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Information technology — Process assessment — Requirements for process measurement frameworks

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National foreword

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The UK participation in its preparation was entrusted to Technical Committee IST/15, Software and systems engineering.

A list of organizations represented on this committee can be obtained on request to its secretary.

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© The British Standards Institution 2015.
Published by BSI Standards Limited 2015

ISBN 978 0 580 74308 5
ICS 35.080

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This British Standard was published under the authority of the Standards Policy and Strategy Committee on 30 April 2015.

Amendments/corrigenda issued since publication

Date	Text affected

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Full document details: BS ISO/IEC 33003:2015

INTERNATIONAL STANDARD

ISO/IEC 33003

Second edition
2015-03-01

Information technology — Process assessment — Requirements for process measurement frameworks

Technologies de l'information — Évaluation du processus — Exigences relatives au cadres de mesure du processus

Reference number
ISO/IEC 33003:2015(E)

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Published in Switzerland

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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).

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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*.

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Introduction

This International Standard provides requirements for process measurement frameworks that support and enable the assessment of process quality characteristics, from conceptualization to empirical validation. In process measurement frameworks, measurement of a process quality characteristic produces a composite measure (e.g. process capability levels of ordinal scale in ISO/IEC 33020). Examples of process quality characteristics that are constructs (theoretical concepts) include process capability, process security, process agility, and process safety. The main users of this International Standard are developers of process measurement frameworks and process assessment models. Conformity to this International Standard ensures that any process measurement framework is developed with reliable structures or elements which will generate quality composite measures.

This International Standard is part of a set of International Standards designed to provide a consistent and coherent framework for the assessment of process quality characteristics, based on objective evidence resulting from implementation of the processes. The framework for assessment covers processes employed in the development, maintenance, and use of systems across the information technology domain and those employed in the design, transition, delivery, and improvement of services. The set of International Standards, as a whole, addresses process quality characteristics of any type. Results of assessment can be applied for improving process performance, or for identifying and addressing risks associated with application of processes.

This International Standard provides requirements for the development of process measurement frameworks, such as ISO/IEC 33020. These can then be used to define process assessment models, conformant to ISO/IEC 33004, that can be employed for process assessments conformant with ISO/IEC 33002. The overall architecture and content of the series is described in ISO/IEC 33001.

Several International Standards in the ISO/IEC 330xx family of standards for process assessment are intended to replace and extend parts of the ISO/IEC 15504 series of Standards. ISO/IEC 33001, Annex A provides a detailed record of the relationship between the ISO/IEC 330xx family and the ISO/IEC 15504 series.

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INTERNATIONAL STANDARD ISO/IEC 33003:2015(E)

Information technology — Process assessment — Requirements for process measurement frameworks

1 Scope

This International Standard sets out the requirements for process measurement frameworks for use in process assessment. The requirements defined in this International Standard form a structure which

a) establish the requirements for process measurement frameworks in the context of process assessment,

b) establish the requirements for the validation of process measurement frameworks for use in process assessment, and

c) establish requirements that are applicable to any process measurement frameworks to develop composite measures across domains.

This International Standard is applicable to the development of process measurement frameworks for any process quality characteristic across all application domains.

Annex A presents a map of terminologies used in this International Standard. Annex B provides an explanation of construct specifications. Annex C reviews statistical validation methods. Annex D provides some methods including references that can be utilized in implementing the requirements for process measurement frameworks. These Annexes will be moved to a guide for constructing process measurement frameworks to be developed as part of the set of International Standards.

NOTE ISO/IEC 33020 is a process measurement framework for assessment of process capability based on this International Standard.

2 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 15939:2007, *Systems and software engineering — Measurement process*

ISO/IEC 33001:2015, *Information technology — Process assessment — Concepts and terminology*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC 33001, ISO/IEC 15939, and the following apply:

3.1
aggregation method
method that combines a set of measurement values to create a composite value

Note 1 to entry: Aggregation methods are based on compensatory or non-compensatory models.

