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Second edition
2020-04

Systems and software engineering — Lifecycle profiles for Very Small Entities (VSEs) —

Part 3-1: Process assessment guidelines

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CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Fax: +41 22 749 09 47
Email: copyright@iso.org
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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).

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/TR 29110-3-1:2015), which has been technically revised.

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

— Annex A has been reworked and split to distinguish measurement framework and exemplar process assessment model; exemplar process assessment model for system life cycle processes has been added;

— main concepts for VSE profiles, i.e. maturity levels and process capability levels, have been added;

— structure of the process assessment model has been reworked and mapped to VSE profiles and processes dimensions;

— process assessment indicators description has been reworked;

— software project management and software implementation process base practices indicators and work product characteristics have been aligned with the latest editions of ISO/IEC 29110-4-1, ISO/IEC/TR 29110-5-1-2 and ISO/IEC/TR 29110-5-2-1;

— software process performance indicators for organizational profile group have been added;

— software process capability levels and process attributes indicators (PA.1 to PA.4) have been added;

— rules to derive VSE profiles from process capability levels have been added;

— subclauses on conformity of the exemplar process assessment model have been added.

A list of all parts in the ISO/IEC 29110 series can be found on the ISO website.

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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.

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Introduction

Very Small Entities (VSEs) around the world are creating valuable products and services. For the purpose of the ISO/IEC 29110 series, a Very Small Entity (VSE) is an enterprise, an organization, a department or a project having up to 25 people. Since many VSEs develop and/or maintain system and software components used in systems, either as independent products or incorporated in larger systems, recognition of VSEs as suppliers of high quality products is required.

According to the Organization for Economic Co-operation and Development (OECD) SME and Entrepreneurship Outlook 2019 report, 'Small and medium-sized enterprises (SMEs) and entrepreneurship are essential drivers of economic and social well-being. Representing 99 % of all businesses, generating about 60 % of employment and totalling between 50 % and 60 % of value added in the OECD area'. The challenge facing OECD governments is to provide a business environment that supports the competitiveness of this large heterogeneous business population and that promotes a vibrant entrepreneurial culture.

From studies and surveys conducted, it is clear that the majority of International Standards do not address the needs of VSEs. Implementation of and conformance with these standards is difficult, if not impossible. Consequently, VSEs have no, or very limited, ways to be recognized as entities that produce quality systems/system elements, including software in their domain. Therefore, VSEs are excluded from some economic activities.

It has been found that VSEs find it difficult to relate International Standards to their business needs and to justify the effort required to apply standards to their business practices. Most VSEs can neither afford the resources, in terms of number of employees, expertise, budget and time, nor do they see a net benefit in establishing over-complex systems or software life cycle processes. To address some of these difficulties, a set of guides has been developed based on a set of VSE characteristics. The guides are based on subsets of appropriate standards processes, activities, tasks, and outcomes, referred to as profiles. The purpose of a profile is to define a subset of International Standards relevant to the VSEs' context; for example, processes, activities, tasks, and outcomes of ISO/IEC/IEEE 12207 for software; processes, activities, tasks, and outcomes of ISO/IEC/IEEE 15288 for systems; information products (documentation) of ISO/IEC/IEEE 15289 for software and systems.

VSEs can achieve recognition through implementing a profile and by being audited against ISO/IEC 29110 specifications.

The ISO/IEC 29110 series of standards and technical reports can be applied at any phase of system or software development within a life cycle. This series is intended to be used by VSEs that do not have experience or expertise in adapting/tailoring ISO/IEC/IEEE 12207 or ISO/IEC/IEEE 15288 standards to the needs of a specific project. VSEs that have expertise in adapting/tailoring ISO/IEC/IEEE 12207 or ISO/IEC/IEEE 15288 are encouraged to use those standards instead of the ISO/IEC 29110 series.

The ISO/IEC 29110 series is intended to be used with any lifecycle such as waterfall, iterative, incremental, evolutionary or agile.

Systems, in the context of the ISO/IEC 29110 series, are typically composed of hardware and software components.

The ISO/IEC 29110 series, targeted by audience, has been developed to improve system or software and/or service quality, and process performance. See Table 1.

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Table 1 — ISO/IEC 29110 target audience

ISO/IEC 29110	Title	Target audience
ISO/IEC/TR 29110-1	Overview	VSEs and their customers, assessors, standards producers, tool vendors and methodology vendors.
ISO/IEC 29110-2	Framework for profile preparation	Profile producers, tool vendors and methodology vendors. Not intended for VSEs.
ISO/IEC 29110-3	Certification and assessment guidance	VSEs and their customers, assessors, accreditation bodies.
ISO/IEC 29110-4	Profile specifications	VSEs, customers, standards producers, tool vendors and methodology vendors.
ISO/IEC/TR 29110-5	Management, engineering and service delivery guides	VSEs and their customers.
ISO/IEC 29110-6	Management and engineering guides not tied to a specific profile	VSEs and their customers.
ISO/IEC/TR 29110-7	Specific profile guidelines	VSEs and their customers.

If a new profile is needed, ISO/IEC 29110-4 and ISO/IEC/TR 29110-5 and ISO/IEC 29110-6 and or ISO/IEC/TR 29110-7 ISO/IEC/TR 29110-5 can be developed with minimal impact to existing documents.

ISO/IEC/TR 29110-1 defines the terms common to the ISO/IEC 29110 series. It introduces processes, lifecycle and standardization concepts, the taxonomy (catalogue) of ISO/IEC 29110 profiles and the ISO/IEC 29110 series. It also introduces the characteristics and needs of a VSE, and clarifies the rationale for specific profiles, documents, standards and guides.

ISO/IEC 29110-2 introduces the concepts for systems and software engineering profiles for VSEs. It establishes the logic behind the definition and application of profiles. For standardized profiles, it specifies the elements common to all profiles (structure, requirements, conformance, assessment). For domain-specific profiles (profiles that are not standardized and developed outside of the ISO process), it provides general guidance adapted from the definition of standardized profiles.

ISO/IEC 29110-3 defines certification schemes, assessment guidelines and compliance requirements for process capability assessment, conformity assessments, and self-assessments for process improvements. ISO/IEC 29110-3 also contains information that can be useful to developers of certification and assessment methods and developers of certification and assessment tools. ISO/IEC 29110-3 is addressed to people who have direct involvement with the assessment process, e.g. the auditor, certification and accreditation bodies and the sponsor of the audit, who need guidance on ensuring that the requirements for performing an audit have been met.

ISO/IEC 29110-4-m provides the specification for all profiles in one profile group that are based on subsets of appropriate standards elements.

ISO/IEC/TR 29110-5-m-n provides management, engineering and service delivery guides for the profiles in a profile group.

ISO/IEC 29110-6-m provides the specification for specific profiles that are based on subsets of appropriate standards elements.

ISO/IEC/TR 29110-7-x provides a guide for each profile in the specific profile group.

This document defines the process assessment guidelines needed to meet the purpose of defined VSE profiles. It is applicable to all VSE profiles and is compatible with ISO/IEC 33002.

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Figure 1 describes the ISO/IEC 29110 series of International Standards (IS) and Technical Reports (TR) and positions the parts within the framework of reference. Overview, assessment guide, management and engineering guide are available from ISO as freely available Technical Reports (TR). The Framework document, profile specifications and certification schemes are published as International Standards (IS).

