INTERNATIONAL STANDARD

ISO/IEC 33020

Second edition
2019-11

Information technology — Process assessment — Process measurement framework for assessment of process capability

Technologies de l'information — Évaluation du processus — Cadre de mesure du processus pour évaluer la capacité du processus

Reference number
ISO/IEC 33020:2019(E)

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Fax: +41 22 749 09 47
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents

Page

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).

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) or the IEC list of patent declarations received (see http://patents.iec.ch).

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

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html.

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 33020:2015), which has been technically revised.

The main changes compared to the previous edition are as follows:

— the definitions of process capability levels and process attributes in 5.2, to improve consistency with ISO 9001:2015;

— two additional annexes are included, following Annex A; these are numbered as Annex B (Indicators of process capability) and Annex C (Guidance on the process assessment framework);

— the original Annex B has been relocated as Annex D (Example of a process performance model).

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.

Introduction

This document defines a process measurement framework for the process quality characteristic of process capability. The process measurement framework in this document conforms to the requirements of ISO/IEC 33003 and is applicable to any domain. The process measurement framework can be included in any process assessment model for the assessment of process capability, as specified in ISO/IEC 33004.

This document is primarily addressed to developers of process assessment models for the process quality characteristic of process capability. It is also addressed to the lead assessor and other stakeholders, such as the sponsor of the assessment, who need to be assured that the requirements of this process measurement framework have been met.

This document 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 set of International Standards, as a whole, addresses process quality characteristics of any type. Results of assessment can be applied for improving process performance, benchmarking, or for identifying and addressing risks associated with application of processes.

The set of International Standards ISO/IEC 33001 to ISO/IEC 33099, termed the ISO/IEC 330xx family, defines the requirements and resources needed for process assessment. The overall architecture and content of the series is described in ISO/IEC 33001. General issues relating to the application of conformity assessment to the assessment of process quality characteristics and organizational process maturity are addressed in ISO/IEC 29169.

Several standards in the ISO/IEC 330xx family for process assessment are intended to replace and extend parts of the ISO/IEC 15504 series. This document is intended to replace ISO/IEC 15504-2:2003, Clause 5. ISO/IEC 33001:2015, Annex A provides a detailed record of the relationship between the ISO/IEC 330xx family and the ISO/IEC 15504 series.

Information technology — Process assessment — Process measurement framework for assessment of process capability

1 Scope

This document defines a process measurement framework that supports the assessment of process capability, in accordance with the requirements of ISO/IEC 33003. The process measurement framework provides a schema that can be used to construct a process assessment model conformant with ISO/IEC 33004 which can be used in the performance of assessment of process capability according to the requirements of ISO/IEC 33002. In the context of this document and related standards, process capability is a process quality characteristic related to the ability of a process to consistently meet current or projected business goals.

The process measurement framework defined in this document forms a structure which

a) facilitates self-assessment,

b) provides a basis for use in process improvement and process quality determination,

c) is applicable across all application domains and sizes of organization,

d) produces a set of process (capability) attribute ratings (process profile), and

e) derives a process capability level.

This document also includes as informative annexes a set of assessment indicators of process capability that can be used in the construction of a process assessment model using this process measurement framework, and guidance on the meaning of the process capability levels and the achievement of the process attributes.

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 33001, *Information technology — Process assessment — Concepts and terminology*

ISO/IEC 33003, *Information technology — Process assessment — Requirements for process measurement frameworks*

3 Terms and definitions

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

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

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

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

3.1
conformity
fulfilment of a requirement

Note 1 to entry: In English the word "conformance" is synonymous but deprecated. In French the word "compliance" is synonymous but deprecated.

[SOURCE: ISO 9000:2015, 3.6.11, modified — Note 2 to entry has been removed.]

3.2
documented information
information required to be controlled and maintained by an organization and the medium on which it is contained

Note 1 to entry: Documented information can be in any format and media and from any source.

Note 2 to entry: Documented information can refer to:

— the management system, including related processes;

— information created in order for the organization to operate (documentation);

— evidence of results achieved (records).

