures Elements (QMEs) in this document are:

- To provide guidance for organisations developing and implementing their own QMEs;
- To promote the consistent use of specific QME for measuring and using the product properties that are relevant to different product quality characteristics and subcharacteristics;
- To help identify a set of QMEs that are uniquely required to derive all the quality measures for a given set of characteristics or a set of subcharacteristics of a product.

The QMEs are the common components of a number of quality measures. The intended usage of this International standard is that users will be able to select and define relevant valid QMEs to define internal, external, data or quality-in-use quality measures. Then, these can be used for quality requirements definition, products evaluation and quality assessment but not necessary limited to those. It is therefore recommended to use this document prior or together with the ISO/IEC 2502n series of standards.

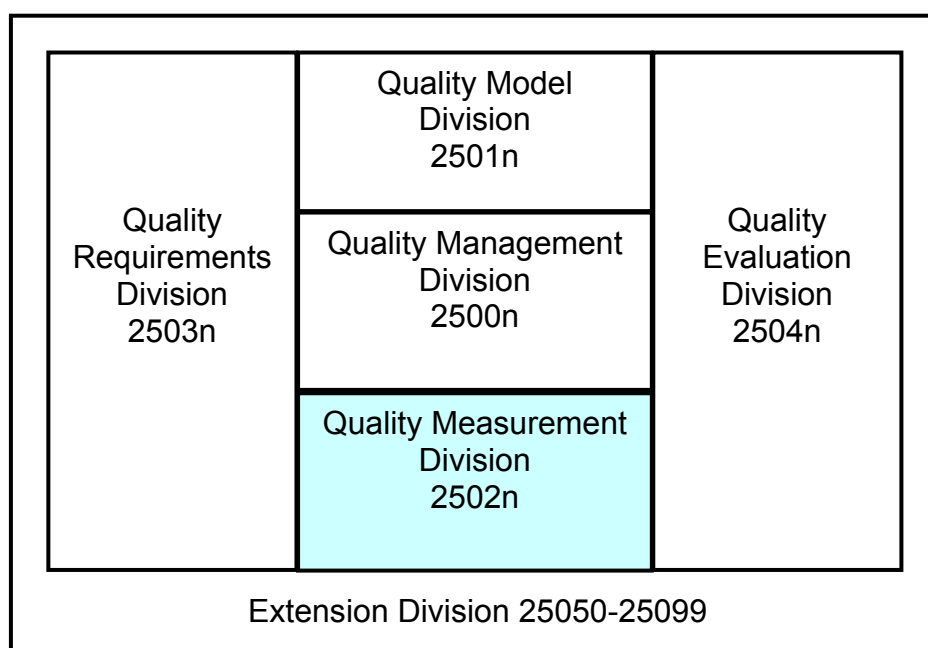


Figure 1 — Organisation of the SQuaRE series of international standards

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

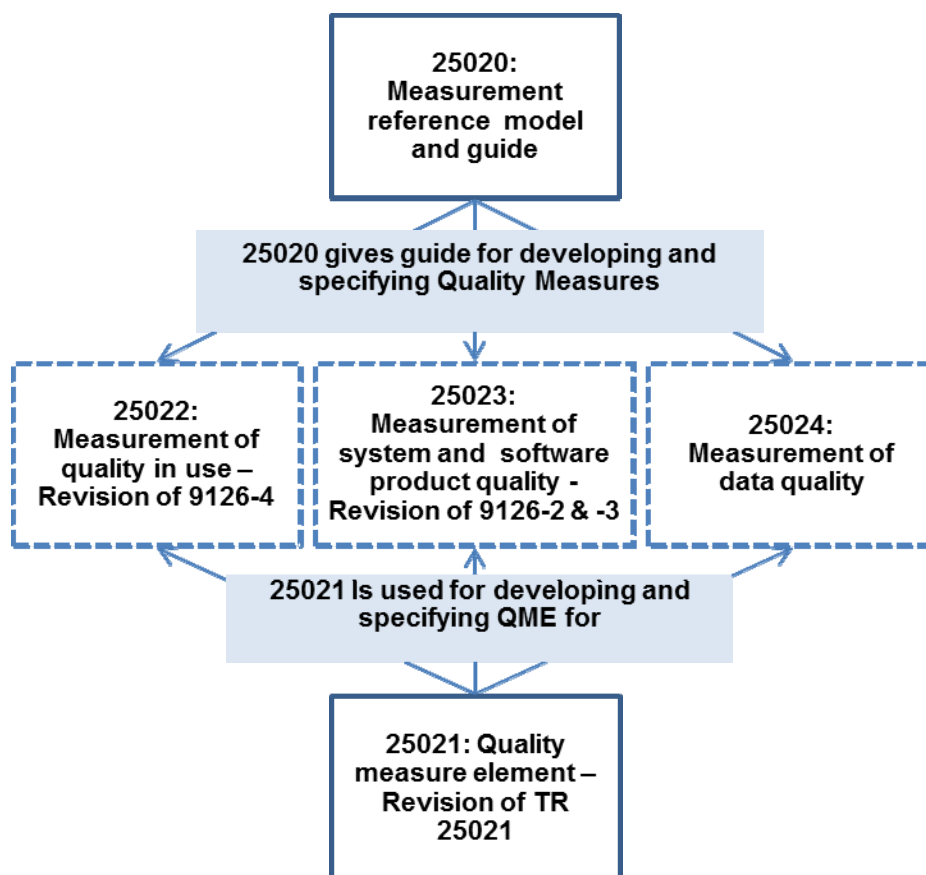


Figure 2 — Structure of the Quality Measurement Division

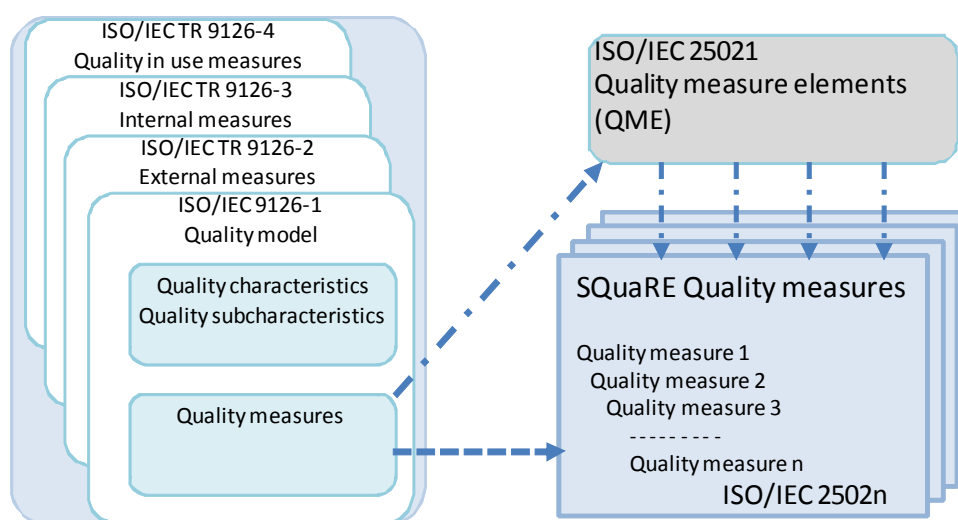


Figure 3 — The relationship of ISO/IEC 25021 as a link between the 9126 series and the SQuaRE series of standard

The ISO/IEC 9126 series is composed of four documents that list and describe the characteristics, subcharacteristics and quality measures that are referred to as the quality model. The SQuaRE quality models categorize product quality into characteristics which are further subdivided into subcharacteristics and quality properties (ISO/IEC 25010). Each quality measure within ISO/IEC 9126 series is composed of at least two QMEs. The properties (of a product) are linked to the QME (ISO/IEC 25020), using a measurement method. The 2502n series designs and describes quality measures and associated QMEs for all the quality (sub)characteristics in the quality model.

AUSTRALIAN/NEW ZEALAND STANDARD

Systems and software engineering—Systems and software Quality Requirements and Evaluation (SQuaRE)—Quality measure elements**1 Scope**

This International Standard contains the following information:

- Requirements for defining QMEs as part of the specification of the product quality requirements with examples (see 6.2 Tables 1 and 2);

NOTE Product quality includes system quality, software product quality, data quality and eventually system service quality.