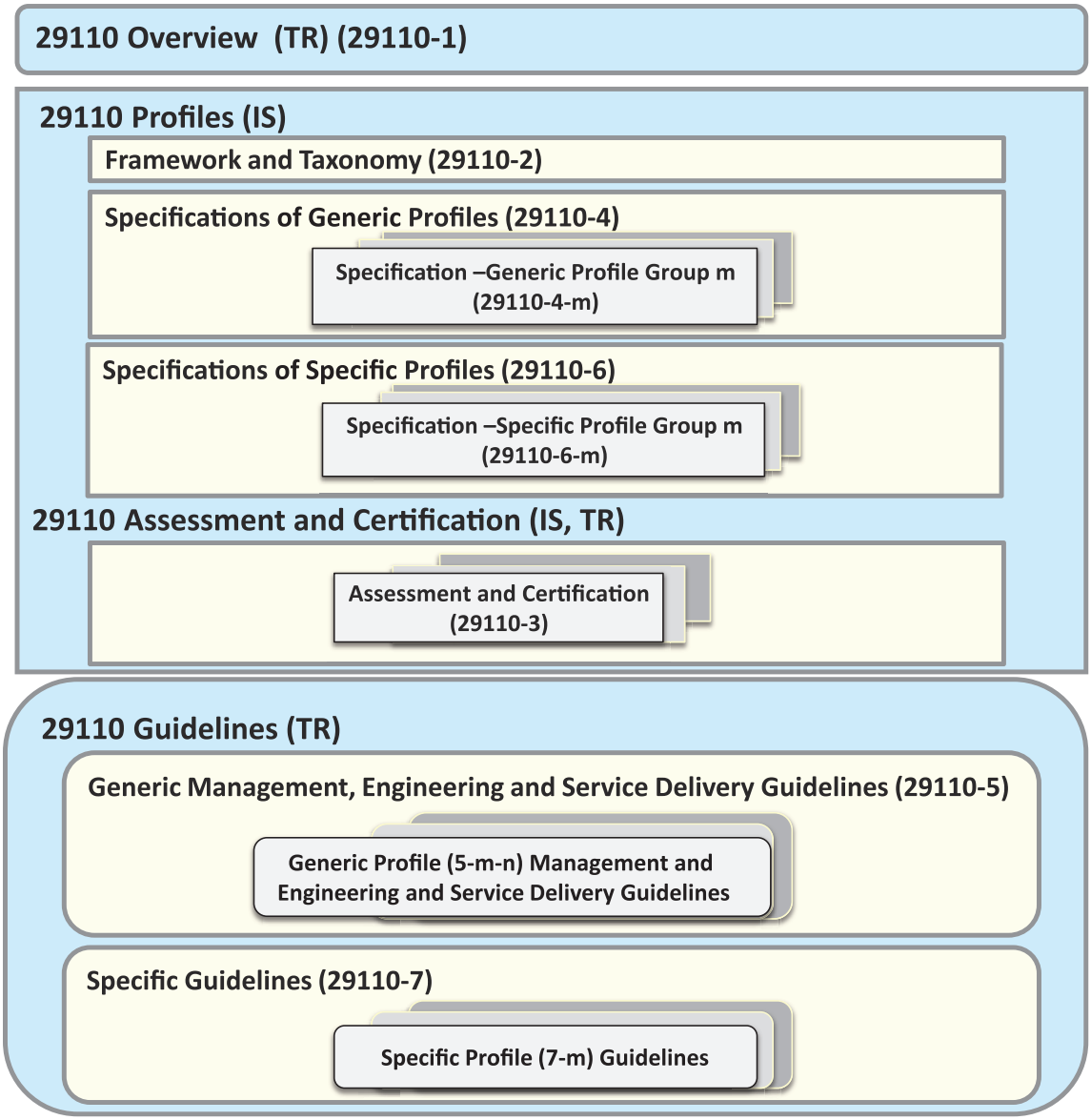

Figure 1 — The ISO/IEC 29110 series

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Systems and software engineering — Lifecycle profiles for Very Small Entities (VSEs) —

Part 3-1: Process assessment guidelines

1 Scope

1.1 Fields of application

This document defines the process assessment guidelines needed to meet the purpose of defined VSE profiles. It is applicable to all VSE profiles and is compatible with ISO/IEC 33002.

The possible uses of this document are as follows.

a) Assessment to evaluate the process capabilities. Use when an organization wants an assessment of profile conformance (basic, etc.) of the implemented processes.

b) Supplier's capability assessment. Use when a customer asks for a third party to conduct an assessment in order to obtain a profile (basic, etc.) of the implemented process by the system or software development and maintenance supplier.

1.2 Target audience

The target audience of this document is primarily those who perform or have direct relationship with process assessments of VSEs. This document also contains information that can be useful to developers of assessment methods and assessment tools and those requiring additional guidance on the assessmet process.

This document is addressed to people who have a direct relation with the assessment process based on the VSE profiles (e.g. the assessors and the sponsor of the assessment) who need guidance on ensuring that the requirements for performing an assessment have been met.

It is intended that ISO/IEC/TR 29110-1 be read first when initially exploring VSE profile documents.

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/TR 29110-1, *Systems and software engineering — Lifecycle profiles for Very Small Entities (VSEs) — Part 1: Overview*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC/TR 29110-1 and the following apply.

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

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

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

NOTE In the ISO/IEC 29110 series, to minimize confusion about the term 'basic' that is used to mean different ideas, the term 'Basic' with a capital B is used to refer to the Basic profile while the term 'basic' is used to mean forming an essential foundation or starting point (e.g. basic types of work products).

3.1
process profile
set of process attribute ratings for an assessed process

Note 1 to entry: Within the ISO/IEC 29110 series, a profile is defined as "set of one or more base standards and/or profiles and, where applicable, the identification of chosen classes, conforming subsets, option and parameters of those base standard, or standardized profiles necessary to accomplish a particular function" (ISO/IEC/TR 10000-1).

Note 2 to entry: When used unqualified in this document, this is the applicable definition.

[SOURCE: ISO/IEC 33001:2015, 3.2.18, modified — Note 1 to entry and Note 2 to entry have been added.]

3.2
process quality
ability of a process to satisfy stated and implied stakeholder needs when used in a specified context

[SOURCE: ISO/IEC 33001:2015, 3.4.8]

3.3
process quality level
representation of the achieved level of a *process quality* (3.2) characteristic derived from the process attribute ratings for an assessed process

[SOURCE: ISO/IEC 33001:2015, 3.4.10, modified — "point on a scale of achievement" has been replaced with "representation of the achieved level".]

3.4
target process profile
process profile (3.1) specifying which process attributes are required and the rating necessary for each process attribute for a required process

[SOURCE: ISO/IEC 33001:2015, 3.2.20]

4 Abbreviated terms

BP base practice

OM organizational management

PA process attributes

PAM process assessment model

PMP process management process

PPM project portfolio management

PRM process reference model

RM resource management

VSE Very Small Entity

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5 Process assessment framework

These guidelines apply to VSE process assessments. The assessment, as defined in this document, has two purposes:

— To evaluate the process capability based on a two-dimensional assessment model containing a process dimension and the process quality dimension. The process dimension refers to the processes defined in each VSE profile which are provided by an external process reference model (PRM). The process quality dimension consists of a Process measurement framework comprising process quality levels, their associated process attributes, and the rating scale.

— To evaluate whether an organization fulfils the targeted VSE profile based on the evaluated capabilities for the processes.

For an official recognition, the conformity assessments should be carried out following a process assessment process satisfying the requirements of ISO/IEC 33002 and described in Clause 6. For self-assessments emphasizing identification of process improvements, other approaches can be applied (additional information can be found in other parts of ISO/IEC 29110 specifically dedicated to self-assessment).

According to ISO/IEC 33001, a process assessment is "a disciplined evaluation of an organizational unit's processes against a process assessment model (PAM)". In this context, the process assessment model consists of a subset of process purposes and outcomes of a process reference model, and the process attributes, quality levels and rating scale that are defined in the correspondent process assessment model. A process reference model is, for instance, ISO/IEC/IEEE 12207 and the applicable subset is defined in a Specification of a VSE profile, for instance, ISO/IEC 29110-4-1. The applied process assessment model, always conformant to ISO/IEC 33002, has as its result represented as a set of process attribute ratings, i.e. a process profile. Figure 2 illustrates the relevant documents and data for a process applicable to VSE process assessment.

ISO/IEC 33002 sets out the minimum requirements for performing a process assessment that ensure consistency and repeatability of the ratings. The requirements help to ensure that the process assessment output is self-consistent and provides evidence to substantiate the ratings and to verify conformance with the requirements.

Self-assessments are typically performed to identify process improvement opportunities or to check current status of the organization's performance. Self-assessments in VSEs are outside the scope of this document.