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3.2
compensatory model
MCDM model in which a composite measure is composed of individually weighted terms and where criteria (also refer to attribute terms) with a high value can compensate for those of a low value in proportion to each weight

Note 1 to entry: A compensatory model suggests that improving the more important measures (those with a higher weighting) is more likely to increase or improve the overall composite value than improving the less important ones. This model assumes that the weight (influence level) of criteria remains the same regardless of the measured level of the criteria.

3.3
composite measure
variable derived from a set of operations of a construct's multi-item measures defined according to construct specification (either reflective or formative) that is the way in which the latent variable representing the construct of interest is linked to its measures

3.4
composite value
value from a composite measure

Note 1 to entry: A composite value can be from an ordinal, interval, or ratio scale.

3.5
construct
concept such as the abstract idea, image, underlying theme, or subject matter that one wishes to measure using process assessments

Note 1 to entry: In process measurement frameworks, constructs (also refers to latent constructs) are theoretical concepts such as the process quality characteristics and process attributes.

Note 2 to entry: The meaning that one assigns to a construct is called theoretical definition, which should explain its meaning, as well as discuss its distinct dimensions (facets).

3.6
dimension
distinct components that a multidimensional construct encompasses

3.7
formative construct
construct that is formed from its observed measures in the relationship between a construct and its measures

Note 1 to entry: The construct is a consequence of its measures and each measure is a determinant of the construct.

3.8
latent variable
variable representing a unidimensional construct

Note 1 to entry: There should be a separate latent variable for each dimension of a construct and a minimum of one measure per latent variable.

3.9
MCDM
Multiple-Criteria Decision Making or Multi-Attribute Decision Making
making preference decisions (e.g., evaluation, prioritization, and selection) of available alternatives characterized by multiple criteria

Note 1 to entry: A criterion in MCDM corresponds to measure.

Note 2 to entry: An MCDM with one alternative is the same as the development of a composite measure.

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3.10
measurement model
the implicit or explicit relationship between a latent variable and its (multi-item) measures

Note 1 to entry: The relationship between a reflective (formative) construct and its measure(s) is called a reflective (formative) measurement model.

3.11
multidimensional construct
construct that consists of a number of unidimensional constructs.

Note 1 to entry: Each dimension of a multidimensional construct is called unidimensional and is represented by one latent variable. Each dimension can have multiple measures. In a multidimensional construct, for example, the meaning of capability when it is defined as the common factor underlying its process attributes is different from the case when capability is defined as a simple sum of its process attributes. The former is called a reflective multidimensional construct and the latter is formative. A multidimensional construct can span an indeterminate number of levels.

3.12
non-compensatory model
MCDM model that does not allow criteria to compensate for each other in proportion to their weights

Note 1 to entry: Strongly positive or negative terms influence the overall composite value disproportionately, although the weight stays the same. There are various non-compensatory models depending on the evaluation policy, the purpose of the composite measure, and/or the measurement scale.

3.13
reflective construct
construct that is viewed as the cause of measures in the relationship between a construct and its measures

Note 1 to entry: Reflective construct is an underlying factor of the variation of its measures.

3.14
scale
ordered set of values, continuous, or discrete, or a set of categories to which the attribute is mapped

Note 1 to entry: The type of scale depends on the nature of the relationship between values on the scale. Four types of scales are commonly defined:

Nominal — the measurement values are categorical. For example, the classification of defects by their type does not imply order among the categories.

Ordinal — the measurement values are rankings. For example, the assignment of defects to a severity level is a ranking.

Interval — the measurement values have equal distances corresponding to equal quantities of the attribute. For example, cyclomatic complexity has the minimum value of one, but each increment represents an additional path. The value of zero is not possible.

Ratio — the measurement values have equal distances corresponding to equal quantities of the attribute where the value of zero corresponds to none of the attribute. For example, the size of a software component in terms of LOC is a ratio scale because the value of zero corresponds to no lines of code and each additional increments represents equal amounts of code.

[SOURCE: ISO/IEC 15939:2007]

3.15
unidimensionality
existence of a single trait or construct underlying a set of measures

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