Note 3 to entry: This constitutes one of the common terms and core definitions for ISO management system standards given in Annex SL of the Consolidated ISO Supplement to the ISO/IEC Directives, Part 1.

[SOURCE: ISO 9000:2015, 3.8.6]

3.3
nonconformity
non-conformity
non-fulfillment of a requirement

[SOURCE: ISO/IEC/IEEE 24765:2017, 3.2615, modified — The admitted term "non-conformity" has been added.]

3.4
process capability
characterization of the ability of a process to meet current or projected business goals

3.5
process capability level
characterisation of a process on an ordinal measurement scale of *process capability* (3.4)

4 Overview

The process measurement framework for assessment of process capability described in this document is expressed in terms of a set of process attributes. Each process attribute is defined in terms of a set of process attribute outcomes which can be evaluated to indicate the extent of achievement of the process attribute. The process attributes are organised into process capability levels, ranging from Incomplete (in which the process does not achieve its defined process outcomes) to Innovating (in which the process is continually improved to respond to organizational change). The process measurement framework for assessment of process capability shall be conformant with the requirements for process measurement frameworks in ISO/IEC 33003. Annex A documents the conformance of the measurement framework.

In addition to the definitions of process capability levels and process attributes, this document contains in Annex B, a set of assessment indicators of process capability comprising generic practices for each process attribute. The document also includes, in Annex C, detailed guidance on the use and application of the measurement framework, and in Annex D, an example of a process performance model.

The result of an assessment, using a process assessment model that incorporates this process measurement framework, will be a set of process profiles — ratings of the achievement of the set of process attributes for each process in the scope of the assessment. The result can also be expressed in terms of the capability level ratings achieved for each process in the assessment scope. A capability level rating does not guarantee that an organization will perform its processes at any given process capability level, simply that it is capable of performing its processes at that level.

Users of this document may reproduce 5.2, 5.3, 5.4, 5.6 and Annex B as part of any process assessment model or maturity model so that it can be used for its intended purpose.

5 A process measurement framework for process capability

5.1 General

This clause defines a process measurement framework for the assessment of process capability, conformant with the requirements of ISO/IEC 33003. This process measurement framework provides a schema that can be used to construct a process assessment model for assessing process capability.

Within this process measurement framework, the measure of capability is based upon a set of process attributes. Each process attribute defines a measurable property of process capability. The extent of process attribute achievement is characterised on a defined rating scale. The process capability level for an assessed process is derived from the set of process attribute ratings represented in the process profile.

The achievement of one process attribute may be associated with the achievement of another process attribute within the process measurement framework.

5.2 Process capability levels and process attributes

5.2.1 General

Process capability is defined on a six-point ordinal scale that enables capability to be assessed from the bottom of the scale, **Incomplete**, through to the top end of the scale, **Innovating**. The scale represents increasing capability of the implemented process, from failing to achieve the process purpose through to continually improving and able to respond to organizational change.

5.2.2 Process capability Level 0: Incomplete process

The process is not implemented or fails to achieve its process purpose.

At this level there is little or no evidence of any systematic achievement of the process purpose.

5.2.3 Process capability Level 1: Performed process

5.2.3.1 General

The implemented process achieves its process purpose. The following process attribute demonstrates the achievement of this level.

5.2.3.2 PA 1.1 Process performance process attribute

The process performance process attribute is a measure of the extent to which the process purpose is achieved. As a result of full achievement of this process attribute:

a) The process achieves its defined process outcomes.

5.2.4 Process capability Level 2: Managed process

5.2.4.1 General

The previously described *Performed process* is now implemented in a managed fashion (planned, monitored and adjusted) and its documented information are appropriately established, controlled and maintained.

The following process attributes, together with the previously defined process attribute, demonstrate the achievement of this level.