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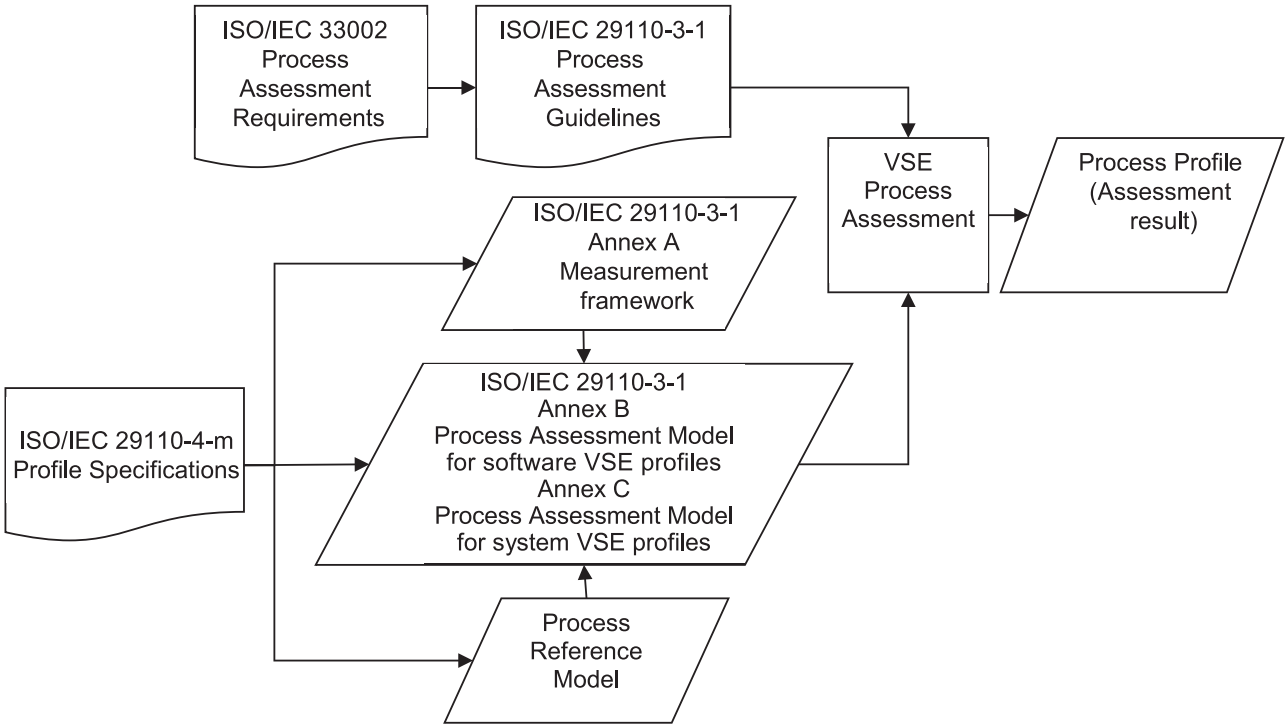

Figure 2 — Elements of VSE process assessment

6 VSE process assessment

6.1 Performing an assessment

6.1.1 General

In performing a process assessment based on the ISO/IEC 29110 series, the requirements expressed in ISO/IEC 33002 are intended to be satisfied in full. This clause provides additional guidance related specifically to the process assessment in VSEs.

A process assessment is conducted according to a documented process that is capable of meeting the process assessment purpose. The key elements of a documented assessment process are closely tied to the requirements for performing an assessment, defined in ISO/IEC 33002. The documented assessment process is the set of instructions for conducting the process assessment. A documented assessment process addresses the following aspects of the conduct of a process assessment:

— incorporate as a minimum, the tasks defined in ISO/IEC 33002;

— identify the classes of process assessment for which the documented assessment process can be applied and the nature and extent of tailoring associated with each class addressed by the documented process;

— define the criteria for ensuring coverage for both the defined organizational scope and the defined process scope for the assessment, in terms of the strategy for collecting and analysing data;

— identify or define the approach to be taken in performing the generation of process attribute ratings, including (where applicable) the aggregation of observations and/or characterisations across the elements of the assessment.

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6.1.2 Assessment inputs

Process assessment inputs as specified in ISO/IEC 33002:2015, 4.4 are to be defined. In conducting process assessments of VSEs based on ISO/IEC 29110-4-1, the following issues are expected.

— The process scope of the process assessment [ISO/IEC 33002:2015, 4.4 (d) (1, 2)] should be determined by the target VSE profile specified for the process assessment.

— The organizational scope of the process assessment [ISO/IEC 33002:2015, 4.4 (d) (3)] should typically be the entire VSE; however, where the VSE deploys a small number of clearly distinct projects or functions, the scope can be limited to a single project or function.

— In defining the process assessment context [ISO/IEC 33002:2015, 4.4 (d) (4)], the process assessment plan should take into account the VSE business and engineering context and be affordable for a VSE.

— In defining the process assessment constraints [ISO/IEC 33002:2015, 4.4 (g)], the specific nature of the VSE should be explored to establish constraints on availability of resources or data that might affect the reliability of the process assessment.

6.1.3 Roles and responsibilities

Typically, the process assessment team for VSE process assessment process consists of at least one lead assessor or a lead assessor with other assessors. The assessors should be familiar with the VSE characteristics.

6.1.4 The assessment process

The activities to be performed will be determined by the chosen documented assessment process tailored as necessary. The documented process for the process assessment of a VSE should address all of the required activities defined in ISO/IEC 33002:2015, 4.2.

Specific concerns of relevance to process assessment of VSEs include the following.

a) Plan the assessment

Typically, the schedule for process assessment of a VSE will need to take account of the availability of key resources. The level of resources required for the process assessment should be determined according to the resources available to the VSE.

b) Collect the data

The strategy for data collection should take account of the nature of the work performed within the VSE and of the nature of the items of objective evidence that will typically be available. Often, process assessments in VSEs rely heavily on testimony from performers of the processes; however, to the best extent possible, the assessors should endeavour to obtain other supporting objective evidence drawn from the VSE work products.

c) Validate the data

The key issue in data validation in process assessment of a VSE is ensuring that the data collected is representative of the normal operations of the enterprise.

d) Derive results

In conducting process attribute rating, the assessors should focus on the extent to which the evidence obtained addresses the processes and process attributes being rated. The requirement for traceability between the rating and the evidence employed [ISO/IEC 33002:2015, 4.2.1 e) 1)] is relevant here.

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e) Report the assessment

The assessors should ensure that the report to the sponsor of the process assessment covers the full scope of the VSE profile employed in the process assessment.

6.2 Use of the assessment results

The process assessment results can be used to:

a) evaluate the process quality levels of an organization;

b) determine the improvement opportunities, in order to enhance the organization's ability to meet its business goals by improving efficiency and quality of its products and services. The findings can be used as a base to perform the improvement plan;

c) benchmark the process quality levels with other organizations in the market;

d) select a supplier based on the supplier's quality level assessment.

6.3 Achievement of a VSE profile

This subclause provides guidance on how to determine whether an organization fulfils a VSE profile. The determination is based on the evaluated quality levels for the processes within each VSE profile. ISO/IEC 29110-4-1 defines the conformance requirements.

The requirements for the VSE profiles are defined in ISO/IEC 29110-4-1. The corresponding quality levels to be evaluated for each VSE profile can be derived from the respective parts of ISO/IEC 29110-4-1. At minimum, all mandatory elements of the VSE profile, as defined in ISO/IEC 29110-4-1, are the ones to be considered in the process assessment.

For example, the achievement of the software Basic profile, implies that the assessed processes achieve quality level one as defined in Annex A. This means that the implemented process achieves its process purpose and its defined outcomes. For example, for the Generic Basic profile for software, the applicable process purposes are documented in ISO/IEC 29110-4-1 (process reference model for the Basic profile):

— Project management process;

— Software implementation process.

NOTE Process reference models are now to be contained in ISO/IEC 29110-4-1.

The related outcomes of the process reference model are documented in Annex A (supported by ISO/IEC/TR 29110-5–1–2 under the process-specific objectives). A detailed mapping of the VSE profile process elements to ISO/IEC/IEEE 15288, ISO/IEC/IEEE 12207, and other base standards are provided in ISO/IEC 29110-4-1.

6.4 Application of process assessment models

Use of ISO/IEC 33004 compliant process assessment model (PAM) ensures that the process assessment results are comparable, reliable, and repeatable. The assessor should confirm that the applied PAM is suitable for assessing the process capability in the context of VSEs.

The applied PAM should have a set of indicators that address the process purpose and outcomes, and demonstrate the achievement of the required capability level.

ISO/IEC 29110-4-1 Specifications for VSE profiles document a detailed mapping of process elements between ISO/IEC 29110-5-m-n and the process reference model in of ISO/IEC 29110-4-1, respectively.

A VSE-specific PAM can be derived by selecting those process assessment indicators relevant to the corresponding process outcomes defined in ISO/IEC 29110-4-1.

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Two examplars of PAMs are provided in Annex B and Annex C, respectively.

Annex A presents two main process assessment aspects for the assessment of VSE software related processes: a) the measuremment framework, and b) the principles of VSE maturity model (i.e. VSE profiles achievement rules).

Annex B presents the software process assessment model for the assessment of the processes of Software development VSEs, as defined in ISO/IEC 29110-4-1 and ISO/IEC 29110-5-2-1 (Basic profile processes for software and the organizational profile processes respectively). It also details the VSE maturity model specific for the software development VSEs.