- An initial set of QMEs, as examples (see Annex A Table A.1);
- A guideline for defining and quantifying the property of the product (target entity) for QMEs (see Annex B)

This document is intended for, but not limited to, developers, acquirers and independent evaluators of products, particularly those responsible for defining product quality requirements and for product evaluation. This International Standard is applicable when defining the QMEs to be used to implement quality measures such as those specified in ISO/IEC 25022, ISO/IEC 25023 and ISO/IEC 25024.

2 Conformance

When users define quality measures for a product, each of the referred QME shall be described according to the information items of format specified in Table 1 (see 6.2). The same should be applied for modifying an existing QME.

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 25000:2005, *Software engineering — Software product Quality Requirements and Evaluation (SQuaRE) — Guide to SQuaRE*

ISO/IEC 25010:2011, *Systems and software engineering — Systems and software product Quality Requirements and Evaluation (SQuaRE) — System and software quality models*

ISO/IEC 25020:2007, *Software engineering — Software product Quality Requirements and Evaluation (SQuaRE) — Measurement reference model and guide*

ISO/IEC 15939:2007, *Systems and software engineering — Measurement process*

ISO/IEC Guide 99:2007, *International vocabulary of metrology — Basic and general concepts and associated terms (VIM)*

4 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC 25000, ISO/IEC 25010, ISO/IEC 25020, ISO/IEC 15939, ISO/IEC Guide 99, and the following apply. The following definitions are replicated here for the convenience of the user of this document.

4.1

data quality

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

[ISO/IEC 25012:2008]

4.2

external measure of software quality

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

NOTE 1 The behavior can be verified and/or validated by executing the software product during testing and operation.

NOTE 2 Based on the ISO/IEC 25000:2005 definition of external software quality.

NOTE 3 This definition was adapted from ISO/IEC 25010:2011.

4.3

internal measure of software quality

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

NOTE 1 Static properties include those that relate to the software architecture, structure and its components.

NOTE 2 Static properties can be verified by review, inspection, simulation and/or automated tools.

NOTE 3 This definition was adapted from ISO/IEC 25010:2011.

EXAMPLE Depending on the context specifications faults, design faults and code faults could be used as internal quality measures.

NOTE 4 Based on the ISO/IEC 25000:2005 definition of internal software quality.

4.4

measure (noun)

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

NOTE The term “measures” is used to refer collectively to base measures, measures, and indicators.

[ISO/IEC 15939:2007]

4.5

measure (verb)

make a measurement

[ISO/IEC 25000:2005]

4.6

measurement

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

[ISO/IEC 15939:2007]

NOTE Measurement can be nominal, ordinal, interval and ratio scale type.

4.7**measurement function**

algorithm or calculation performed to combine two or more quality measure elements

NOTE This definition is modified from ISO/IEC 15939:2007 definition of measurement method.

4.8**measurement method**

logical organisation of operations, described generically, used in measurement

NOTE This definition is modified from ISO/IEC 15939:2007 definition of measurement method.

4.9**measurement procedure**

logical organisation of operations, applied specifically, used in the performance of particular measurements according to a given measurement method

NOTE 1 This definition is modified from ISO/IEC 15939:2007 definition of measurement procedure.

NOTE 2 A measurement procedure is usually recorded in a document that is sometimes itself called a "measurement procedure" and is usually in sufficient detail to enable an operator to carry out a measurement without additional information.

4.10**model**

specification of the concepts, relationships and rules that are used to define a methodology

[ISO/IEC 24744:2007, Software Engineering — Model for Development Methodologies]

4.11**property to quantify**

property of a target entity that is related to a quality measure element and which can be quantified by a measurement method

NOTE 1 A software artifact is an example of a target entity.

NOTE 2 A sub-property is related to a property.

4.12**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

NOTE Based on the ISO/IEC 25010:2011 definition of quality in use.

4.13**quality measure**

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

4.14**quality measure element (QME)**

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

4.15**repeatability (of results of measurement)**

closeness of the agreement between the results of successive measurements of the same measurand carried out under the same conditions of measurement

[ISO/IEC TR 14143-3:2003]

4.16**reproducibility (of results of measurement)**

closeness of the agreement between the results of measurements of the same measurand carried out under changed conditions of measurement

[ISO/IEC TR 14143-3:2003]

NOTE Repeatability and reproducibility may be expressed quantitatively in terms of the dispersion characteristics of the results.