5.2.4.2 PA 2.1 Performance management process attribute

The performance management process attribute is a measure of the extent to which the performance of the process is managed with necessary resources and competences. As a result of full achievement of this process attribute:

a) results to be achieved are determined and communicated;

b) risks that can affect performance of the process are determined and addressed;

c) performance of the process is planned, monitored, measured, evaluated and adjusted (as needed);

d) responsibilities and authorities for performing the process are determined, assigned and communicated;

e) resources necessary for performing the process are determined, provided and maintained (as needed);

f) person(s) performing the process are competent on the basis of appropriate education, training, or experience;

g) interfaces between the involved parties are managed to ensure both effective communication and the level of control expected.

NOTE 1 Results to be achieved can include quality criteria for documented information, process cycle time or frequency, resource usage and boundaries of the process.

NOTE 2 Techniques for progress monitoring and evaluation can include milestone achievement and percentage complete towards next milestones, elapsed time compared to estimated time of activities, actual resource usage compared against planned requirements, experienced people estimate of percentage complete of activities or work packages, burn down charts representing measurable progress such as outstanding work (or backlog) over time (or story points).

NOTE 3 Resources include people, infrastructure, and environment for the operation of processes. Infrastructure can include buildings and associated utilities, equipment (including hardware and software), transportation resources and information and communication technology. A suitable environment can be a combination of human and physical factors including social and psychological environmental factors. Resources include internal and external resources and can include customers and users. The term 'resources' is defined in ISO/IEC/IEEE 24765.

NOTE 4 Applicable actions to acquire necessary competences can include, for example, the provision of training to, the mentoring of, or the re-assignment of persons, or the hiring or contracting of competent persons.

NOTE 5 Addressing risk establishes a basis for achieving improved results and preventing negative effects. Actions taken to address risks should be proportionate to the potential impact. Options to address risk can include avoiding the risk, taking risk in order to pursue an opportunity, eliminating risk source, changing the likelihood or consequences, sharing the risk, or retaining risk by informed decision.

5.2.4.3 PA 2.2 Documented information management process attribute

The documented information management process attribute is a measure of the extent to which the documented information produced internally, or acquired from an external source when performing the process is appropriately managed. As a result of full achievement of this process attribute:

a) requirements for the documented information of the process are determined;

b) requirements for control of the documented information are determined;

c) documented information is appropriately identified, and controlled according to requirements;

d) documented information is reviewed and approved for suitability and adequacy in accordance with planned arrangements and adjusted as necessary to meet requirements;

e) documented information is determined, maintained and retained to the extent necessary to have confidence that the process has been performed as planned and to demonstrate the conformity of products and/or services to their requirements.

NOTE 1 Requirements for the control of documented information can include requirements for the identification and description, format and media, and control of changes (e.g. version control), distribution, retrieval and use, storage and preservation, including preservation of legibility, retention and disposition, and for making it available and suitable for use when and where it is needed.

NOTE 2 The documented information referred to in this clause is that which results from the achievement of the process purpose through the process outcomes.

5.2.5 Process capability Level 3: Established process

5.2.5.1 General

The previously described *Managed process* is now implemented using a defined process which is assured and continually improved.

The following process attributes, together with the previously defined process attributes, demonstrate the achievement of this level.

5.2.5.2 PA 3.1 Process definition process attribute

The process definition process attribute is a measure of the extent to which a standard process is established and maintained. As a result of full achievement of this process attribute:

a) a standard process, including appropriate tailoring guidelines, is established and maintained that describes the fundamental elements that must be incorporated into a defined process;

b) the required inputs and the expected outputs for the *standard* process are determined;

c) sequence and interaction of the *standard* process with other processes is determined;

d) roles, competences, responsibilities and authorities for performing the *standard* process are determined;

e) resources for performing the *standard* process are determined;

f) knowledge necessary for the operation of the *standard* process is determined and maintained.

NOTE Knowledge can be based on internal sources (e.g. intellectual property, knowledge gained from experience, lessons learned, and the results of improvements in the process) and external sources (e.g. standards, academia, conferences, customers and external providers).

When addressing changing needs and trends, the need to acquire or access any necessary additional knowledge and required updates should be considered.