Annex C presents the same two process assessment aspects as in Annex B but for the assessment of VSE system related processes

Each main aspect above is accompanied by their compliancy verification section towards their applicable requirements defined in ISO/IEC 330xx standards, respectively within each annex.

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Annex A
(informative)

Measurement framework for the assessment of process capability and VSE profiles

NOTE The statements using the verbal form "shall" in this annex are copied from the applicable standards and do not constitute requirements of this document.

A.1 Structure of the annex and overview

This annex provides the measurement framework for the evaluation of the process quality attributes of the processes defined in the ISO/IEC 29110 series for VSEs.

This annex sets out the measurement framework that may be used in the assessment of process capability and VSE profiles for Very Small Entities developing software. The requirements for process capability and VSE profile scales defined in this annex form a structure which:

a) facilitates self-assessment;

b) provides a basis for use in process improvement and capability determination;

c) takes into account the context in which the assessed process is implemented;

d) produces a process capability scale;

e) is applicable across all application domains and mainly for a VSE;

f) may provide an objective benchmark between organizations.

The capability of a process to perform at a specific level of performance depends on well established principles. A.2 sets out those principles that are common to all domains. The process capability measurement framework described in this annex 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 organized into process capability levels, ranging from Incomplete (in which the process does not achieve its defined process outcomes) to Aligned (in which the process implemented aligned to the organizational business goals as well as ensuring customer satisfaction).

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, at the time of the assessment.

This annex also presents the main concepts for VSE profiles, maturity levels within the ISO/IEC 29110 profiles for VSE.

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A.2 Measurement framework for the assessment of process capability for processes for VSEs

A.2.1 General

This subclause defines a measurement framework for the assessment of process capability. The measurement framework provides a schema for use in characterizing the capability of an implemented process with respect to a process assessment model.

Within this process measurement framework, the measure of capability is based upon a set of process attributes (PA). Each 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.

Process attributes are defined in such a way that they can be rated independently of one another; there can be other relationships between them, e.g. the achievement of one process attribute may be associated with the achievement of another process attribute within the process measurement framework.

A.2.2 Process capability levels and process attributes

Process capability is defined on a four point ordinal scale that enables capability to be assessed from the bottom of the scale, Incomplete, through to the top end of the scale, Aligned. The scale represents increasing capability of the implemented process, from failing to achieve the process purpose through to aligning to the organizational business goals as well as ensuring customer satisfaction.

Table A.1 — Capability levels and process attributes

Capability levels	Process attribute ID
Level 0: Incomplete process	
Level ALPHA: Performed process	PA.1 Process performance
Level BETA: Articulated Process	PA.2 Management of resources
	PA.3 Defined process
Level GAMMA: Aligned Process	PA.4 Process alignment

a) **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.

b) **Level ALPHA: Performed process**

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

PA.1 Process performance attribute

The process performance attribute is a measure of the extent to which the process purpose is achieved. As a result of full achievement of this attribute, the process achieves its defined outcomes.

c) **Level BETA: Articulated process**

The previously described Performed process is now implemented in a managed fashion (resources managed) and it follows a monitored defined process.

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

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1) **PA.2 Management of resources attribute**

The management of resources attribute is a measure of the extent to which the organizational resources are used for the performance of the process. As a result of full achievement of this attribute:

— performance of the process is planned and monitored;

— resource needs for the performance of the process are identified;

— responsibilities and authorities for performing the process are assigned and communicated;

— resources and information necessary for performing the process are made available, allocated and used;

— interfaces between the involved parties are managed to ensure both effective communication and clear assignment of responsibility.

2) **PA.3 Defined process attribute**

The defined process attribute is a measure of the extent to which the organizational process is defined and used for the performance of the process. As a result of full achievement of this attribute:

— a standard process, including appropriate tailoring guidelines, is defined that describes the fundamental elements that must be incorporated into a defined process, including competencies and roles and infrastructure;

— the defined process is deployed based upon an appropriately selected and/or tailored standard process, including the use of the standard competencies and roles and infrastructure;

— suitable methods for monitoring the effectiveness and suitability of the process are determined;

— appropriate data are collected and analyzed as a basis for understanding the behaviour of and to demonstrate the suitability and effectiveness of the process, and to evaluate how the process is performed and where continuous improvement of the process can be made.

d) **Level GAMMA: Aligned process**

The previously described Articulated process is now implemented aligned to the organizational business goals, as well as ensuring customer satisfaction.

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

PA.4 Process alignment attribute

The process alignment attribute is a measure of the extent to which the process is maintained aligned to the organization business objectives. As a result of full achievement of this attribute:

— process information needs and objectives (quantitative and qualitative) in support of relevant business goals are established;

— results of measurement are collected, analyzed and reported in order to monitor the extent to which the quantitative objectives for process performance are met;

— corrective actions are taken to address deviations from objectives defined.

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A.2.3 Process attribute rating scale

Within this process measurement framework, a process attribute is a measureable 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.

— C Completely 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 is represented in terms of percentage achievement of a process attribute.

The corresponding percentages are:

N	Not achieved	0 % to ≤15 % achievement
P	Partially achieved	>15 % to ≤50 % achievement
L	Largely achieved	>50 % to ≤90 % achievement
C	Completely achieved	>90 % to ≤100 % achievement

A.2.4 Process attribute rating method

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 being relevant to the class of assessment, that for VSE process assessments is of R3 (as defined in ISO/IEC 33020), where the process attribute rating across assessed process instances are made without aggregation.

A.2.5 Process capability level model

The process capability level achieved by a process is derived from the process attribute ratings for that process according to the process capability level model defined in Table A.2.

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Table A.2 — Process capability level ratings

Scale	Process attributes	Rating
Level ALPHA	PA 1 Process performance	Completely
Level BETA	PA 1 Process performance	Completely
	PA.2 Management of resources	Completely
	PA.3 Defined process	Completely
Level GAMMA	PA 1 Process performance	Completely
	PA.2 Resource management	Completely
	PA.3 Defined process	Completely
	PA.4 Process alignment	Completely

A.3 Measurement framework for VSE profiles

A.3.1 General

This clause defines a measurement framework for the assessment of VSE profiles, i.e. VSE maturity levels. VSE profiles are measured on a three point ordinal scale: from the Low profile, the Immature Organization through to the highest one, the Organizational profile. The scale represents the extent to which the organization has explicitly and consistently performed its basic keyprocesses.

The scale for VSE profiles retains the semantic intent of the process capability levels that are defined in A.2.2. The framework for process capability characterises the ability of a process to meet current or projected business goals; the framework of VSE organizational profile characterises the extent to which an organization consistently implements sets of processes within a defined scope . Thus, the two frameworks, while consistent, characterise different attributes of separate entities: the process and the organization. The measurement framework provides a schema for use in characterising the profile of an organization with respect to a specified process assessment model.

Within this measurement framework, each level of VSE profile is characterised by the demonstration of achievement of specified levels of process capability in process sets drawn from the specified process assessment model(s) (see A.3).

Processes in ISO/IEC 29110-4-1 can be categorized into one set based on its contributions to the business goals of the organization. The set of fundamental processes that support the primary activities of the organization is called the basic process set. Each VSE profile Level beyond level Basic is characterized by the implementation, at an appropriate level of process capability, of a further set of processes that drive the achievement of the capabilities relevant to each profile level. These are called extended process sets.