4.17**target entity**

fundamental thing of relevance to the user, about which information is kept, and need to be measured

4.18**unit (of measure)**

a particular quantity defined and adopted by convention, with which other quantities of the same kind are compared in order to express their magnitude relative to that quantity

NOTE 1 Only quantities expressed in the same units of measurement are directly comparable. Examples of units include the number of faults and the number of failures. Hour and meter are also unit of measure.

NOTE 2 Units of measurement have conventionally assigned names and symbols.

NOTE 3 Based on the ISO/IEC 25000:2005 definition of unit of measurement.

5 Abbreviated terms

In this International Standard, the following abbreviations are used:

- a) QME - Quality measure element;
- b) QM - Quality measure;

6 Quality measure elements concept**6.1 Presentation of the measurement method model**

To understand and indicate quality (sub)characteristics, QM is defined and then QMEs are defined.

A measurement function is applied to QME to generate QM. A measurement method shall be applied to a property to define and identify a way to quantify a QME.

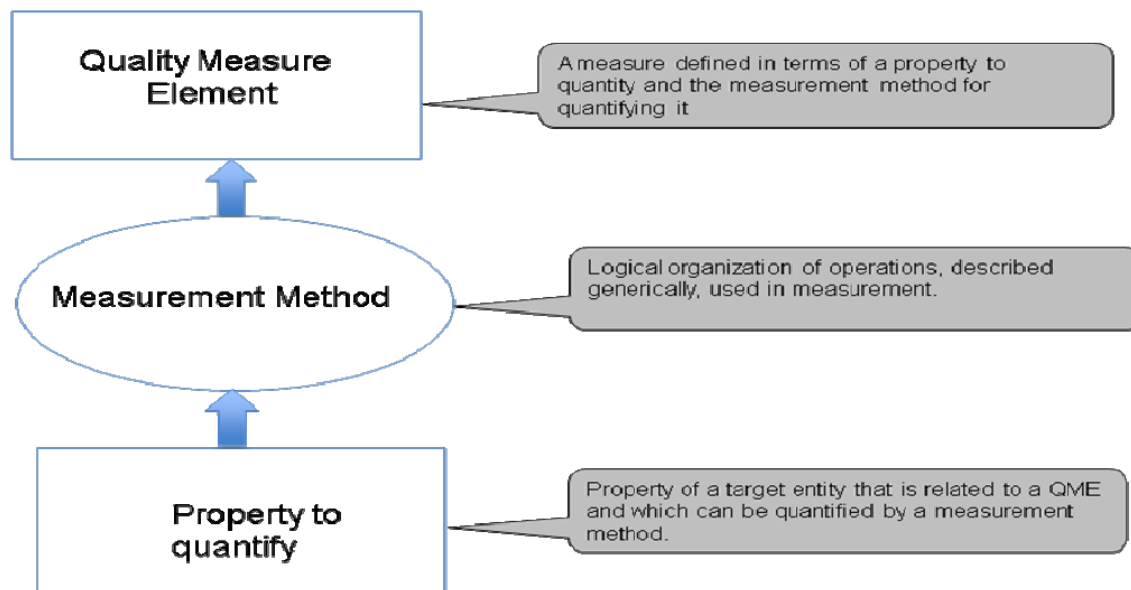


Figure 4 — Relationship between property to quantify, measurement method and QME

The user of the measurement method shall identify and collect data related to quantifying the property (Figure 4). Depending on the context of usage and objective(s) of the QME, a number of properties and sub properties can be identified. These are the input of the measurement method. Those properties are extracted and defined from the artefacts, components, content or behaviour of the target entity (e.g. documentation, code).