5.2.5.3 PA 3.2 Process deployment process attribute

The process deployment process attribute is a measure of the extent to which a standard process is deployed as a defined process. As a result of full achievement of this process attribute:

a) a defined process is deployed based upon an appropriately tailored standard process;

b) required roles, responsibilities and authorities necessary for performing the defined process are assigned and communicated;

c) required person(s) necessary for performing the defined process are competent on the basis of defined education, training and experience;

d) required resources necessary for performing the defined process are made available, monitored and measured;

e) documented information is available to ensure that the defined process achieves its intended results.

NOTE 1 Responsibilities and authorities are normally assigned to roles or actors in the processes.

NOTE 2 Appropriate tailoring includes deploying the standard process as is.

5.2.5.4 PA 3.3 Process assurance process attribute

The process assurance process attribute is a measure of the extent to which the defined process is assured and continually improved. As a result of full achievement of this process attribute:

a) appropriate data and information are collected and analysed from monitoring and measurement of the process to evaluate the effectiveness and risks of the process, and to identify needs and opportunities for improvement;

b) criteria and methods needed to ensure effective operation and control, and continuing suitability, adequacy, effectiveness and risks of the process are determined and evaluated;

c) conformity of the defined process (and associated activities, outputs and documented information) is objectively assured;

d) action is taken on any nonconformity, based on its nature and effect, and tracked to closure;

e) the standard process is continually improved based on identified needs and opportunities.

Documented information should be retained of any nonconformities describing actions taken, concessions obtained, and authority deciding action in respect on the nonconformity. Documented information reviews include management reviews

NOTE Action in dealing with nonconformity can include any of the following a) correction b) segregation, containment or suspension of products or services c) informing the customer d) obtaining authorization for acceptance under concession e) evaluating the need for and eliminating causes in order to prevent re- occurrence. Any action taken to adjust the performance of the process will be managed in the scope of the Performance Management process attribute (PA2.1).

5.2.6 Process capability Level 4: Predictable process

5.2.6.1 General

The previously described *Established process* is now performed predictively. Quantitative management needs are identified, measurement data are collected and analysed to identify assignable causes of variation. Corrective action is taken to address assignable causes of variation.

The following process attributes, together with the previously defined process attributes, demonstrate the achievement of this level.

5.2.6.2 PA 4.1 Quantitative analysis process attribute

The quantitative analysis process attribute is a measure of the extent to which information needs are defined, relationships between process elements are identified and data are collected. As a result of full achievement of this process attribute:

a) process information needs in support of relevant defined quantitative business goals are established;

b) process measurement objectives are derived from process information needs;

c) measurable relationships between process elements that contribute to the process performance are identified;

d) quantitative objectives for process performance are established to support relevant business goals;

e) appropriate measures and frequency of measurement are identified and defined in line with process measurement objectives and quantitative objectives for process performance;

f) techniques for analysing the collected data are selected;

g) results of measurement are collected, validated and reported in order to monitor the extent to which the quantitative objectives for process performance are met.

NOTE 1 Information needs typically reflect management, technical, project, process or product needs.

NOTE 2 Measures can be either process measures or product measures or both.

NOTE 3 Techniques for quantitative data analysis can include statistical and mathematical methods — data tabulation, descriptive data, data aggregation/disaggregation and other advanced analytical methods such as correlation, analysis of variance and regression.

5.2.6.3 PA 4.2 Quantitative control process attribute

The quantitative control process attribute is a measure of the extent to which objective data are used to manage and control process performance that is predictable. As a result of full achievement of this process attribute:

a) assignable causes of process variation are determined through analysis of the collected data;

b) distributions that characterize the performance of the process are established;

c) corrective actions are taken to address assignable causes of variation;

d) separate distributions are established (as necessary) for analysing the process under the influence of assignable causes of variation;

e) process performance data are used to develop predictors of process outcomes.

5.2.7 Process capability Level 5: Innovating process

5.2.7.1 General

The previously described *Predictable process* is now continually improved to respond to changes through identified innovative approaches for process innovation.