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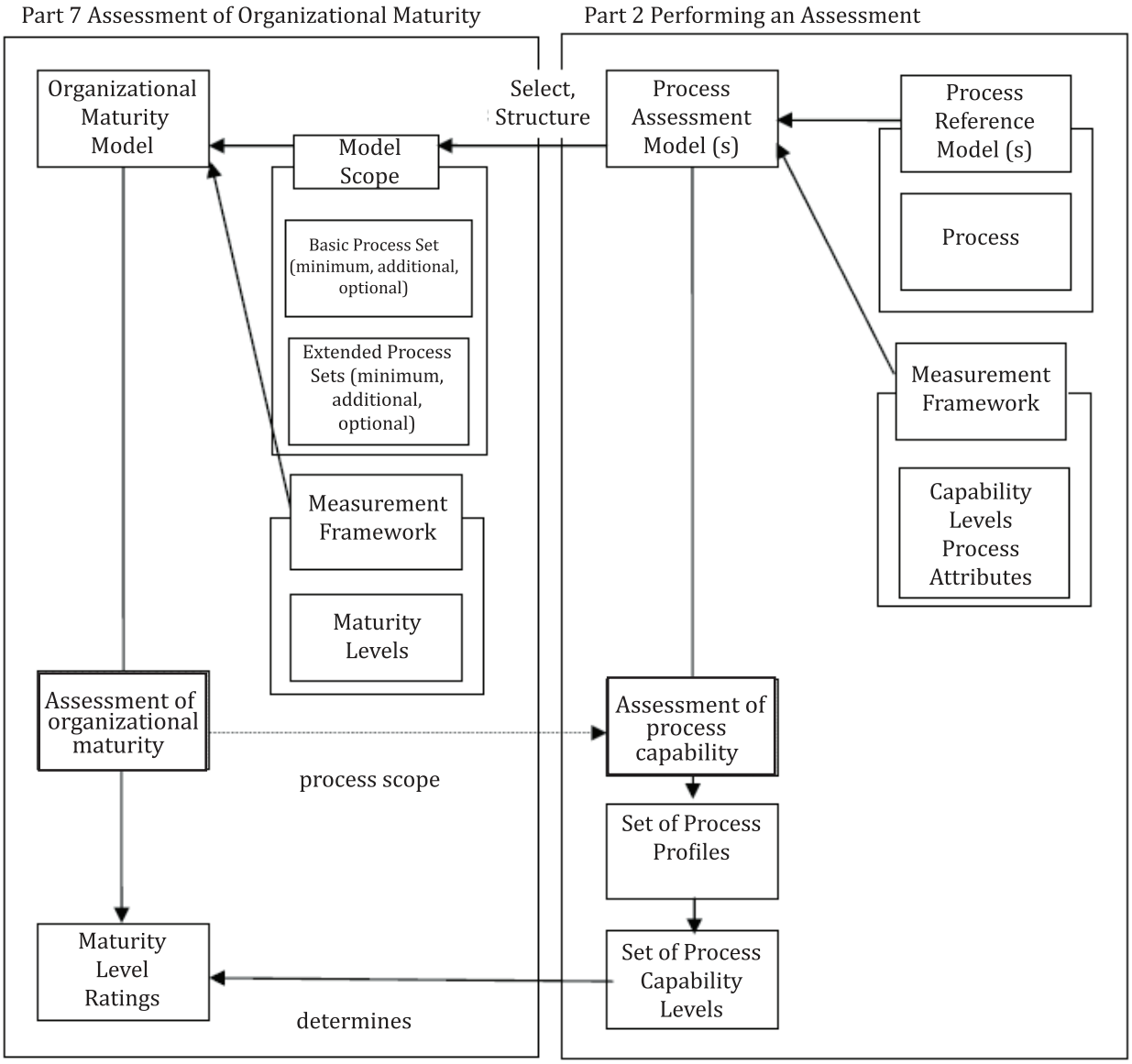

NOTE Amended from ISO/IEC/TR 15504-7:2008, Figure 1.

Figure A.1 — Relationship between assessment of process capability and derivation of VSE profiles

Figure A.1 above shows the relationship between the VSE profile model and the specified process assessment model(s) when an assessment of the organizational profile is conducted. The key elements are the defined components of the relevant process reference models and the measurement frameworks, shown in the figure as nested boxes. These components are used to construct models supporting the assessment of process capability and VSE profile. The definition of the VSE profile model scope and the selection of the basic and extended process sets are made in the context of the VSE profile model. Once the assessment has been planned employing a VSE profile model based upon one or more conformant process assessment models, the assessment is performed using the specified process assessment model(s) to obtain the set of process profiles. The process capability levels, derived from the process profiles, are then transformed into a VSE profile level rating according to the rules for deriving profile levels from capability levels.

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A VSE profile is expressed on a scale from profile level 0 (Immature Organization) through Organizational profile level aligned as follows.

a) Level Immature Organization

The organization does not demonstrate effective implementation of its processes that are fundamental to support the organization's primary activities

At least one process in the basic process set is assessed at capability level 0.

b) Level Basic profile

The basic organizational profile is the implementation of one project, performing the processes identified as belonging to the Basic profile at level ALPHA. The organization demonstrates achievement of the purpose of the processes that are fundamental to support the organization's primary activities.

As a result of achieving this level, the organization:

1) implements the processes required to support the organization's primary activities;

2) performs sets of activities and tasks that achieve the purposes of these processes.

All processes in the basic process set are assessed at capability level ALPHA or higher.

c) Level Organizational profile

The previously described Basic profile is now implementing organizational processes. All Basic profile processes should be performed to GAMMA level (influenced by the management of multi-projects, aligned to the company objectives and towards customer satisfaction), plus all processes belonging to the organizational profile should be performed at capability level BETA or higher.

A.3.2 Rules for deriving VSE profiles from capability levels

Based on the measurement framework for assessment of process capability and process profiles for Very Small Entities (VSEs) defined in A.2, the rating of an VSE profile is derived from a set of process profiles in the following manner.

a) An assessment of process capability, compliant to the requirements of ISO/IEC 33002 and meeting the requirements of ISO/IEC 33004, is conducted.

b) The process scope of the assessment embraces all of the processes in the basic process sets defined in the selected Organizational profile model.

c) All process attributes up to and including the highest relevant capability level are rated for all processes in the scope of the assessment.

d) Process capability level ratings are derived for all processes in the scope of the assessment.

e) The profile level achieved by an organization are derived from the process capability level ratings according to the specific rules identified for each specific process assessment model (see Annex B and Annex C)

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A.4 Conformity verifications

A.4.1 Conformity verification of the measurement framework (defined in A.2)

This subclause presents how the measurement framework defined in A.2 fulfils all requirements for a process measurement framework (defined in ISO/IEC 33003). Where text has been quoted from ISO/IEC 33003:2015, that text is enclosed in a box, for ease of identification.

4.1 Conceptualization

A process capability level is characterised by one or more process attributes, which are formative measures of the process capability. Process attributes are required in order to construct the process capability. Process attributes are demonstrated by achievement of the process attribute outcomes, which are reflective measures. See Figure A.2.

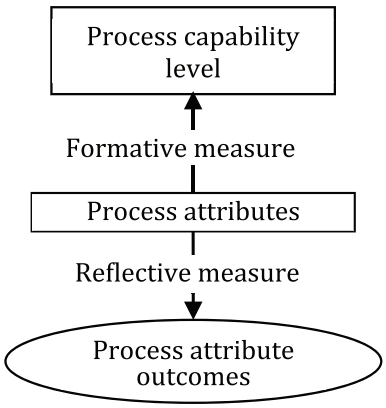

Figure A.2 — Formative and reflective measures of process capability (as per ISO/IEC 33003)

The concept of process capability does not provide a measure of anything other than process capability formed by process attributes. For example, process capability does not infer anything about organizational performance.

4.1.1 Requirements

a) A process measurement framework shall identify and address a single process quality characteristic;

The measurement framework is defined for the single process quality characteristic of software quality.

b) A process quality characteristic in a process measurement framework shall be defined on the basis of a multidimensional construct;

The process measurement framework is a construct comprised of four process attrributes.

c) A process quality characteristic in a process measurement framework shall be defined as a set of process attributes;

The process measurement framework is a construct comprised of four process attrribute.

d) Each process attribute shall define a property of the process quality characteristic;

The property defined by each process attribute is described in A.2.2.

e) Each process attribute that is not directly measurable shall be considered as a construct;

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Each process attribute in this measurement framework is a construct and defined in this annex.

f) Process attributes in a process measurement framework shall be defined as either reflective or formative

The process attributes of this measurement framework are formative.

g) The process measurement framework shall document the policies and assumptions underlying its use and application;

The policies and assumptions underlying the use and application of this process measurement framework are set out in this annex.

4.2 Construct definition

4.2.1 Requirements

a) The construct definition shall define the meaning of the process quality characteristic and its process attributes in a process measurement framework;

The meaning of the process quality characteristic and its process attributes are given in A.2.

b) The construct definition shall clarify the specification of the process quality characteristic and its process attributes as dimensions;

The specifications of the process quality characteristic and its process attributes are given in A.2.

c) The construct definition shall provide a guide for the operationalization of the process quality characteristic and its process attributes;

Operationalization of the process quality characteristic and its process attributes is given in A.2.

d) The construct definition shall state the scales of composite measures such as categorical (e.g. a series of ordinal values such as capability level) or numeric;

The scales of composite measures in this measurement framework are given in A.2.

e) At least one of the process attributes shall comprise the achievement of the defined process purpose and process outcomes for the process; this is termed the process performance attribute;

The process performance attribute (PA.1) comprises the achievement of the defined process purpose through achievement of the process outcomes for that process.

4.3 Operationalization

4.3.1 Requirements

a) All process attributes shall be defined according to their construct specification;

The process attributes are defined in in A.2.1; the descriptions follow a common approach, described in A.2.

b) Achievement of process attributes shall be verifiable through objective evidence.