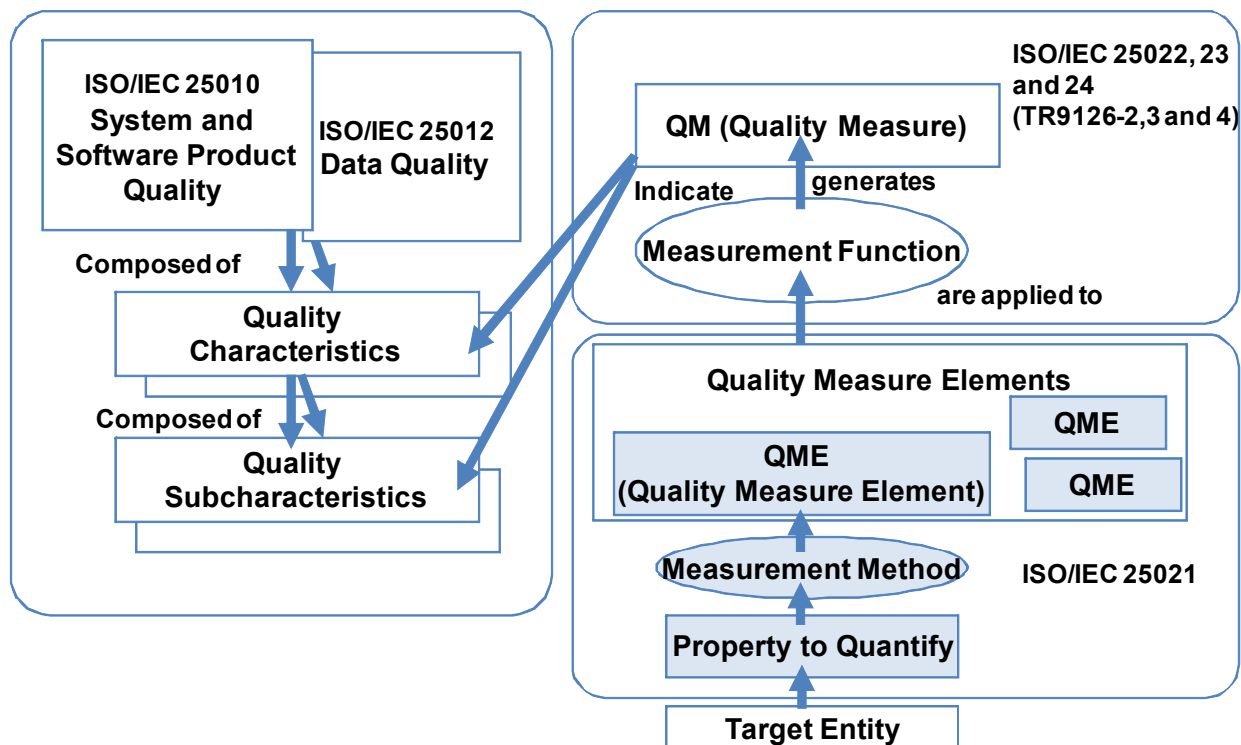


Figure 5 — Relationship among property to quantify, measurement method, QME and QM

Figure 5 shows that

- product quality is expressed as a set of quality characteristics which in turn are composed of subcharacteristics;
- product quality measures are used to indicate the quality characteristics and subcharacteristics of interest;
- the relationship between the property to quantify, the measurement method and QME.

NOTE This Figure 5 is based on the Systems and Software Product Quality Measurement Reference Model defined in ISO/IEC 25020.