NOTE Innovation can involve the adoption of wholly new processes and methods, new technologies that require different processes, or others.

The following process attribute, together with the previously defined process attributes, demonstrates the achievement of this level.

5.2.7.2 PA 5.1 Process innovation process attribute

The process innovation process attribute is a measure of the extent to which changes to the definition, management and performance of the process are identified and effectively implemented from identified innovative approaches for process innovation using internal resources and/or using external ideas according to defined process innovation objectives.

As a result of full achievement of this process attribute:

a) process innovation objectives for the process are defined that support the relevant business goals;

b) appropriate data are analysed to identify opportunities for best practice and innovation;

c) innovation opportunities derived from new technologies and process concepts are identified;

d) an implementation strategy is established to achieve the process innovation objectives;

e) impact of all proposed changes is assessed against the objectives of the defined process and standard process;

f) implementation of all agreed changes is managed to ensure that any disruption to the process performance is understood and acted upon;

g) effectiveness of process change on the basis of actual performance is evaluated against the defined product requirements and process and innovation objectives.

5.3 Process attribute rating scale

Within this process measurement framework, a process attribute is a measurable property of process capability. A process attribute rating is a judgement of the degree of achievement of the process attribute for the assessed process.

A process attribute is measured using an ordinal scale as defined below.

N Not achieved:

There is little or no evidence of achievement of the defined process attribute in the assessed process.

P Partially achieved:

There is some evidence of an approach to, and some achievement of, the defined process attribute in the assessed process. Some aspects of achievement of the process attribute may be unpredictable.

L Largely achieved:

There is evidence of a systematic approach to, and significant achievement of, the defined process attribute in the assessed process. Some weaknesses related to this process attribute may exist in the assessed process.

F Fully achieved:

There is evidence of a complete and systematic approach to, and full achievement of, the defined process attribute in the assessed process. No significant weaknesses related to this process attribute exist in the assessed process.

The ordinal scale defined above shall be understood in terms of percentage achievement of a process attribute.

The corresponding percentages shall be:

N	Not achieved	0 % to ≤15 % achievement
P	Partially achieved	>15 % to ≤50 % achievement
L	Largely achieved	>50 % to ≤85 % achievement
F	Fully achieved	>85 % to ≤100 % achievement

The ordinal scale may be further refined for the measures P and L as defined below.

P+ Partially achieved:

There is some evidence of an approach to, and some achievement of, the defined process attribute in the assessed process. Some aspects of achievement of the process attribute may be unpredictable.

P– Partially achieved:

There is some evidence of an approach to, and some achievement of, the defined process attribute in the assessed process. Many aspects of achievement of the process attribute may be unpredictable.

L+ Largely achieved:

There is evidence of a systematic approach to, and significant achievement of, the defined process attribute in the assessed process. Some weaknesses related to this process attribute may exist in the assessed process.

L– Largely achieved:

There is evidence of a systematic approach to, and significant achievement of, the defined process attribute in the assessed process. Many weaknesses related to this process attribute may exist in the assessed process.

The corresponding percentages shall be:

P–	Partially achieved–	>15 % to ≤32.5 % achievement
P+	Partially achieved+	>32.5 % to ≤50 % achievement
L–	Largely achieved–	>50 % to ≤67.5 % achievement
L+	Largely achieved+	>67.5 % to ≤85 % achievement

5.4 Process attribute rating method

5.4.1 General

A process outcome is the observable result of successful achievement of the process purpose.

A process attribute outcome is the observable result of achievement of a specified process attribute.

Process outcomes and process attribute outcomes may be characterised as an intermediate step to providing a process attribute rating.

When performing rating, the rating method employed shall be specified relevant to the class of assessment. The following rating methods are defined.

The use of rating method may vary according to the class, scope and context of an assessment. The lead assessor shall decide which (if any) rating method to use. The selected rating method(s) shall be specified in the assessment input and referenced in the assessment report.