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In the process performance attribute, the achievement of process outcomes is demonstrable based on objective evidence.

4.4 Construct specification examination

4.4.1 Requirements

Construct specifications of the process quality characteristic and its associated process attributes shall be examined through operationalization and with rationale.

Each process attribute is operationalized through a set of base or derived measures depending on the class of assessment. See A.2.3 and A.2.4.

4.5 Rating process attributes

4.5.1 Requirements

a) The process attributes shall be scored;

The unit of measurement is specified in A.2.2.

b) A measurement scale, i.e., nominal, ordinal, interval, or ratio, shall be defined for the process attributes

The measurement scale for base measures are ordinal, defined in A.2.2.

c) A measurement method shall be identified that objectively assigns value to each measure.

The method for assigning a value to the measure of process capability is described in A.2.4.

4.6 Aggregation

4.6.1 Requirements

a) All aggregations required within the measurement framework shall be identified;

Aggregation methods are defined in A.2.3.

b) Aggregation methods shall be specified

Aggregation methods are defined in A.2.3.

c) Aggregation methods shall be statistically valid.

Rationales for the validity of aggregation methods in this international standard are given in A.2.3.

b) Aggregation methods shall utilize consistent measurement scales

Aggregation methods are defined in A.2.3.

c) Aggregation methods shall be consistent with the measurement framework policies and assumptions;

d) Aggregation methods shall be consistent with construct specifications.

Consistency with policies and assumptions, and with the construct specifications is described in A.2.3.

4.7 Sensitivity analysis

4.7.1 Requirements

a) Sensitivity analysis shall be performed for measurement scales of base and derived measures.

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Sensitivity of the process capability scale was tested during the SPICE trials[9][10], as well as the Moprosoft experiences. The investigations included inter-rater agreement and internal consistency, both of which were found to be acceptable. The possibility of increasing internal consistency was investigated by varying the four category scale to a three or two category scale by combining either the middle two ratings [N, (P, L), C] or the outer two ratings [(N, P), (L, C)]. The current four category scale cannot be improved by reduction to a three or two category scale.

Sensitivity of process capability level ratings was investigated during the SPICE trials and reported in the interim report[11], as well as in the Moprosoft trials. Overall, the investigation concluded that distortion downward of the capability level rating had greater effect than distortion upwards, but that guidance should be provided to assessors concerning the potential effects of distortion.

b) Sensitivity analysis shall be performed for aggregation methods

Some sensitivity analysis data related to aggregation is available in Reference [11]; however, its relevance to the current approach is limited. The issue of aggregation was examined in detail during the development of the International Standard.

c) Sensitivity analysis shall be performed for weights, if applicable.

Weights are not used in this measurement framework so are not applicable.

5 Requirements for the validation of process measurement frameworks

5.1 Requirements

a) Plans for reliability and validity of process measurement frameworks shall be established at the beginning of standardization. These plans shall include post-standardization activities.

b) Claims on reliability and validity of process measurement frameworks shall be consistent with construct specification.

c) Consistency (also refers to equivalence) as a reliability measure shall be examined for process attributes, if reflective.

d) Validities shall be examined for the process quality characteristic and its process attributes in a process measurement framework.

e) Construct specification shall be empirically examined for the process quality characteristic and its measures in a process measurement framework.

f) External measures (e.g. goals, criteria, and/or achievements) of a process measurement framework under development shall be documented for validity investigation.

Post hoc statistical analysis has been performed to validate process measurement frameworks. Validation has been performed during the SPICE trials conducted during standard development.

The measurement method and capability scale were tested during the SPICE trials. There has been no change to the concepts of the measurement scale that would invalidate the process capability scale or the findings of the trial.

When data is available during trials and/or after the publication of a framework, rigorous statistical analyses will be required for all the applicable requirements.

The results of such analyses are documented in References [9], [10] and [11].

A.4.2 Conformity of the requirements for a VSE profile or maturity model for VSEs (defined in A.3)

This subclause verifies how the defined VSE profiles or maturity model (defined in A.3 complemented by what is defined in B.5 and C.5 for software and system concrete process assessment models, respectively) meets the requirements for conformance defined in ISO/IEC 33004. The Organizational

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Profile or maturity model can be used in the performance of assessments that meet the requirements of ISO/IEC 33002. It may also be used as a guide for an Organizational Profile or maturity model developer.

For ease of reference, the requirements from ISO/IEC 33004 are embedded verbatim in the text of this clause. Where text has been quoted from ISO/IEC 33004:2015, that text is enclosed in a box, for ease of identification They should not be construed as normative elements of this annex.

This VSE profiles o maturity model has been explicitly constructed to be an elaboration of the process assessment model defined in Annex B. The conformance claim is relatively simple. For other models, particularly ones with a different architecture, the demonstration of conformance may be more difficult.

7.3.1 A maturity model shall document the community of interest of the maturity model and the actions taken to achieve consensus within that community of interest:

a) the relevant community of interest shall be characterized or specified;

b) the extent of achievement of consensus shall be documented;

c) if no actions taken to achieve consensus, a statement to this effect shall be documented.

The Organizational maturity model is designed for the specific domain of the software industry, specific for VSE organizations; as process includes approaches designed to achieve consensus within the community of interest.

7.3.2 The maturity model shall define:

a) a declaration of scope of application;

b) its use with respect to a process quality characteristic associated with business success in the domain of application.

In A.1, the scope of aplication and its use are declared.

7.3.3 A maturity model shall be based upon one or more specified process assessment models that utilize a common process measurement framework for the specified process quality characteristic.

The VSE maturity model is based upon A.3 and the process assessment model for software processes for VSEs defined in B.5 and for systems defined in C.5. Conformance of the process assessment models are demonstrated in Annex B and Annex C.

The VSE maturity models contains all processes contained in ISO/IEC 29110-4-1 (rules in Annex B) and all processes contained in ISO/IEC/TR 29110-5-6-2 (rules in Annex C). These are assigned to basic process sets.

The VSE maturity model addresses all of the maturity levels defined in the measurement framework in A.3.

7.3.4 Scale of organizational process maturity

A maturity model shall define an ordinal scale for organisational process maturity.

A maturity model shall specify a maturity level for each point on the ordinal scale.

A maturity model shall specify a continuous set of maturity levels, representing increasing levels of organizational process maturity, starting at the basic maturity level.

A maturity level shall be defined with a unique identification and description.

A maturity level shall be characterised by the demonstration of achievement of a set of process profile(s).

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In A.3, the maturity levels are declared.

7.3.5 Process descriptions

A set of processes from the specified process assessment model(s), which represent operations seen as essential for achievement for the specified level of maturity, shall be selected and assigned to each maturity level in the maturity model.

Basic process set

A set of processes shall be selected from the specified process assessment model(s) that represent operations seen as essential for business success in the domain. This set of processes shall be termed the basic process set for the maturity model.

The basic maturity level (maturity level 1) shall be represented by achievement of the process performance attribute for all processes in the basic process set.

Extended process sets

Sets of processes shall be selected from the specified process assessment model(s) for all levels above the basic level in the maturity model that represent operations seen as essential for achievement for the specified level of maturity. These shall be termed the extended process sets for the maturity model.

Additional processes

A basic or extended process set may include additional processes that:

— are required for assessments with a particular scope of application; and

— are optional depending on the particular circumstances of the organization.

A maturity model shall include specifications of the particular circumstances for inclusion of any additional processes in the basic and extended process sets.

In A.3, the process set is defined and its use are declared. The processes drawn from ISO/IEC 29110-4-1 that constitute the basic process set are listed in Annex B and Annex C for the specific PAMs, along with their status and the conditions under which they are to be applied. No extended process set is defined for this measurement framework.

7.3.6 Rules for deriving maturity level from process quality level

The basic maturity level shall be represented by achievement of the process performance attribute for all processes in the basic process set.

A maturity model shall define the rules for deriving an organizational process maturity level rating from the set of process profiles that result from an assessment.

In A.3, the rules for deriving maturity level from process quality level are defined.

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Annex B
(informative)

Examplar software life cycle process assessment model for Very Small Entities

NOTE The statements using the verbal form "shall" in this annex are copied from the applicable standards and do not constitute requirements of this document.

B.1 Structure of the process assessment model

This annex:

— defines a process assessment model that meets the requirements of ISO/IEC 33004 and that supports the performance of an assessment by providing indicators for guidance on the interpretation of the process purposes and outcomes as defined in ISO/IEC 29110-4-1 (processes included in the Basic profile for Very Small Entities for software) and the process attributes as defined in Annex A (our MF);

— provides guidance, by example, on the definition and use of assessment indicators.