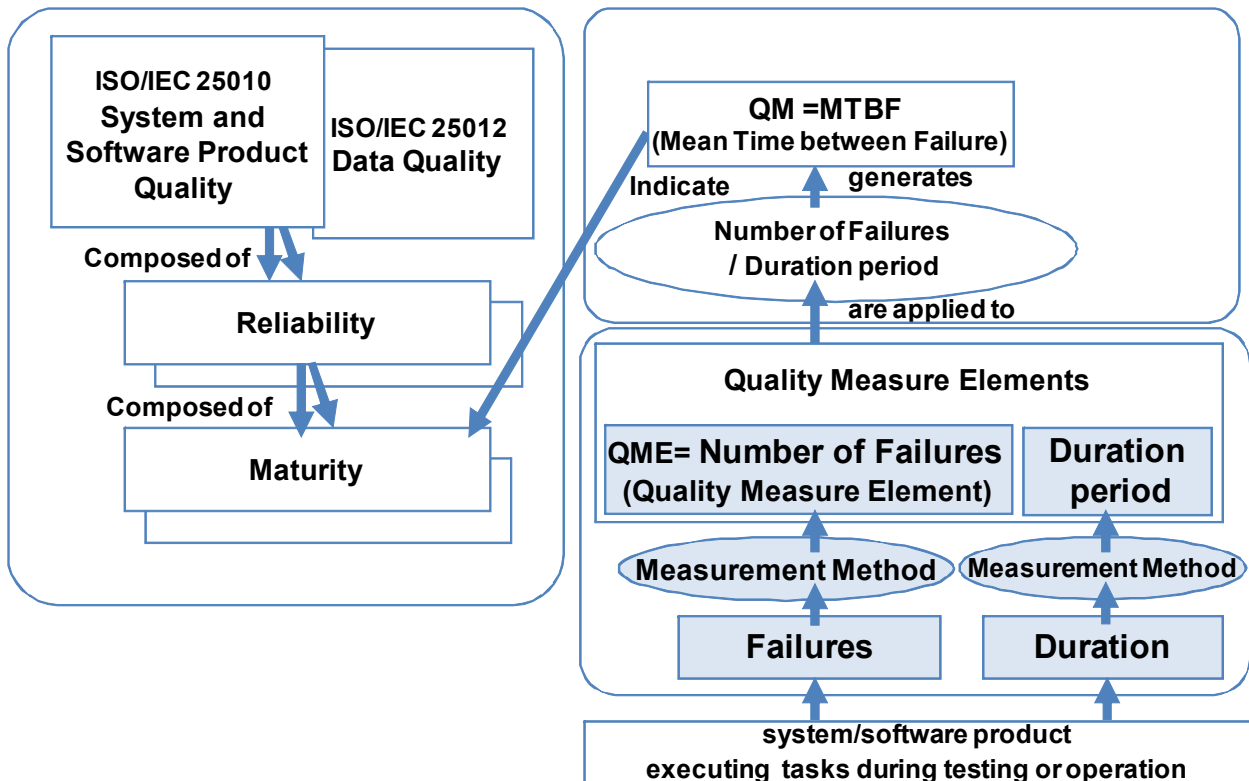


Figure 6 — An Example of Relationship among property to quantify, measurement method, QME and QM

Figure 6 shows an example that a QME is derived by applying a measurement method to a property to quantify.

Table 1 shows the measurement information items for QME which shall be used to describe QME.

NOTE 1 A QME can be identified when quality characteristic or subcharacteristic are selected and/or a QM is defined to indicate it. The same QME may be used by different QMs.

NOTE 2 Guide for designing a QME is provided in Annex B.

6.2 Table format of QMEs

The information items listed in table format of the QMEs (see Table 1) shall be used to define¹ and/or design a QME to provide necessary or helpful information.

Table 1 — Table format for QMEs

NOTE Items in the below table are organized into four groups which are a) for QME identification, b) – d) for “what the QME is”, e) – k) for “how to measure the QME” and l) – n) for management of QME application.

a) QME Name	A QME should have a unique name and should be identified with a serial number, if necessary. Most of the time it begins with “number of... (ratio scale)”.
b) Target entity	A QME shall have a target object that is to be characterized by measuring its property Target entity should be a work product or behavior of a system, software, or stakeholders such as users, operators, developers, testers, or maintainers.
c) Objectives and property to quantify	<p>Identification of the property to quantify is usually related to the name of the QME. Selected property to quantify should be the one which is most relevant to the measurement of information needed. A given property may be incorporated in multiple measurement constructs. For example, “number of software faults” is the QME and “fault” is the property of the software to quantify.</p> <p>Objective of QME should be specified with the definition of the property to quantify to describe such as the followings:</p> <ul style="list-style-type: none"> - What is intended to know by making definition of the property to quantify of this QME? - What is the information needed that is expected to be represented by this QME? <p>From the identification and definition of the property to quantify, what needs to be measured is determined (e.g. line of code, defects, duration).</p> <p>It is helpful to describe what kinds of component or event in the designated target entity need to be identified, defined and quantified.</p> <p>The followings are examples:</p> <ol style="list-style-type: none"> 1) Lines, functions, paths or tokens having specified feature in program source code may be identified, defined and quantified; 2) Events every when the software under testing fails to specified test cases may be identified, defined and quantified; 3) Events every when the user of the system fails to user’s intended tasks may be identified, defined and quantified.
d) Relevant Quality measure(s)	<p>Reference to specific quality measure(s) which use this QME shall be specified.</p> <p>Examples of quality measures can be found in the ISO/IEC 9126 series, 25000 SQuaRE series and other documents. An exhaustive list of quality measures is not required.</p>

¹ For the definitions see c) (objectives and properties to quantify) and g) (definition of each sub-properties).