The process assessment model is a two-dimensional model of process capability. In one dimension, the process dimension, the processes are defined in ISO/IEC 29110-4-1 (the PRM). In the other dimension, the capability dimension, a set of process attributes grouped into capability levels is defined. See Figure B.1. The process attributes provide the measurable characteristics of process capability.

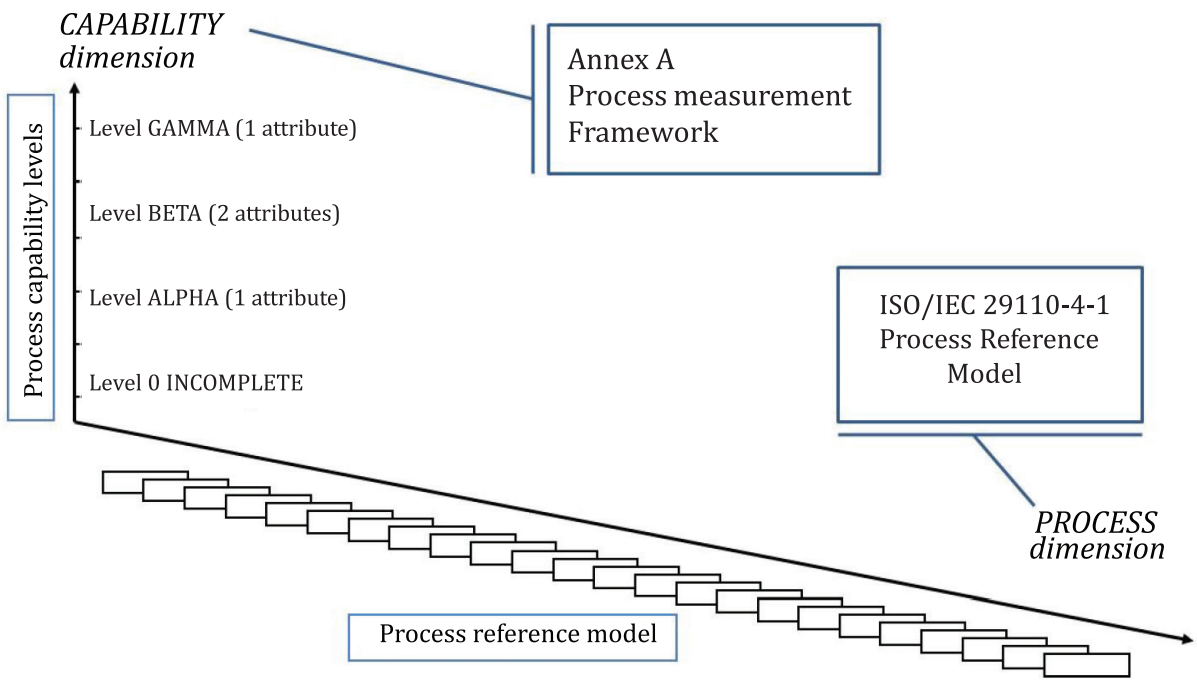

Figure B.1 — Structure of the process assessment model

The process reference model defined in ISO/IEC 29110-4-1, associated with the process attributes defined in Annex A, establishes a process assessment model used as a common basis for performing assessments of software engineering process capability, allowing for the reporting of results using a common rating scale.

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The process reference model and the capability dimension defined in Annex A cannot be used alone as the basis for conducting reliable and consistent assessments of process capability since the level of detail provided is not sufficient. The descriptions of process purpose and outcomes in the process reference model and the process attribute definitions in Annex A need to be supported with a comprehensive set of indicators of process performance and process capability that are used for assessment performance

The indicators are used as a basis for collecting the objective evidence that enables an assessor to assign ratings. The set of indicators included in this annex is intended to be an all-inclusive set and it is intended to be applicable in its entirety.

The process assessment model in this annex (this PAM) is directed at assessment sponsors and lead assessors who wish to select a model and associated documented process method, for assessment (for either capability determination or process improvement). Additionally, it may be of use to developers of assessment models in the construction of their own model, by providing examples of good software engineering and management practices.

The process assessment model defined in this annex is conformant with the ISO/IEC 33004 requirements for a process assessment model and can be used as the basis for conducting an assessment of software engineering process capability for VSEs.

Copyright release for the process assessment model: Users of this annex may freely reproduce the detailed descriptions contained in the assessment model as part of any tool or other material to support the performance of process assessments, so that it can be used for its intended purpose.

B.2 Processes dimension

Figure B.2 lists the processes from ISO/IEC 29110-4-1 that are included in the process dimension of the process assessment model.

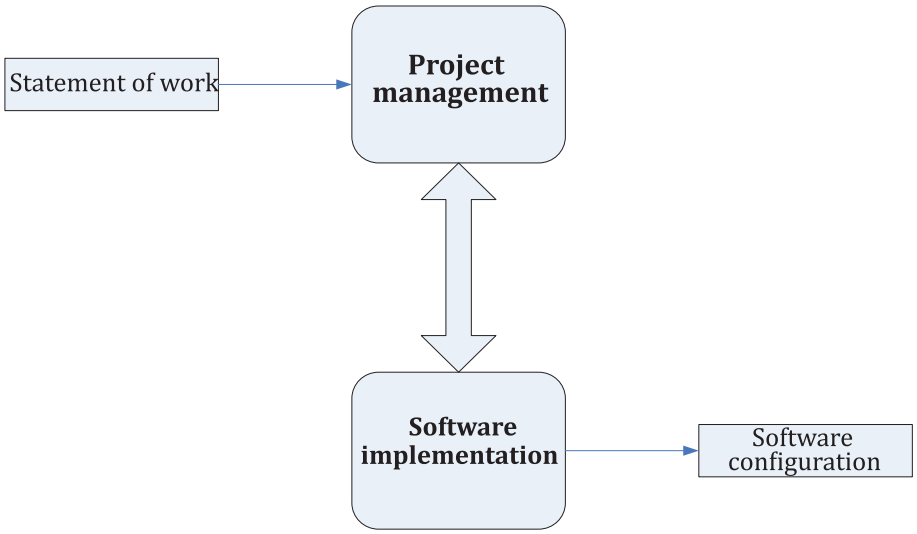

Figure B.2 — Processes included in the software Basic profile for VSEs

The organizational group of processes are interrelated (see Figure B.3).

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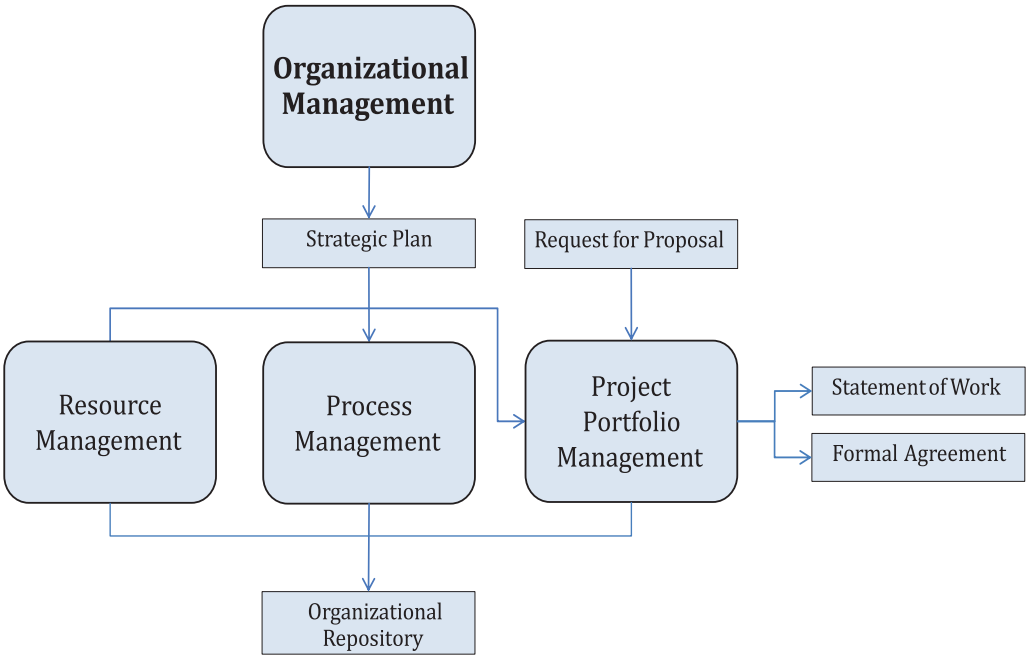

Figure B.3 — Processes included in the Organizational profile for VSEs

The organizational management process provides a Strategic Plan which defines project strategies, budget, and required processes.

The resource management process, process management process and project portfolio management process receive the *Strategic Plan as an input that will* guide its activities. The resource management receives the *Resource Request* from all the processes and projects, analyzes them and assigns resources to the processes and projects according to the *Resource Policies and/or Mechanisms*.

The process management process receives the *Process Improvement Suggestions* from all the processes, analyzes them and applies this suggestions to the processes in order to improve them. The Process Evaluation activity, evaluates the processes implementation finding strengths and weakness, and coordinates the resolution of the weakness.

The project portfolio management process receives the *Request for Proposal* form the customers, actives the accepted projects and supervises the correct execution of these projects.

For the process dimension, all the processes in Figure B.2 and Figure B.3 are included within the process dimension of the process assessment model. Each process in the process assessment model is described in terms of a purpose statement. These statements contain the unique functional objectives of the process when performed in a particular environment. A list of specific outcomes is associated with each of the process purpose statements, as a list of expected positive results of the process performance.

B.3 Capability dimension

For the capability dimension, the process capability levels and process attributes are identical to those defined in Annex A, the measurement framework (MF).

Evolving process capability is expressed in the process assessment model in terms of process attributes grouped into capability levels. Process attributes are features of a process that can be evaluated on a scale of achievement, providing a measure of the capability of the process. They are applicable to all processes. Each process attribute describes a facet of the overall capability of managing and improving the effectiveness of a process in achieving its purpose and contributing to the business goals of the organization.

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A capability level is a set of process attribute(s) that work together to provide a major enhancement in the capability to perform a process. The levels constitute a rational way of progressing through improvement of the capability of any process and are defined in Annex A (the MF).

Within the process assessment model, the measure of capability is based upon the one process attributes (PA) defined in Annex A (the MF). Process attributes are used to determine whether a process has reached a given capability. Each attribute measures a particular aspect of the process capability.

At each level, there is no ordering between the process attributes; each attribute addresses a specific aspect of the capability level. The list of process attributes is shown in Table A.1.

The process attributes are evaluated on a four point ordinal scale of achievement, as defined in Annex A (the MF). They provide insight into the specific aspects of process capability required to support process improvement and capability determination.

B.4 Assessment indicators

B.4.1 General

The process assessment model is based on the principle that the capability of a process can be assessed by demonstrating the achievement of process attributes on the basis of evidence related to assessment indicators. These indicators provide guidance for assessors in accumulating the necessary objective evidence to support judgments of capability. Assessment indicators are used to confirm that certain practices were performed, as shown by observable evidence collected during an assessment. All such evidence comes either from the examination of work products of the processes assessed or from statements made by the performers and managers of the processes.

The evidence obtained should be recorded in a form that clearly relates to an associated indicator, so that the support for the assessor's judgment can be readily confirmed or verified as required by ISO/IEC 33002.

The output from a process assessment is a set of process profiles, one for each process within the scope of the assessment. Each process profile consists of a set of the process attribute ratings for an assessed process. Each attribute rating represents a judgment by the assessor of the extent to which the attribute is achieved. To improve the reliability and repeatability of the assessment, the judgments of the assessor are based on a coherent set of recorded objective evidences. The assessment indicators, and their relationship to process performance and process capability, are shown in Figure B.4.

There are two types of assessment indicators: process capability indicators, which apply to capability levels ALPHA to GAMMA and process performance indicators, which apply exclusively to capability level ALPHA. These indicators are defined in B.4.2.

The process attributes in the capability dimension have a set of process capability indicators that provide an indication of the extent of achievement of the process attribute in the instantiated process. These indicators concern significant activities, resources or results associated with the achievement of the process attribute purpose by a process.

The process capability indicators are:

— generic practice (GP);

— generic work product (GWP).

As additional indicators for supporting the assessment of a process at Level ALPHA, each process in the process dimension has a set of process performance indicators which is used to measure the degree of achievement of the process performance attribute for the process assessed.

The process performance indicators are:

— base practice (BP);

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— work product (WP).

The process performance indicators are used to measure the degree of achievement of the process performance attribute (PA.1) for the process assessed.

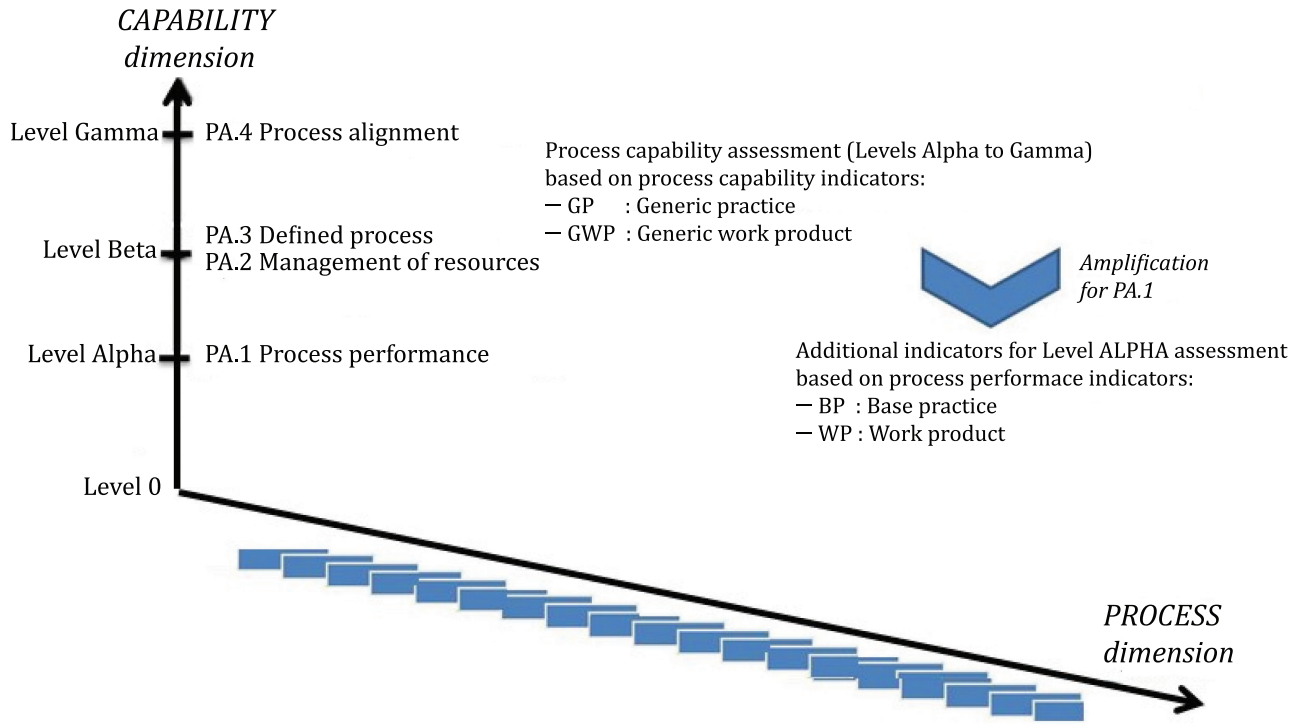

Figure B.4 — Assessment indicators

The process capability indicators represent the type of evidence that would support judgments of the extent to which the process attributes are achieved. Evidence of their effective performance or existence supports the judgment of the degree of achievement of the process attribute. The generic practices are the principal indicators of process capability.

The generic practice (GP) indicators are activities of a generic type and provide guidance on the implementation of the process attribute's characteristics. They support the achievement of the process attribute and many of them concern management practices, i.e. practices that are established to support the process performance as it is characterized at level 1. During the evaluation of process capability, the primary focus is on the performance of the generic practices. In general, performance of all generic practices is expected for full achievement of the process attribute.

The generic work product (GWP) indicators are sets of characteristics that would be expected to be evident in work products of generic types as a result of achievement of a process attribute. The generic work products form the basis for the classification of the work products defined as process performance indicators; they represent basic types of work products that may be inputs to or outputs from all types of process.

These two types of indicators help to establish objective evidence of the extent of achievement of the specified process attribute.

Due to the fact that level Alpha capability of a process is only characterized by the measure of the extent to which the process purpose is achieved, the process performance attribute (PA.1) has a single generic practice indicator (GP.1.1). In order to support the assessment of PA.1 and to amplify the process performance achievement analysis, additional process performance indicators are defined in the process assessment model.

There are two types of process performance indicators; **base practice (BP)** indicators and **work product (WP)** indicators. Process performance indicators relate to individual processes defined

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